Troldtekt®

TROLDTEKT® NATURAL ACOUSTIC SOLUTIONS

www.troldtekt.com

04-07
Natural acoustic solutions

08-09
Natural raw materials

10-11
Structures & colours

12
Troldtekt® acoustic panels

13-15
Troldtekt® Plus

16
Troldtekt® A2

17-21
Troldtekt® installation

22
Troldtekt® wave

23
Troldtekt® mosaik

24
Troldtekt® rhomb

26
Troldtekt® lighting

27
Troldtekt® speakers

28
Troldtekt® decoration

30-31
Troldtekt® web tools

32
Six good reasons for choosing Troldtekt

33-35
Good acoustics

36
Healthy indoor climate

38-40
Documented sustainability

41
Effective fire protection

42
Natural strength

43
Flexible design solutions

46-47
Labels & certifications

48-51
About Troldtekt A/S

Scan the QR code and subscribe to Troldtekt's online newsletter. The newsletter contains inspiring contemporary articles on acoustics, indoor climate, architecture and sustainable building. Each issue focuses on a relevant theme which is covered in articles, photos and videos. The newsletter is issued about eight times a year.

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INFORMATION
TROLDTEKT® NATURAL ACOUSTIC SOLUTIONS

Natural acoustic solutions

Troldtekt acoustic panels are the natural ceiling and wall cladding choice for all types of building. Our high performance acoustic solutions can be seen everywhere, such as in schools, sports centres swimming pools, offices and public buildings, theatres, hotels and even private homes, in Denmark and around the world.

The combination of wood and cement creates Troldtekt's unique sound absorbing properties, ensuring good acoustics in any room. The material has a natural resilience and can handle moist environments, while also providing effective fire protection. Troldtekt is a natural product with documented sustainability throughout its entire life cycle.

But Troldtekt is more than just acoustic panels. Our solutions also give you the opportunity to integrate and conceal for example speakers in the Troldtekt ceiling. Specially designed lighting, decorative elements and a wide range of accessories are also available.

You can read about all this on the following pages.

Pleasant reading.

Project: Gymnasium in Tórshavn
Architect: BBP Arkitekter A/S
Ceilings: Troldtekt Plus panels, natural wood
Walls: Troldtekt Plus panels, special colours
Lighting: Troldtekt lighting, model Wave, longitudinal

Photo: Per á Hædd

Natural raw materials

Troldtekt is cement-bonded wood wool panels made using nature's own materials – wood and cement.

The recipe for Troldtekt acoustic panels is as simple as it is viable, and has been followed since 1935. By mixing wood and cement, we create cement-bonded wood wool, combining the strength of cement with the natural properties of wood. The result is a healthy material with a number of inherent natural benefits.

Wood
The wood used in Troldtekt is Norway spruce from local forests. Danish timber is a renewable resource, as more is planted than is logged. Wood is also a CO_2-neutral resource, as it absorbs as much CO_2 during its growth as is emitted during its management, logging and transportation. We use certified wood, guaranteeing that it can be traced back to responsible forestry operations.

Troldtekt achieved PEFC™ certification in 2009, and added FSC® certification in 2013.

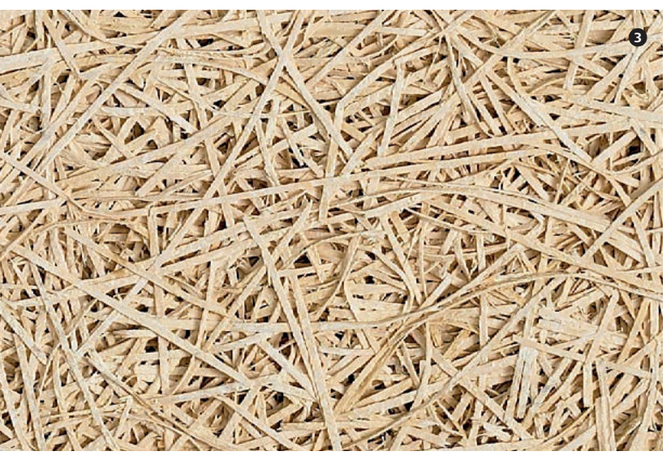
Cement
The production of Troldtekt panels uses only cement from Aalborg Portland A/S, which extracts the raw materials from the Danish bedrock with minimal environmental impact. Chalk and sand are the key raw materials used to make Portland cement. Both chalk and sand is extracted in Denmark, where sand dredging helps keep sailing channels navigable.

Aalborg Portland is certified under the ISO 14001 eco-management system and the European EMAS (Eco-Management and Audit Scheme).

Cement-bonded wood wool
Our Troldtekt cement-bonded wood wool panels used for acoustic ceiling and wall cladding are produced at our factory in Troldhede, Denmark.

The Troldtekt acoustic series comprises the Troldtekt, Troldtekt Plus, Troldtekt A2 panels, Troldtekt design solutions and a wide range of accessories. All Troldtekt panels have the same characteristic appearance and good properties.

Visit › www.troldtekt.com and watch our film on the production of Troldtekt panels.



1. Extreme fine structure, 0,5 mm
2. Ultrafine structure, 1.0 mm
3. Fine structure, 1.5 mm
4. Coarse structure, 3.0 mm

Structures & colours

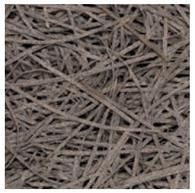
Fine or coarse structure, natural colours, classic white or custom painted colours. The choice is yours.

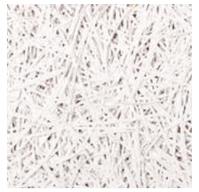
The characteristic Troldtekt structure derives from the thickness of the wood wool. Troldtekt panels are available in extreme fine, ultrafine, fine and coarse structures.

We use either grey or white Portland cement, resulting in our natural grey or natural wood colours. Troldtekt panels require no further surface treatment, but can be supplied spray-painted with water-based paint in the following standard colours: white 101, grey 202, grey 208, black 207 and red 210. Troldtekt panels can be supplied in all NCS and RAL colours to order.

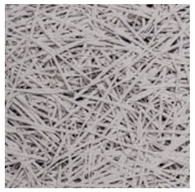
Natural wood

Natural grey

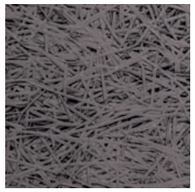




White 101

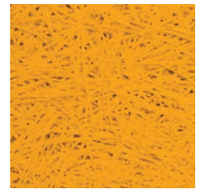


Grey 202



Grey 208

Black 207



Custom colour

Troldtekt® acoustic Panels

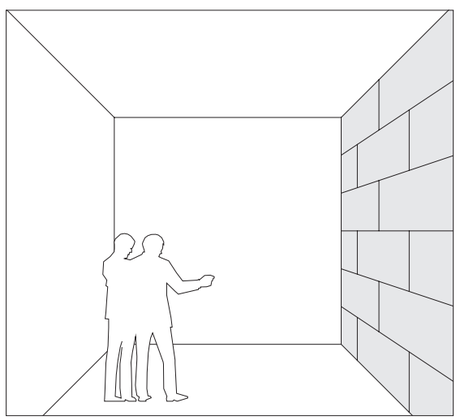
Troldtekt acoustic panels are used as ceiling and wall cladding in all types of buildings.

Troldtekt is our classic acoustic panel, used in most types of buildings. In terms of reaction to fire, Troldtekt acoustic panels have been tested in accordance with BS 476 and are “Class O” as designated in the British Building Regulations and have a Class 1 Spread of Flame classification.

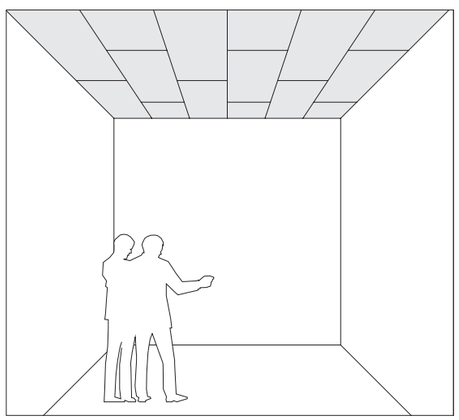
Technical data sheets, declarations of performance (DoP’s), safety data sheets and installation instructions for Troldtekt products available at › www.troldtekt.com

DIMENSIONS

Width (mm)	600			
Length (mm)	600/1200/2000/2400			
Thickness (mm)	20	25	35	50
Weight (kg/m²)				
Coarse		9,7	12,0	15,0
Fine	8,3	9,7	12,0	15,0
Ultrafine	9,0	10,6	13,3	
Extreme fine		11,7	14,2	



Troldtekt walls



Troldtekt ceilings

Troldtekt® Plus

Our two-layer acoustic panel, Troldtekt Plus is available in two versions: Troldtekt with laminated backing layer of mineral wool or with a backing layer of Stratocell. Both two-layer panels are ideal for the refurbishment of existing ceilings and saves construction time.

Troldtekt® Plus with mineral wool

The Troldtekt series’ two-layer panel, Troldtekt Plus, consists of a Troldtekt panel with a layer of mineral wool on the back. The mineral wool is cut to fit and withdrawn from the panel edges and fits in between the profiles or wooden battens. Using Troldtekt Plus, the acoustic ceiling and mineral wool are fitted in one workflow, saving construction time. Using Troldtekt Plus panels you also save space and with an installation height of only 47 mm you can achieve almost the same sound absorption as with a suspended Troldtekt ceiling backed by mineral wool.

DIMENSIONS

Width (mm)	600			
Length (mm)	600/1200/2400			
Thickness (mm)	43 (25+18)	53 (35+18)	65 (25+40)	75 (35+40)
Weight (kg/m²)				
Fine	11,0	13,3	12,5	14,8
Ultrafine	11,9	14,6	13,4	16,1
Extreme fine	13,0	15,5	14,5	17,0

Troldtekt® Plus with Stratocell

Troldtekt Plus with a Stratocell backing is particularly suitable for direct installation on ceilings or walls where extraordinary sound absorption is required.

The Stratocell panel is cut to size and set back from the edges of the Troldtekt panel so it fits in between the profiles or wood battens. The double-layer panel is installed in one and the same workflow, which saves construction time.

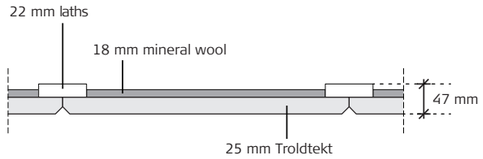
Troldtekt Plus-Stratocell comes with either a 20 or 40 mm thick Stratocell backing layer.

Stratocell is made of indoor climate-labelled polyethylene.

DIMENSIONS				
Width (mm)	600			
Length (mm)	600/1200/2400			
Thickness (mm)	45 (25+20)	55 (35+20)	65 (25+40)	75 (35+40)
Weight (kg/m²)				
Fine	10,3	12,6	10,8	13,1
Ultrafine	11,2	13,9	11,7	14,4
Extreme fine	12,3	14,8	15,3	15,3

47 mm

You can install 43 mm Troldtekt Plus panels directly on 22 mm wooden battens on an existing ceiling – and only lower the ceiling height by 47 mm.



Construction: 43 mm Troldtekt Plus (25 mm Troldtekt + 18 mm mineral wool) installed on 22 mm wooden battens. Installation height is only 47 mm.

Troldtekt Plus panels are ideal for the refurbishment of existing ceilings and for suspended and floating ceilings.

Easy-to-install new acoustic ceiling
Problems with noise and poor acoustics can be solved with a new acoustic ceiling. However, most people are daunted by the thought of having to remove the existing ceiling – a comprehensive process which causes inconvenience and generates dust. But this can be avoided. You install Troldtekt Plus directly on wooden battens fitted to the existing ceiling and this saves you the trouble of removing the old ceiling. Drop sheets and a rolling scaffold are all that is required and the refurbishment can be completed in just a few days.

Removable ceilings
Troldtekt Plus is also the ideal solution for removable ceilings where workmen may require later access to installations above the ceiling. In profile systems such as Troldtekt T35 for concealed or exposed fitting, you just tilt up the acoustic panel to inspect and maintain installations above the ceiling. The back of the mineral wool is covered with non-woven material and glued to the back of the Troldtekt panels, so workmen completely avoid contact with mineral wool fibres.

Floating acoustic clouds
Floating acoustic clouds using Troldtekt or Troldtekt Plus are an ideal solution if it is not possible to fit Troldtekt acoustic panels to the entire ceiling surface. Simply install Troldtekt or Troldtekt Plus panels using the C60 profile system and terminate the clouds with Troldtekt aluminium edge profiles. This creates an easy and elegant acoustics solution for defined areas.

Troldtekt® A2

Our non-combustible acoustic panel has no toxic fire retardant additives. It is used for areas with strict fire regulations.

Troldtekt A2 is the non-combustible one-layer acoustic panel in the Troldtekt range. It is installed in areas where there are stricter fire safety regulations, such as in means of escape. Troldtekt A2 acoustic panels are CE-marked and comply with A2-s1,d0 fire safety requirements.

The fire safety of the Troldtekt A2 panel is achieved exclusively by using special cement without the addition of any toxic fire-retardant additives. Like the classic Troldtekt acoustic panels, the Troldtekt A2 panels have also achieved the Cradle to Cradle certification in the silver category because, among other things, they do not contain any harmful substances and can be returned to nature as compost.

The use of special cement rather than fire-retardant additives has the great advantage that the Troldtekt A2 panel visually looks like the classic Troldtekt acoustic panel. For that reason, the two types of panel can be combined and installed in the same building without compromising the aesthetics or the acoustics, because the Troldtekt A2 panel can also achieve $\alpha w = 1,0$.

Troldtekt A2 is available in the following dimensions:

DIMENSIONS	
Thickness (mm)	25
Width (mm)	600
Length (mm)	600/1200/2000/2400
Weight (kg/m²)	11,0

Troldtekt® installation

Troldtekt panels are installed directly on wooden battens on ceilings and walls, or in profile systems as suspended ceilings.

The Troldtekt series includes specially designed screws and brackets and profile systems for suspended ceilings, with concealed or visible profiles.

Troldtekt screws
Troldtekt screws have been specially developed for installing Troldtekt panels. Troldtekt screws are available with crosshead (PH2) and Torx head (Torx 20). Troldtekt screws are electro-galvanised and coated in colours that complement Troldtekt natural wood and natural grey panels as well as standard Troldtekt colours. For Troldtekt panels in custom colours we provide extra paint, so the screws can be dipped in the same colour as the acoustic panels.

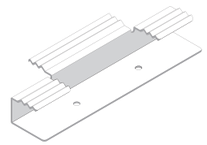
Troldtekt structure screws for wood and steel (PH 2)

Troldtekt screws with Ø13 mm washer for wood (TORX)

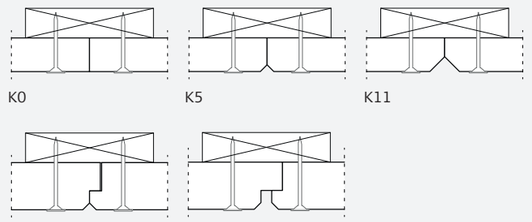
Troldtekt structure screw (close-up view of head)

Troldtekt structure screws have a pattern matching the Troldtekt structure on the screw head, making them less visible on ceiling and wall surfaces.

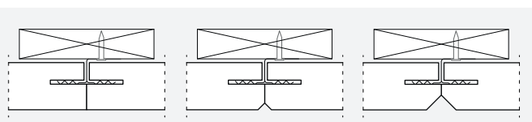
Troldtekt KN brackets
Troldtekt KN brackets have also been specially developed for installing Troldtekt ceilings. The KN brackets allow concealed installation, resulting in a streamlined ceiling surface with no visible screws. Visible screws are only used to install the acoustic panels along the walls.



Troldtekt KN brackets



Installed with screws on wooden battens

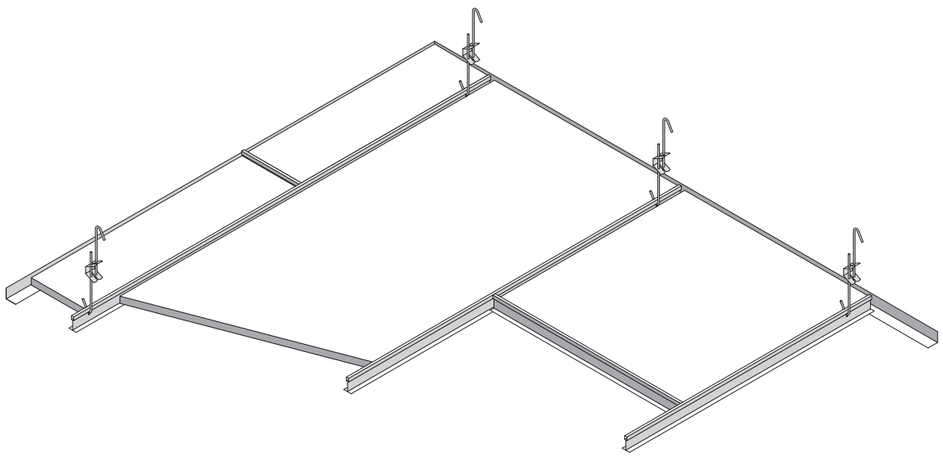


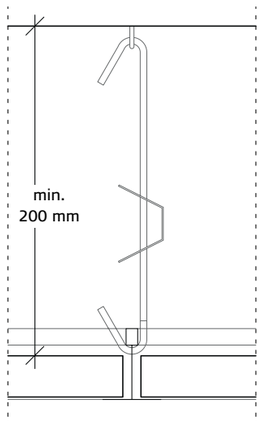
Installed with concealed KN brackets on wooden battens

T profile systems

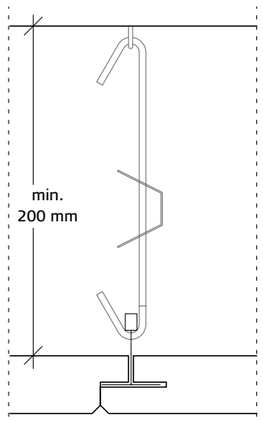
For removable suspended ceilings, Troldtekt panels can be installed in visible T24 or T35 profile systems. Suspended, removable and concealed installation is also possible using the Troldtekt T35 profile system.

Troldtekt panels can be installed in the T profile systems without tools.

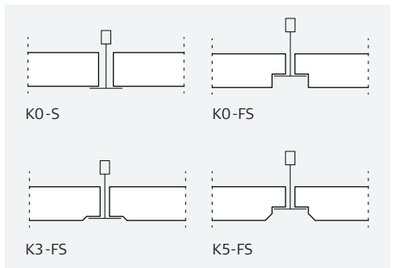




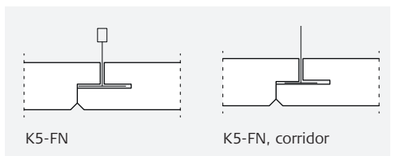
Visible T profiles, K0-S



Concealed T profiles, K5-FN



Installed with visible T profiles

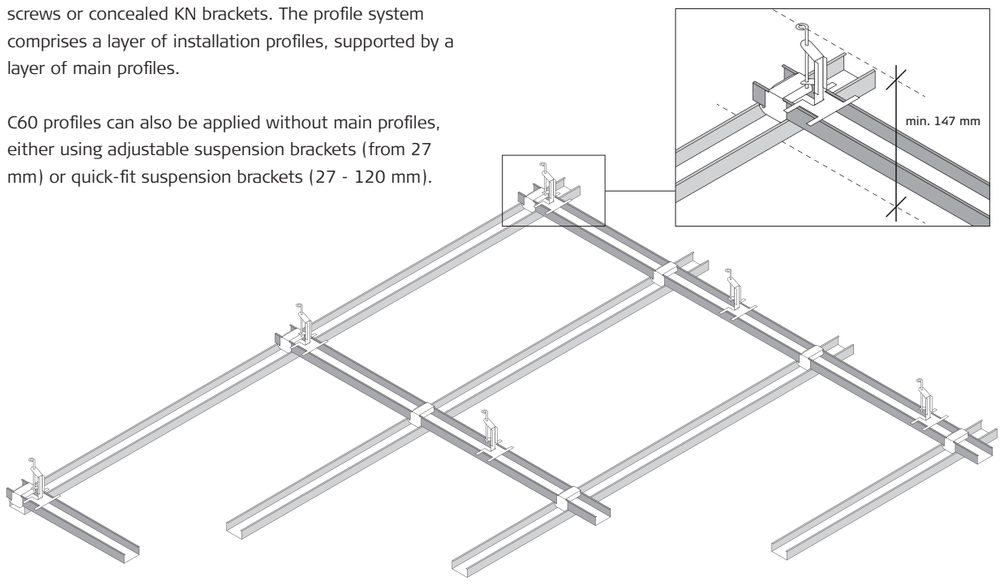


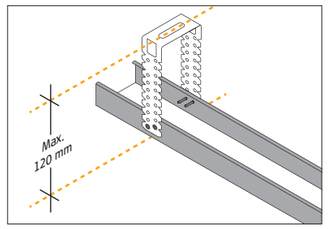
Installed with concealed T profiles

Troldtekt C60 profile system

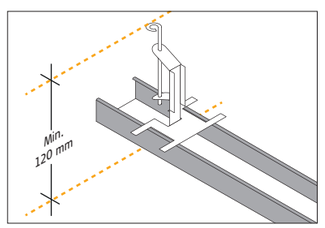
The Troldtekt C60 profile system is applied for suspended Troldtekt acoustic ceilings, installed using screws or concealed KN brackets. The profile system comprises a layer of installation profiles, supported by a layer of main profiles.

C60 profiles can also be applied without main profiles, either using adjustable suspension brackets (from 27 mm) or quick-fit suspension brackets (27 - 120 mm).

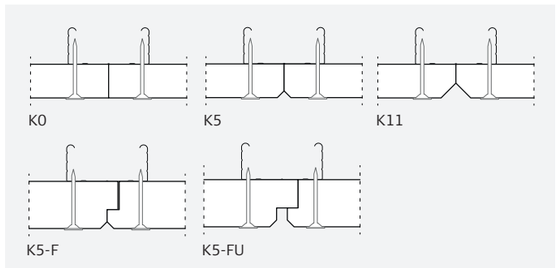




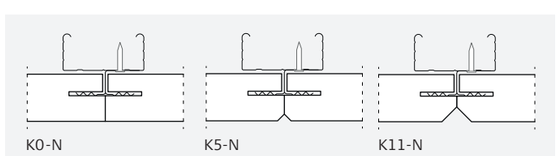
Adjustable suspension bracket



Quick-fit suspension brackets

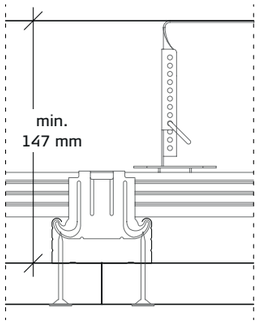


Installed with screws on C60 profiles

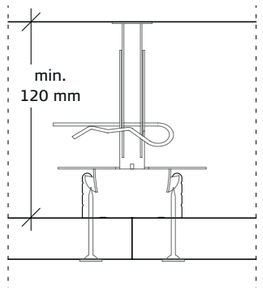


Installed with concealed KN brackets on C60 profiles

Nonius brackets
Both the C profiles and the C profile system are available with nonius brackets.



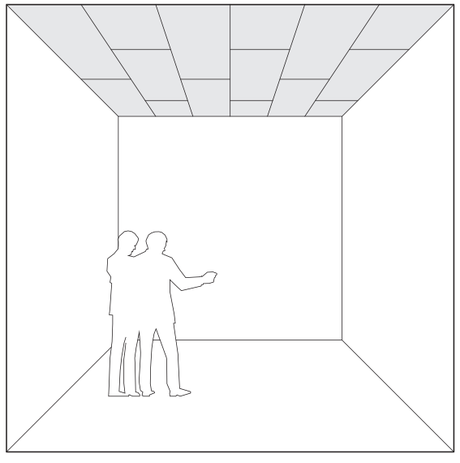
C profile system, suspended with nonius bracket.



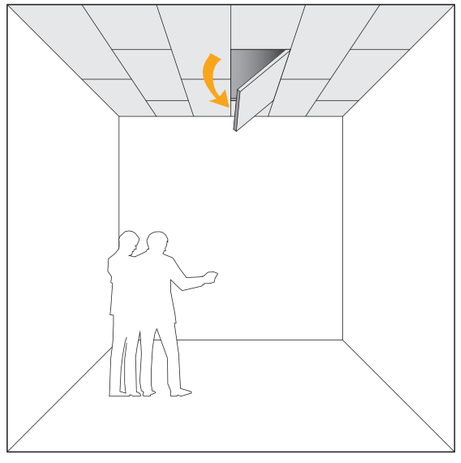
C profiles, suspended with nonius bracket.

Access panels
An integrated Troldtekt access panel provides easy access to 'hidden services' above the ceiling. As the access panel is integrated into a Troldtekt acoustic panel, it has the same visual expression as the ceiling. To open the access panel, you simply just press the Troldtekt acoustic panel lightly under the push release locks.

Access panels are available in four sizes: 600 x 1200 mm and 600 x 600 mm, which are fixed via the C60 profile system, and 400 x 400 mm and 300 x 300 mm, which are fixed via the Troldtekt panel.

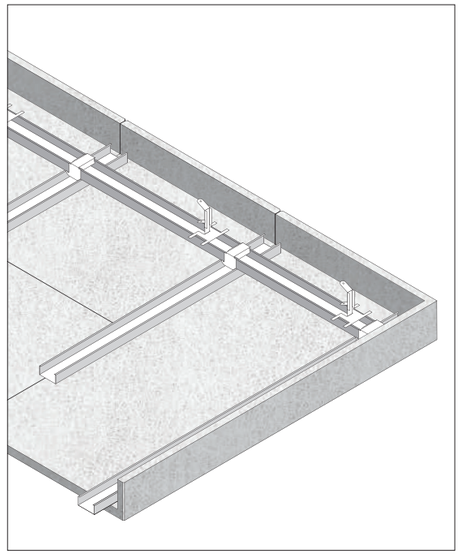


Troldtekt ceiling, access panel closed

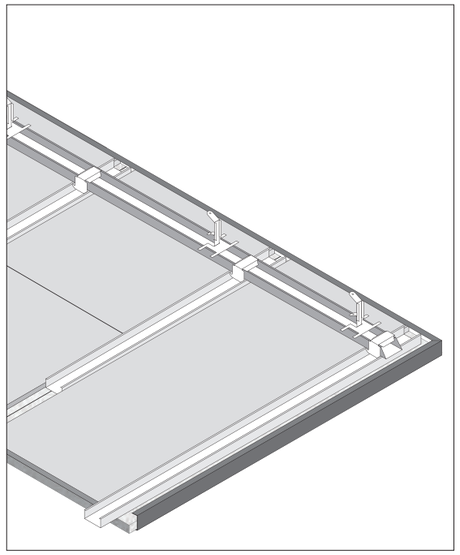


Troldtekt ceiling, access panel open

TROLDTEKT INSTALLATION



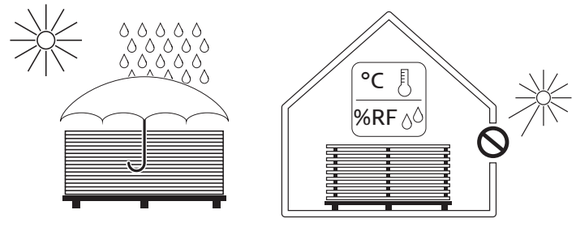
Cloud upstands
With special panels for Troldtekt cloud upstands, the C60 profile system is finished with a 125 mm vertical Troldtekt edge all around.



Clouds
With an elegant aluminium edge strip, floating ceiling clouds can be integrated in any type of building where acoustics need to be improved.

Storage and acclimatisation
Troldtekt is a natural material consisting of about 50% wood, and the panels will therefore 'work' in order to achieve the same temperature and moisture level as their surroundings. You should therefore not begin installing Troldtekt panels before the building has been completed and the heating has been turned on.

Instructions are available at › www.troldtekt.com



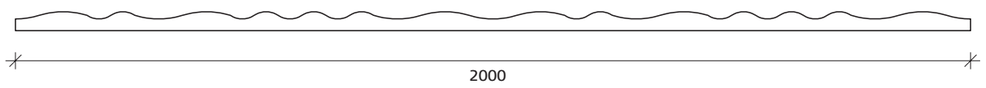
Troldtekt® wave

Troldtekt wave is a wave-shaped acoustic panel which gives wall and ceiling surfaces a sculptural, three-dimensional look.

The varied undulating waves create a sense of movement in the surface while emphasising the material's honesty and simplicity.
Troldtekt wave acoustic panels can be installed in repetitive patterns, horizontally or vertically, in stretcher bond or stack bond, enabling the architect to design his or her own three-dimensional surface for the sound-absorbing wall or ceiling surface.

Troldtekt wave is part of the Troldtekt range and boasts the same outstanding acoustic, fire-protective and indoor climate properties as the classic Troldtekt acoustic panels. Troldtekt wave also has a sound-diffusion effect.

LONGITUDINAL SECTION 2000



Troldtekt® wave has won a range of international design prizes, including the Green Product Award, the Iconic Award and the German Design Award.

Green Product Award Winner 2015

ICONIC AWARDS 2015 product winner

GERMAN DESIGN AWARD WINNER 2016

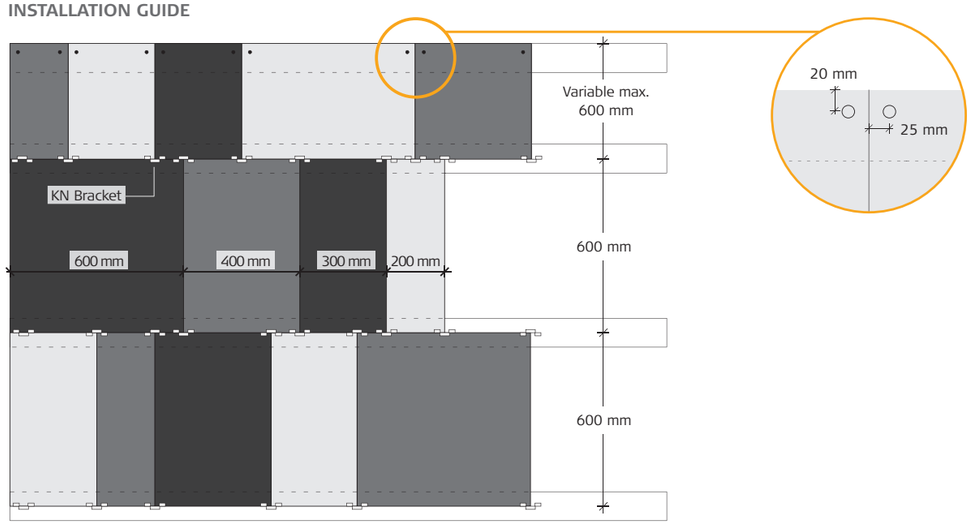
Troldtekt® mosaic

Troldtekt mosaic is Troldtekt acoustic panels in varying panel sizes designed in a selection of Troldtekt standard colours.

Troldtekt mosaic is Troldtekt acoustic panels in varying panel sizes designed in a selection of Troldtekt standard colours. Troldtekt mosaic allows the architect to give a wall a distinctive graphic look. With Cradle to Cradle-certified painted Troldtekt acoustic panels in varying panel widths, the architect has a largely free hand to produce unique designs.

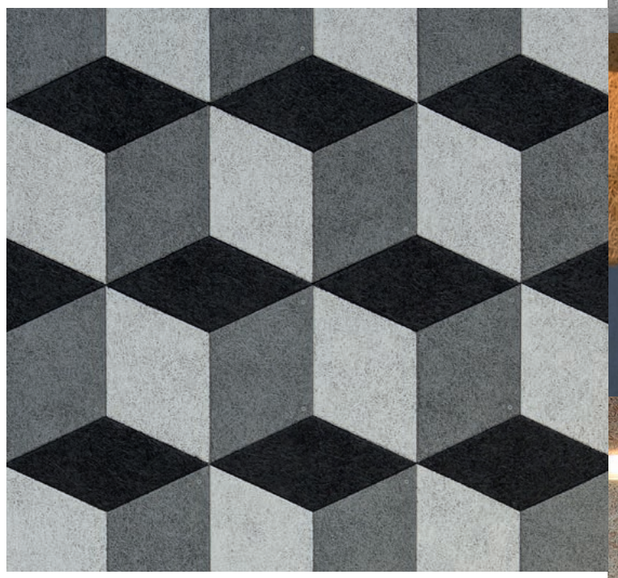
Factory-painted Troldtekt acoustic panels come in all NCS or RAL colours, and all Troldtekt standard colours are Cradle to Cradle-certified in the silver category.

INSTALLATION GUIDE



Troldtekt® rhomb

Troldtekt rhomb is an example of Troldtekt's CNC-milled design solutions that give architects complete freedom to design their own unique look.



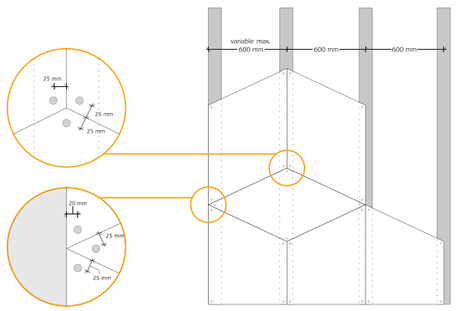
Troldtekt rhomb gives the wall a three-dimensional appearance. Close up, it looks like a beautiful, repetitive pattern of surfaces, while at a distance the wall appears as a formation of cubes in perspective.

Troldtekt rhomb panels are Troldtekt acoustic panels with CNC-milled patterns, and the panels offer, of course, the same outstanding acoustic, fire-protective and indoor climate properties as the classic Troldtekt acoustic panels.

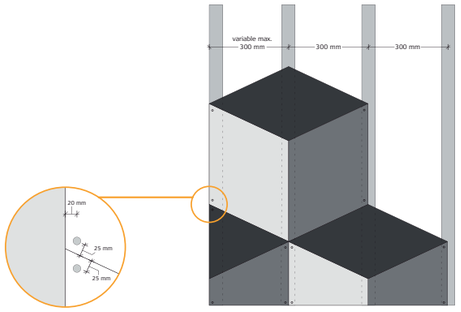
With Troldtekt rhomb mini, we have scaled down the 3D pattern formed by Troldtekt rhomb into a single element: Each element is 60 cm wide, and CNC-milled grooves create the effect of a three-dimensional cube.

The 3D look is further enhanced by three different colours of paint. The attractive 3D design is thus also available in a smaller scale, and suitable for smaller walls.

Troldtekt rhomb



Troldtekt rhomb mini



Troldtekt® rhomb has won several international design awards.

ICONIC AWARDS 2016 product winner

GERMAN DESIGN AWARD WINNER 2017

Troldtekt® lighting

Architectural simplicity and the ideal lighting effect.

Troldtekt lighting comprises a series of built-in fixtures specially designed to be built into Troldtekt acoustic ceilings. The solution is architecturally simple and combines aesthetically pure lines with good light distribution. The acoustic panels come with cut-out holes for lights, making installation easy and saving time at the building site.

Integrated fixtures
The Wave lighting series was designed by Cubo Arkitekter A/S and is characterised by undulating glass that offers a unique design and optimum light distribution without glare. All fixtures in the series are recessed, so that only the glass floats below the ceiling surface and the lighting is harmoniously integrated.

The longitudinal fixtures in the series form an integrated part of the suspension system (C60 or T35 profile system) for acoustic panels, and can be installed as a continuous light channel in the ceiling.

Troldtekt lighting is delivered with LED light sources.

Troldtekt® speakers

Built into and concealed in the acoustic panels, the sound streams out of the ceiling or wall.

You cannot see that Troldtekt speakers are built into the ceiling, but you can hear them. With traditional, visible, speaker systems in ceilings, the sound is emitted from a few points, often resulting in the experience of high sound pressure close to the speakers which quickly attenuates, becoming weak in the remote corners. It is essential for a good sound experience that the sound reaches every corner.

A Troldtekt speaker is an acoustic panel with a specially developed NXT panel, which is a flat speaker unit, built in and concealed on the back of the acoustic panel. The sound waves pass through the Troldtekt panel and are distributed evenly throughout the room. Each speaker has an acoustic spread of over 170 degrees, covering a larger area than a traditional speaker.

Elegant and discreet sound experience
Troldtekt panels ensure optimal acoustics in the room, so sound from the speakers is clear and intelligible with no disruptive reverberation, whether you install them in the ceiling or on the wall.

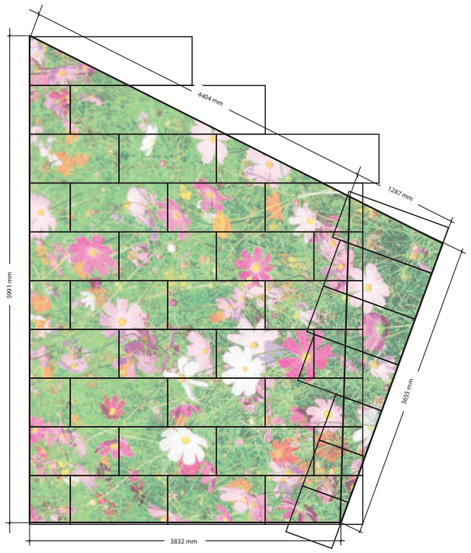
170°

The acoustic spread from a Troldtekt speaker is over 170 degrees, covering a larger area than a traditional speaker.

Subwoofer
Troldtekt speakers can be used on their own, but optimum sound quality is achieved through simultaneous use of a Troldtekt subwoofer. With a height of only 170 mm, including cable, the flat Troldtekt subwoofer can be used as a stand-alone unit, e.g. under furniture, or it can be concealed behind the ceiling.

Troldtekt® decoration

The options are virtually unlimited for your personalised ceiling or wall decoration with print or CNC milled designs.



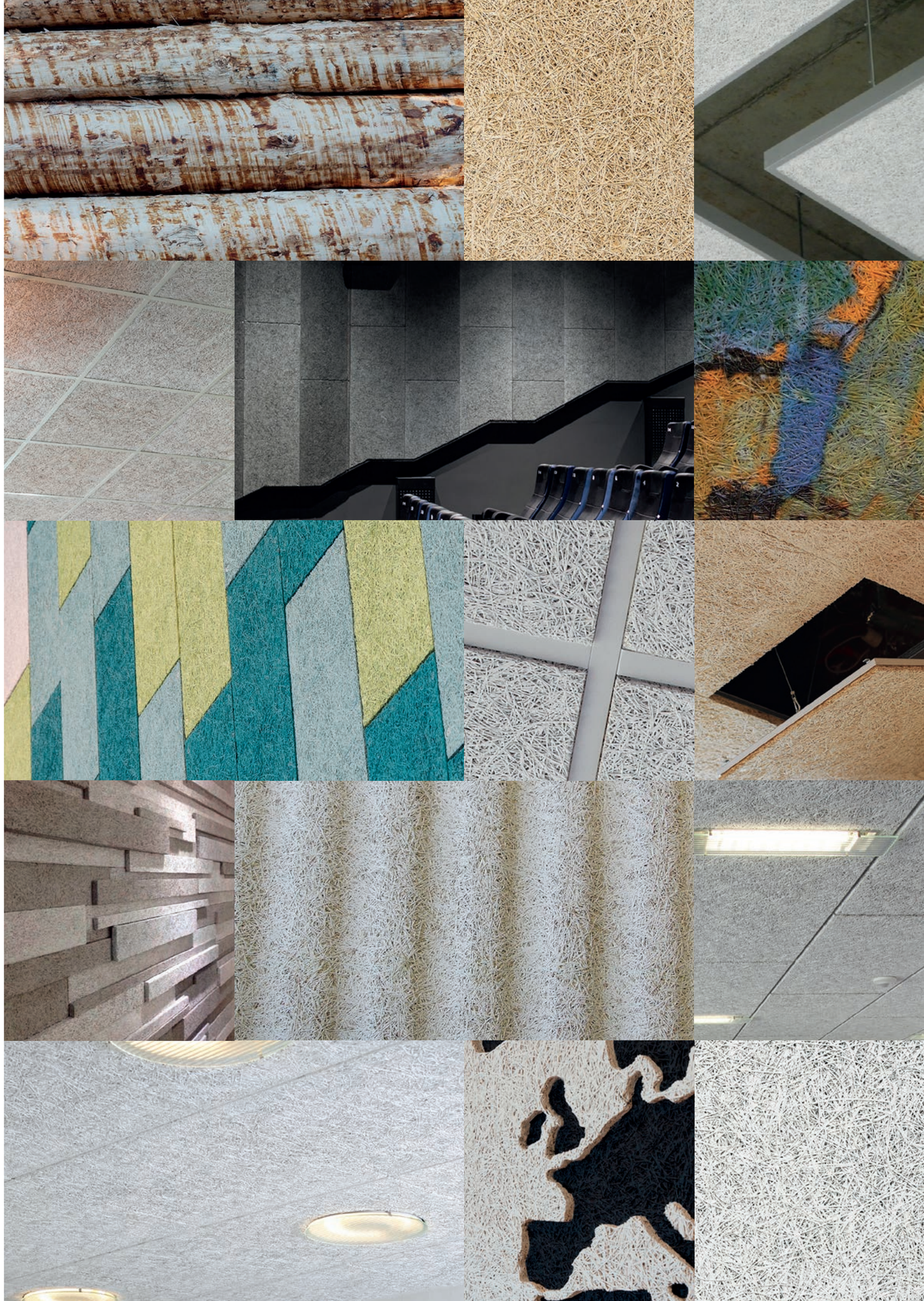
Troldtekt decoration offers personalised decoration for your ceilings, walls and framed wall panels while also ensuring good room acoustics. Advanced printing technology allows graphics, logos, art works, photos or other designs to be transferred directly to Troldtekt panels. If a three-dimensional surface is required, graphic designs and logos can be milled into the panels using CNC technology.

Ideal for large surfaces

Troldtekt's characteristic surface gives whatever design you choose an exciting added dimension, and printing technology allows graphical elements and patterns to be transferred to the panels, so that even large areas can be decorated.

Troldtekt works with artists who have provided creative designs and graphical elements for the Troldtekt decoration series. You can even supply your own digital photo, graphical material or painting – as long as you have secured the rights to copy the motif. The options are virtually unlimited.

The flower motif above is from Children's Cultural Centre Ama'r in Copenhagen. Architects: Nøhr & Sigsgaard Arkitekter & Dorte Mandrup Arkitekter.



Troldtekt® web tools

Perform an acoustic calculation and find your product combination, generate specification and calculate quantities and accessories.

As an architect or interior designer you need easy access to technical documentation such as product specifications, installation instructions and AutoCAD drawings. We have therefore developed a strong web platform to assist you.

Troldtekt acoustics calculator
By using Troldtekt's acoustics calculator you can quickly get an overview of the acoustics in a room. Simply enter your room data to calculate reverberation time or absorption area.

Try it yourself at › www.troldtekt.com

Troldtekt product generator
Our web-based product generator gives you a quick overview of the various ways our products and accessories can be combined. The product generator is easy to use. You simply put together your Troldtekt solution by selecting a number of product properties. Each time you make a selection, the options which cannot be combined with the choices you have already made are faded out.

Revit- and AutoCAD files, specifications, textures and alpha maps
Once you have made your product selections, on the next page you can download installation instructions and specific AutoCAD files for the chosen product combination and a dynamically generated specification which you can copy directly into your own specification. You can also download Troldtekt textures and alpha maps for visual representations. Under 'Downloads' you can find draft NBS specifications as well as Troldtekt's materials library and Revit files containing information on thickness, alpha maps and texture surfaces. High-resolution texture files can also be downloaded.

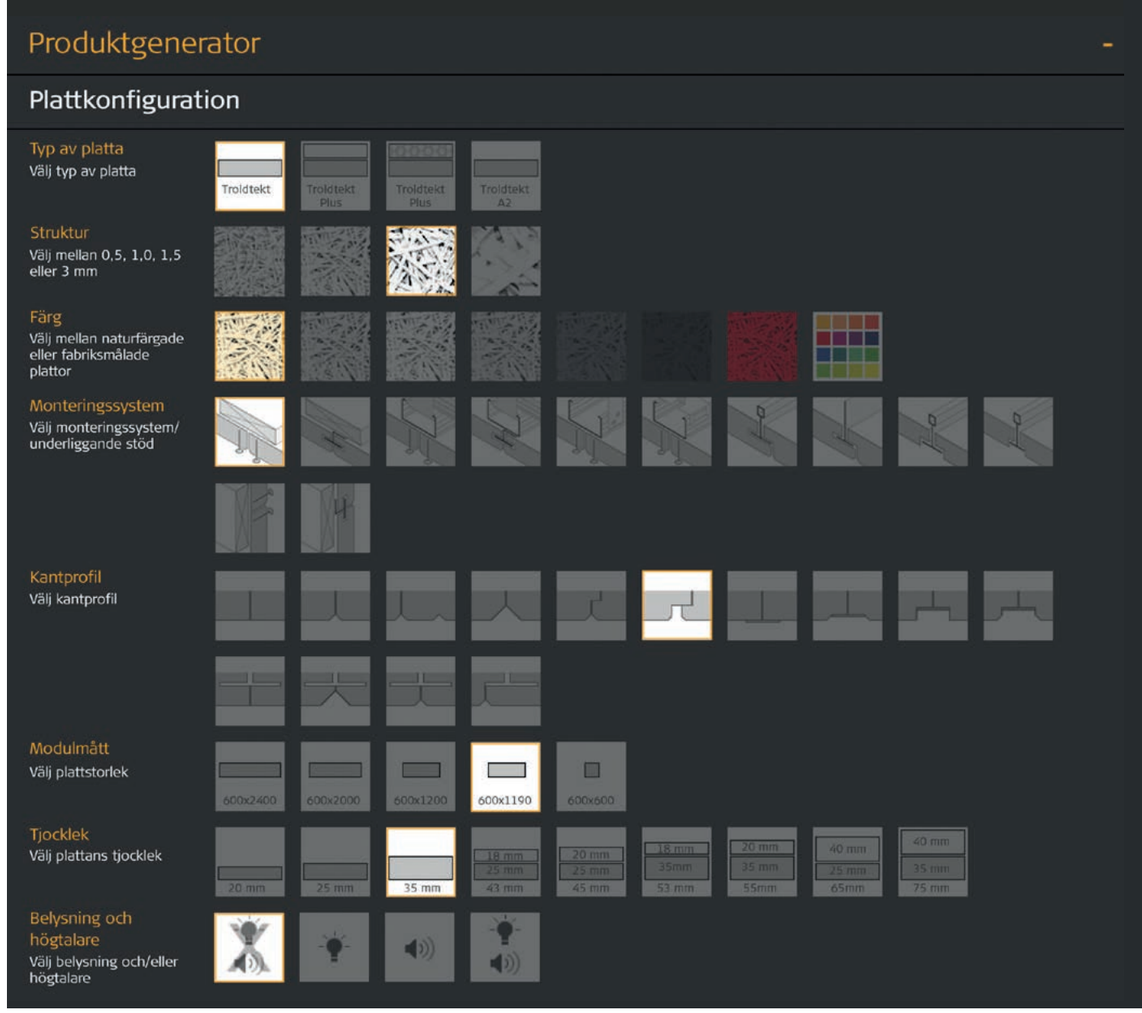
Measurement tools, quantity and accessory calculator
In the product generator you can enter your room's area and circumference, or calculate it using our measurement tool, by simply selecting the room type and entering length, width and ceiling slope (if not level). The quantities and accessories will then be calculated automatically, and you will have a general specification which you can print.

Try it at › www.troldtekt.com

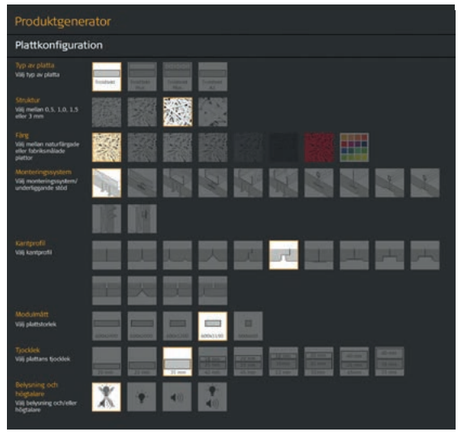
Inspiration
Visit "Inspiration" at www.troldtekt.com to be inspired by all our various references. Here you find great examples of the various design possibilities with Troldtekt acoustic solutions in different colours, sizes and formats.

News
Subscribe to Troldtekt's online newsletter. The newsletter contains inspiring contemporary articles on acoustics, indoor climate, architecture and sustainable construction. Each issue focuses on a relevant theme which is covered in articles, photos and videos.

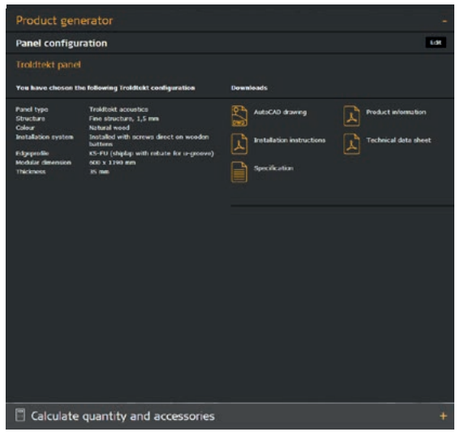
Subscribe at › www.troldtekt.com



The product generator is easy to use. You simply put together your Troldtekt solution by selecting a number of product properties.



Each time you make a selection, the options which cannot be combined with the choices you have already made are faded out.



Once you have made your product selections, on the next page you can download installation instructions and specific AutoCAD files for the chosen product combination and a dynamically generated specification which you can copy directly into your own specification.

Six good reasons for choosing Troldtekt

› Good acoustics
The combination of wood and cement gives Troldtekt panels a unique surface structure which absorbs sound and reduces reverberation time in a room.

› Healthy indoor climate
Troldtekt panels are a natural, breathable material which can absorb and release moisture. The acoustic panels are allergy friendly and have achieved leading Danish and international indoor climate certifications.

› Documented sustainability
Troldtekt panels are sustainable throughout the entire product life cycle. The acoustic panels are made exclusively from nature's own materials, are produced under minimal environmental impact, and can return to nature as compost.

› Effective fire protection
The wood wool in Troldtekt panels is encased in cement and Troldtekt panels therefore have low flammability. Troldtekt acoustic panels have been tested in accordance with BS 476 and are "Class O" as designated in the British Building Regulations and have a Class 1 Spread of Flame classification.

› Natural strength
Troldtekt panels combine the strength of cement with the flexibility of wood, and have a lifetime of at least 75 years. Troldtekt panels are a rugged, durable material, even when subject to moisture or ball impacts. The cement gives the acoustic panels their stable shape and moisture tolerance, while the wood ensures they are easy to work with and suitable for screw installation.

› Flexible design solutions
The characteristic surface structure gives Troldtekt panels their unique expression. Lighting and speakers can be combined and integrated in a complete ceiling.

Read more about the six good reasons on the following pages ›

Good acoustics

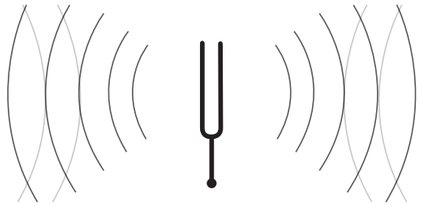
Noise and poor speech intelligibility results in poor well-being and that's why good acoustics are so important.

Good acoustics are important to our well-being, whether at home, at work, at a leisure centre or public building. Here you can read about the factors that impact on room acoustics, what the various terms mean and why they are important:

Sound and noise
Sound is compression waves that travel through the air. We normally distinguish between sound and noise. We call pleasant, ordered waves sound but categorise chaotic obtrusive waves as noise.

Frequency
Frequency expresses how many times a sound wave oscillates per second. Frequency is measured in hertz (Hz). 100 Hz corresponds to 100 oscillations per second. Bass sounds have low frequency while treble sounds have high frequency.

Sound pressure
Sound intensity is described using decibel (dB) units. The higher the sound pressure, the higher the decibel value. If dB measurements are to be comparable, they must be made at the same distance from the sound source.



Reverberation time
Reverberation time is the time it takes for a sound in a room to die out. The room's surfaces determine how sound spreads within the room.

Speech intelligibility
If a room has a long reverberation time, spoken words will not die out before the next words reach the listener. This results in poor speech intelligibility, and it will be difficult for the listener to understand what is said. However, if the sound is absorbed, there is a short reverberation time, good acoustics and a high level of speech intelligibility.

Sound absorption
Short reverberation times can be achieved by using materials which are good at absorbing sound. This property can be described using an absorption coefficient – specified using the Greek letter α (alpha).

Absorption area
A room's acoustics depend on how many square metres of sound dampening material you install. The higher the proportion of the room's surface area that absorbs sound, the shorter the reverberation time will be in the room.

60dB

Reverberation time is the time it takes from when a sound source (such as a clap) ceases, until the sound level has decreased by 60 decibels.

α_w =1.0

Troldtekt panels backed by mineral wool have a sound absorption factor of around 1.0 for sounds above 500 Hz, i.e. the material absorbs 100% of the sound.

You can also say that a sound absorption factor of 1.0 corresponds to the sound disappearing out of an open window.

Reverberation times

Room with flat ceiling

Length:	9,0 m
Width:	7,0 m
Height:	2,7 m
Volume:	170,1 m³
Floor/ceilings:	63,0 m²
Wall area:	62,4 m²
Windows:	20,0 m²
Doors:	4,0 m²

Material:

Floor:	Rubber or vinyl on concrete
Wall:	Plastered walls
Door:	Door, heavy
Window:	Window (3+12+3 mm)

Concrete ceiling						
HZ	125	250	500	1000	2000	4000
Sec	2,93	3,33	3,74	3,90	5,24	5,24

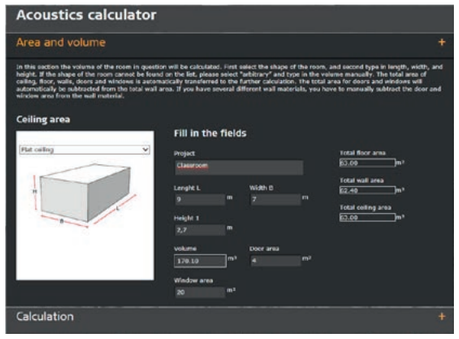
25+18 mm Troldtekt Plus on concrete						
HZ	125	250	500	1000	2000	4000
Sec	1,81	1,03	0,51	0,40	0,47	0,43

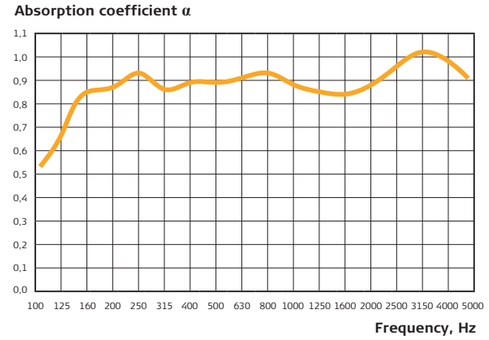
35 mm Troldtekt and 50 mm mineral wool, suspended						
HZ	125	250	500	1000	2000	4000
Sec	0,59	0,45	0,45	0,46	0,45	0,45

The above examples have all been calculated using Troldtekt's acoustics calculator, which you can find at › www.troldtekt.com

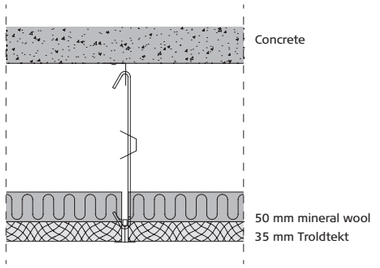
You can use Troldtekt's acoustics calculator to quickly get an overview of the acoustics in a room. Once you have entered the data for a room (dimensions and materials) into the calculator, a simple, clear report is generated showing reverberation times, absorption area and other useful acoustics information.

Accredited sound measurements for a number of constructions with Troldtekt panels are available at › www.troldtekt.com





Troldtekt panels backed by mineral wool have a sound absorption factor of around 1.0 for sounds above 500 Hz



Background noise impacts on well-being

A report from the Danish National Research Centre for the Working Environment found that teachers who teach at schools with poor acoustics are less satisfied with their job than teachers at schools with good acoustics. The study found that the most important factor for teachers' dissatisfaction was long reverberation time, which is known to result in a noisy, chaotic acoustic environment.

107 teachers at ten schools in Copenhagen participated in the study, and the desire to change job was six times greater among teachers who taught in rooms with long reverberation times. If the sound level was high for at least one quarter of the working time, teachers were also less motivated and experienced greater fatigue.

Poor acoustics also influenced teachers' perceptions of class unity. The study found that teachers working in classrooms with long reverberation times perceived the social climate in the class as more competitive and aggressive and less relaxed and comfortable.

6x

The desire to change job was six times higher among teachers who taught in rooms with long reverberation times.

Find out more about acoustics and watch our acoustics movie at › www.troldtekt.com

Healthy indoor climate

A good indoor climate is important for our health and well-being.

Most people spend most of their lives indoors, and much of this time is spent at work. It is therefore vital that the buildings we are in have a good indoor climate which does not cause irritations or affect our health or ability to work.

When we are indoors we are affected by a variety of factors – air quality, humidity, heat, light, smoke, noise and particles and chemicals emitted from various materials. Symptoms of poor indoor climate range from eye, nose and throat irritation to rash, headache and nausea.

Der Blaue Engel

"Der Blaue Engel" is a voluntary and independent environmental certification. The requirements set by "Der Blaue Engel" place a particular focus on examining the impact that products and services have on the environment: on the climate, resources, water, soil and air. These tests also focus on their impact on people. Troldtekt is classified as "Emissionsarm" (low emissions).

Indoor climate certification

Troldtekt is certified to the best indoor climate categories by Danish Indoor Climate Labelling (Dansk Indeklima Mærkning). To qualify for the Danish indoor climate label, a product's off-gassing must decline within the first 60 days following installation. Troldtekt panels fulfil the requirements at the first measurement after 10 days. Ceiling products are also tested for the quantity of fibres and particles they emit. Troldtekt panels qualify for the best category, 'low particle emissions', i.e. less than 0.75 milligrams per square metre.

Healthy materials

One of the five criteria used by the international Cradle to Cradle design concept is the health of the materials. To qualify for Cradle to Cradle certification, the chemical contents of the product must be identified using an 'ABC-X' material assessment, and a phase-out plan must be developed for undesirable (X-list) substances. Troldtekt natural panels contain no X-list substances. This applies to the entire series, including our non-combustible variant, Troldtekt A2. Our standard paint contains minimal X-list substances, which we are phasing out in cooperation with our paint supplier. The entire product series has Cradle to Cradle silver certification, both in natural and standard painted colours.

M1 label

Troldtekt panels are classified in the M1 category by Finnish Indoor Air Association and Building Information Foundation RTS. The classification system divides building materials based on emission classes, i.e. how many substances the materials emit to the air. Emission class M1 corresponds to the best quality (lowest emissions rate), while M3 materials have the highest emission rates. To qualify for M1 classification, products must be tested by an independent and impartial laboratory and fulfil strict emission requirements in relation to VOCs (volatile organic compounds), formaldehyde, odour, etc. Troldtekt panels have been tested by the Danish Technological Institute under ISO 16000-9, ISO 16000-3 and Eurofins 4430.

Allergy Friendly Product Award

Troldtekt qualified for Allergy UK's 'Allergy Friendly Product Award', confirming that Troldtekt panels do not contain allergens or harmful substances. The Allergy Friendly Product Award is only given to products which improve health and well-being for asthma and allergy sufferers. To qualify for the Allergy Friendly Product Award, the product must be investigated and assessed by Allergy UK's panel of advisors and experts.

Documented sustainability

The environment is the main focus throughout the product's entire life cycle.

1 Materials
Troldtekt cement-bonded wood wool panels are made of 100% natural materials: Wood and cement. We use Norway spruce grown in Denmark which is PEFC™ or FSC® certified. Both certification schemes ensure that the wood comes from responsibly managed forests.

The production of Troldtekt panels uses only cement from Aalborg Portland, which extracts the raw materials from the Danish bedrock with minimal environmental impact. Chalk and sand are the key raw materials used to make Portland cement. Both chalk and sand is extracted in Denmark, where sand dredging helps keep sailing channels navigable. Aalborg Portland is certified under the ISO 14001 eco-management system and the European EMAS (Eco-Management and Audit Scheme). Aalborg Portland has twice been nominated for the European Commission's prestigious EMAS Award.

2 Transportation
Troldtekt panels are made exclusively from local raw materials – Danish grown Norway spruce and Danish cement – and the environmental impact from transportation is therefore minimal. We have a broad distribution network of local dealers in our export markets and thus, transportation to end users can be optimised.

Find our export distributors at › www.troldtekt.com

3 Production
We have been manufacturing Troldtekt cement-bonded wood wool panels at our factory in Troldhede since 1935. The production of Troldtekt panels takes place under modern conditions in a closed system without any waste water discharge. About 95% of the energy consumption for heating production derives from CO_2-neutral wood fuel left over from production. Troldtekt is a DONG Energy climate partner, so all electricity used for the production of Troldtekt panels derives from wind power from the Anholt offshore wind farm.
The environmental impact from the production of Troldtekt panels is mapped out in our Environmental Product Declaration (EPD), which has been prepared by the Danish Technological Institute in line with the new EN 15084 European standard.

The EPD can be downloaded from › www.troldtekt.com

4 Use
Troldtekt panels contain no harmful substances or allergens and have qualified for the best Danish Indoor Climate Labelling categories. Troldtekt panels are also recognised as a hypoallergenic product by Allergy UK, and labelled in the lowest emissions class (M1) by the Finnish Indoor Air Association and the Building Information Foundation RTS.

5 Recycling
Troldtekt cement-bonded wood wool panels can be composted and returned to nature as a soil conditioner. The cement in Troldtekt's acoustic panels boosts oxygen levels during the composting process, while the wood adds organic material to the compost. Production waste from our factory in Troldhede is delivered to HedeDanmark a/s, which receives, treats and refines waste products to make soil conditioners.

Like production waste, clean Troldtekt waste from building sites in the form of offcuts and waste from Troldtekt acoustic panels can be safely returned to nature as soil conditioner. We are working to find similar business partners on selected European markets.

Cement-bonded wood wool demolition waste can instead be recirculated in the production process as a raw material in new cement. Cement manufacture is a thermal process which renders any surface treatment harmless. The wood content of the cement-bonded wood wool panels contributes to the combustion process (energy), while the cement component becomes a raw material in new cement. Together with Aalborg Portland, we are working to offer this solution in Denmark from 2018 or 2019. Troldtekt is working to establish similar partnerships in selected markets.

You can find recycling guidelines at › www.troldtekt.com

PEFC™ PEFC/09-31-030 · FSC www.fsc.org FSC® C115450 Miljømærket for ansvarligt skovbrug · Der Blaue Engel weil emissionsarm schützt Umwelt und Gesundheit · Emission class for building material M1 Indeklima Mærket · AllergyUK Allergy Friendly Product · DONG Energy Klima Partner · cradle to cradle CERTIFIED Silver

SUSTAINABILITY

Troldtekt contributes to sustainable building

Sustainability certification for buildings is becoming increasingly widespread, and the three leading voluntary certification schemes are LEED (US), BREEAM (British) and DGNB (German).

LEED, BREEAM and DGNB
Troldtekt panels make a positive contribution to sustainable building and can help developers qualify for more points and thereby achieve higher certification levels under the three schemes. Ramboll (engineering consultants) has determined that Troldtekt panels contribute to the three certification schemes in the following focus areas:

- Total cost of ownership
- Acoustic indoor climate
- Off-gassing for atmospheric indoor climate and toxicity
- Psychological indoor climate – integrated art
- Materials, including:
  - Life cycle assessment
  - Regionality
  - Renewability and reuse
  - Recycled content
  - Procurement of materials and purchasing policy
  - Fire safety
  - Construction site waste management

Ramboll has prepared reports detailing the contribution of Troldtekt panels to sustainable construction, and documentation packages for building auditors and assessors.

EPD
The new EN 15804 European standard for Environmental Product Declarations (EPDs) analyses or declares a product's impacts on seven environment factors which can influence climate change and global warming, among other things. EN 15804 is specific to building materials and is more stringent than the older and more general ISO 14025 standard. Declarations based on the two different standards are therefore not directly comparable.

The Environmental Product Declaration (EPD) for Troldtekt is third party verified by Norwegian SINTEF Byggforsk/SINTEF Building and Infrastructure. The EPD has been registered with The Norwegian EPD Foundation, EPD Denmark as well as accepted and registered in the German register for third party verified EPD's at the Institut für Bauen und Umwelt e.V. (IBU).

Positive contribution
Ramboll reports document the positive contribution of Troldtekt panels to LEED, BREEAM and DGNB.

EN 15804
Troldtekt's EPD is based on the new and stringent EN 15804 standard.

Effective fire protection

Troldtekt panels protect against fire and have fire protection approval under European and national regulations.

The fire characteristics of interior ceiling and wall cladding have a major impact on how a fire develops. During evacuation, it is important that temperature, smoke concentration, heat radiation and other factors do not prevent people inside the building from reaching safety.

The cement encapsulates the wood
Troldtekt panels are made from wood and cement. Wood is an organic and flammable material, but every single wood fibre in a Troldtekt panel is encapsulated and protected by non-flammable cement. Troldtekt panels therefore have low flammability and only emit low heat during a fire, and almost no smoke. Troldtekt A2, made using special cement, is a non-flammable material.

Download Troldtekts' fire certifications from
› www.troldtekt.com

CE

European fire classification and CE marking
Troldtekt panels are CE marked under the EN 13168 European standard for cement-bonded wood wool, and EN 13964 for suspended ceilings. In accordance with the two European standards, Troldtekt panels have been tested for reaction to fire under EN 13501, and have qualified for the following fire classifications:

- Troldtekt acoustic panels: B-s1,d0.
- Troldtekt A2: A2-s1,d0.

International classifications
Troldtekt panels have been fire tested and classified under a number of national standards, including MK (Denmark), Nemko (Norway), Sitac (Sweden) and KOMO (the Netherlands). In Germany, Troldtekt panels are Ü labelled and have an 'allgemeine bauaufsichtliche Zulassung' (abZ).

Exova

EXOVA
Troldtekt acoustic panels have been tested by Exova Warringtonfire in accordance with BS 476 and are "Class O" as designated in the British Building Regulations and have a Class 1 Spread of Flame classification.

Natural strength

Troldtekt panels derive their good properties from the raw materials – strength and durability from cement and natural breathability from wood.

Troldtekt cement-bonded wood wool is a rugged and durable material. The setting and curing process transforms the cement in the panels into concrete and gives the material its strength. The natural properties of the wood make the material breathable and permit diffusion. Troldtekt panels are suitable for screw installation and are also easy to work with and cut.

Moisture-resistant
Troldtekt panels can absorb and release moisture and are therefore ideal for ceiling and wall cladding in wet rooms, such as bathrooms and swimming pool centres. Troldtekt panels can also be used outdoors, for example under overhangs. The material cannot rot and does not provide a breeding ground for fungi or other microorganisms.

Stable shape
Troldtekt panels have an extremely stable shape and retain their flatness – even in moist environments. There is no warping over time. If the air humidity in a room changes by one percentage point, the panel dimensions only change by 0.05 per mille.

0.05 ‰

Troldtekt panels have a stable shape. If the air humidity changes by one percentage point, the panel dimensions only change by 0.05 per mille.

Tested with ball impacts
Ceiling and wall cladding in sports facilities and gymnasiums is exposed to stress from ball impacts. The ability of Troldtekt panels to withstand ball impacts has been tested at MPA in Stuttgart under German DIN standard 'Prüfung der Ballwurfsicherheit, DIN 18032 Teil 3, Sporthallen für Turnen und Spiele'. A wide range of Troldtekt panel structures has been tested and approved as ceiling and wall cladding in sports facilities. This applies to panels installed on wooden battens and suspended in C60 profile systems.

81 km/h

During a ball impact test, handballs hit the wall cladding at a speed of 22.5 m/s, equal to 81 km/hour.

When the ability of Troldtekt panels to withstand ball impacts is tested, a handball is fired 36 times at the ceiling cladding, and 54 times at the wall cladding. The ball is fired from various angles at speeds of 16.5 ± 0.8 m/s and 22.5 m/s – corresponding to 59.5 and 81 km/h.

Test report for moisture stability and overview of ball impact tests for Troldtekt available at
› www.troldtekt.com

Flexible design solutions

Unbroken surfaces with integrated and concealed functions and personalised design. The multi-functional ceiling is a reality.

Troldtekt panels are an honest material with a very characteristic expression. The variety of colours, structures, edge profiles and suspension systems permit customised design solutions.

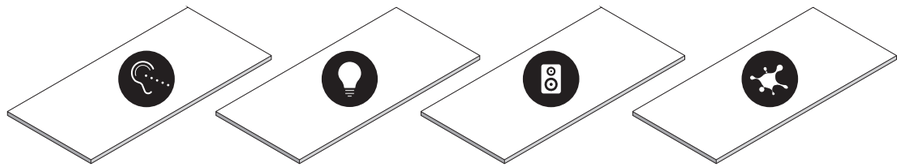
Troldtekt acoustic solutions and the series of special products also allow you to integrate and conceal a number of functions in the ceiling, while maintaining an unbroken plane. The result is streamlined ceiling panels which provide a calm cohesive surface.

Troldtekt speakers concealed in the ceiling allow you to avoid disruptions to the ceiling surface and cabinet speakers. Our series of designer light fixtures are recessed for the best visual results.

The multifunctional ceiling is now a reality. The options for printing or CNC milling designs on acoustic panels are virtually limitless.

Troldtekt Award
Every two years we give international design and architecture students the opportunity to express their creativity and participate in our design competition.

Find out more and see the attractive winning projects at
› www.troldtekt.com/award.



Labels & certifications

Below is an overview and explanation of some of the most important Danish and international labelling and certification schemes, including Troldtekt's status under the schemes.

CE marked
CE marking is compulsory for construction products covered by a European harmonised standard. Troldtekt panels are CE marked under EN 13168 for cement-bonded wood wool and EN 13964 for suspended ceilings. Troldtekt is certified under system 3, and its factory in Troldhede is subject to external auditing. Troldtekt has qualified for B-s1,d0 fire classification and the series' non-flammable Troldtekt A2 variant has qualified for A2-s1,d0 fire classification.

MK approval
In addition to CE marking, further requirements for the fire properties of building materials are set forth in the Danish building regulations (BR10). The Danish fire requirements are function-based and divided into application categories. All categories generally require cladding class K1 10 B-s1,d0 (class 1 cladding). Troldtekt panels are MK approved by ETA Denmark as a class A material and class 1 cladding.

DoPs
The Construction Products Regulation (CPR, EU No. 305/2011) replaced the Construction Products Directive (CPD) as of 1 July 2013. Under the regulation, declarations of conformity are replaced with declarations of performance (DoPs). All Troldtekt products are CE marked, with a QR code directly linking to the specific DoP.

SITAC
In Sweden, type approvals ensure that applicable laws and regulations are observed. Type approvals are carried out by SP Certification (formerly SITAC). Troldtekt panels have been issued with 'Typgodkännande-bevis 1511/75' and approved as 'Tändskyddande beklädnad' under section 5:221 in 'Boverkets Byggregler BBR'.

NEMKO
Norwegian NS labelling is carried out by Nemko and ensures compliance with applicable Norwegian standards, harmonised with corresponding European standards. Troldtekt has a certification licence for NS labelling of 'Brannteknisk klassifiserte kledninger/overflater' in line with the requirements in NS 3919:1997.

KOMO
In the Netherlands, a KOMO certificate ensures that building materials fulfil the Dutch building regulations. In the Netherlands, Troldtekt products are marketed as Stertekt, and our dealer, Isolco, has a KOMO certificate for Stertekt.

EXOVA
Troldtekt acoustic panels have been tested by Exova Warringtonfire in accordance with BS 476 and are "Class O" as designated in the British Building Regulations and have a Class 1 Spread of Flame classification.

Übereinstimmungszertifikat Akustik
'Das Deutsche Institut für Bautechnik' (DIBt) issues 'Allgemeine bauaufsichtliche Zulassungen' (abZ) for building materials. The approval is based on the application of the products. Troldtekt panels have been issued with the Ü label and approved as 'schwerentflammbar' and 'glimmen nicht'.

Übereinstimmungszertifikat A2
'Das Deutsche Institut für Bautechnik' (DIBt) issues 'Allgemeine bauaufsichtliche Zulassungen' (abZ) for building materials. The approval is based on the application of the products. Troldtekt A2 panels have been issued with the Ü label and approved as 'nicht brennbar' and 'glimmen nicht'.

MPA
Ceiling and wall products are subject to stress in sports facilities when they are exposed to ball impacts. A wide range of Troldtekt panel structures have been tested to withstand ball impacts under DIN 18032 and approved as ceiling and wall cladding in sports facilities.

DONG climate partner
Using energy from renewal energy sources avoids carbon emissions. Troldtekt is a DONG climate partner and only receives electricity from renewable energy in the form of wind power from the Anholt offshore wind farm.

Cradle to Cradle
The Cradle to Cradle philosophy is based on three fundamental design principles – recycling, renewable energy and diversity. Troldtekt panels are Cradle to Cradle certified in the silver category, and the certification covers ALL Troldtekt cement-bonded wood wool products, natural and in standard painted colours.

PEFC™
PEFC™ stands for Programme for the Endorsement of Forest Certification schemes and is an international non-profit NGO which works to promote sustainable forestry around the world. The scheme takes into consideration small forestry operations. Troldtekt panels are PEFC™ certified.

FSC®
FSC® stands for Forest Stewardship Council, an international non-profit labelling scheme based on 10 principles for responsible forestry operations. The certification guarantees, for example, that logging levels do not exceed forest regrowth and that flora and fauna are protected. Troldtekt panels are FSC Mix certified.

Danish Indoor Climate Labelling (Dansk Indeklima Mærkning)
Danish Indoor Climate Labelling (DIM) is a voluntary labelling scheme for building materials and their impact on the indoor climate. The indoor climate certificate contains requirements for the products during their usage phase and includes product impact on the indoor air quality. Ceiling products are also tested for the quantity of fibres and particles they emit. Troldtekt panels are Indoor Climate certified in the best category.

Allergy Friendly Product Award
Allergy UK offers the Allergy Friendly Product Award to products which improve health and well-being for asthma and allergy sufferers. The award is a guarantee that the product contains no harmful substances or allergens. To qualify for the award, the product must be investigated by Allergy UK's panel of advisors and allergy experts. Troldtekt panels have qualified for the Allergy Friendly Product Award.

EPD
The Construction Products Regulation (CPR, EU No. 305/2011) was replaced by the Construction Products Directive (CPD) on 01.07.2013 hereby introducing a 7th requirement of documentation for the sustainability of construction products. Until this is incorporated into product standards, sustainability can be documented through environmental product declarations (EPDs) under ISO 14025 or EN 15804. Troldtekt's EPD is prepared according to EN 15804, third party verified by Norwegian SINTEF Building and Infrastructure, registered with EPD Norway, EPD Denmark as well as accepted by and registered with the Institut für Bauen und Umwelt (IBU).

M1
Finnish Indoor Air Association and the Building Information Foundation RTS divide building materials into three emission classes. M1 is the best class, and guarantees that VOCs (volatile organic compounds) and odour emissions meet a number of criteria. Troldtekt panels are approved in emissions class M1.

Der Blaue Engel
"Der Blaue Engel" is a voluntary and independent environmental certification. The requirements set by "Der Blaue Engel" place a particular focus on examining the impact that products and services have on the environment: on the climate, resources, water, soil and air. These tests also focus on their impact on people. Troldtekt is classified as "Emissionsarm" (low emissions).

Global Compact
The UN Global Compact is the largest global initiative for corporate social responsibility and is based on 10 principles in the areas of human rights, labour rights, the environment and anti-corruption. Troldtekt has committed to the UN Global Compact and prepares an extensive report on the company's CSR activities each year.

BREEAM
BREEAM stands for: 'Building Research Establishment Environmental Assessment Method' and is the British sustainability certification for buildings, launched by BRE in 1990. Within the EU, BREEAM is managed by BRE, one of the founders of the UK Green Building Council. BREEAM is used in over 50 countries and several European countries, including the Netherlands and Norway, and has editions adapted to particular countries. Ramboll has prepared a report and documentation package detailing the positive contribution of Troldtekt panels to sustainable construction certified under BREEAM.

LEED
LEED stands for 'Leadership in Energy and Environmental Design' and is the US sustainability certification scheme for buildings, launched in 1998. LEED is managed by the US Green Building Council, and there are LEED certified buildings in over 135 countries. Ramboll has prepared a report and documentation package detailing the positive contribution of Troldtekt panels to sustainable construction certified under LEED.

DGNB
DGNB stands for 'Deutsche Gesellschaft für Nachhaltiges Bauen' and is the German sustainability certification scheme for buildings, launched in 2008. Ramboll has prepared a report and documentation package detailing the positive contribution of Troldtekt panels to sustainable construction certified under DGNB.

Troldtekt A/S

Good acoustics since 1935.

Troldtekt A/S has been designing, developing and manufacturing acoustic panels since 1935 – from natural local materials and under modern conditions with minimal environmental impact. Our products are developed and manufactured in Denmark, and distributed in numerous countries around the world. We believe sustainable indoor climate is a key element of good architecture.

We are a trendsetter
Our vision is to be a trendsetter within intelligent acoustic solutions that focus on a sustainable indoor climate. To this end we continuously develop new specialist products in close collaboration with industry experts, architects and other building consultants. Every two years we also present the Troldtekt Award to the international architecture or design student who best conceives and presents Troldtekt panels in a different and innovative way.

We take responsibility
It is important to us to take responsibility for society around us – including for our own sake. We believe companies do well by doing good. We have therefore systematised our responsibility efforts by committing to the UN Global Compact – the world's biggest voluntary Corporate Social Responsibility initiative.

We create added value
The sustainable Cradle to Cradle design concept is a key part of our business strategy at Troldtekt A/S. The Cradle to Cradle approach focuses on materials creating added value for the environment, society and business in a holistic way. We work with the consultants Vugge til Vugge Danmark to ensure the business initiatives we implement are in line with international Cradle to Cradle principles.

Troldtekt A/S, factory in Troldhede.

Troldtekt was Highly Commended at the Responsible Business Awards 2015 for its business strategy and work with the Cradle to Cradle concept.

2014 Troldtekt A/S won the Danish CSR Strategy Award.

Cradle to Cradle products and business strategy

Troldtekt has qualified for Cradle to Cradle certification in the silver category, and the certification covers the entire series of Troldtekt cement-bonded wood wool products. The certification covers acoustic panels, natural and in standard painted colours.

Cradle to Cradle certification includes assessment based on five parameters: healthy materials, recycling, renewable energy, water consumption and social responsibility.

Theme \ Tier	Basic	Bronze	Silver	Gold	Platinum
Material health			✓		
Material reutilization				✓	
Renewable energy				✓	
Water stewardship				✓	
Social fairness				✓	

The table shows Troldtekt's score at the Cradle to Cradle re-certification in January 2015. Relative to 2014, we have improved 'Material Reutilization' and 'Social Fairness' from silver to gold level.

More than just a product certification
We have ambitious goals for where we hope to be in 2022. We have therefore prepared a roadmap showing how we will actively work on improvements within the five Cradle to Cradle criteria, supplemented by one criterion for our general implementation of the principles

92%

The entire series of Troldtekt cement-bonded wood wool products has qualified for Cradle to Cradle certification in the silver category. This corresponds to 92% of production.

99%

It is our goal to qualify for gold certification for 99% of production in 2016. Only painting in custom colours in line with customer requests cannot be certified.

TROLDTEKT A/S

Roadmap for the development of Cradle to Cradle quality at Troldtekt

Troldtekt A/S's business strategy is based on the Cradle to Cradle vision of creating healthy products which benefit human health and the environment, and which can be incorporated into the natural cycle without wasting resources. Troldtekt has therefore entered into a strategic collaboration with Vugge til Vugge Danmark ApS, and together we have developed a roadmap which is based on the five Cradle to Cradle quality categories and points the way to 2022. For each focus area, we have drawn up concrete action plans to ensure that Troldtekt achieves the specific milestones and objectives. The roadmap is revised every year, and the version below shows the status as of 1 December 2015.

	Status 2012/2013	Status 2014/2015	Objectives 2016/2017	Objectives 2018/2019	Objectives 2020/2021	Objectives 2022
Material Health	✓ 92% of production certified (natural and standard colours) ✓ **C2C silver level**	✓ Product development based on C2C principles	• 99% of production certified • **C2C gold level**			• **C2C platinum level**
Material Reutilization	✓ Complete reuse of production waste in the biological cycle ✓ **C2C silver level**	✓ Take-back scheme for collecting cement-bonded wood wool construction and demolition waste in Denmark established ✓ **C2C gold level**	• Take-back scheme for collecting cement-bonded wood wool construction and demolition waste in Europe established		• 90% of used products collected in Denmark reused • 50% in the rest of Europe	• 90% of used products collected in Denmark reused • 70% in the rest of Europe • **C2C platinum level**
Renewable Energy	✓ DONG Energy climate partner; 100% renewable energy for electricity consumption (wind power) from 2013 ✓ **C2C gold level**		• 20% reduction in energy consumption per produced m² compared to 2012	• 40% reduction in energy consumption per produced m² compared to 2012 • **C2C platinum level**		• 50% reduction in energy consumption per produced m² compared to 2012
Water Stewardship	✓ No wastewater discharge from production ✓ **C2C gold level**	✓ Water-saving scheme established	• **C2C platinum level**	• Initiatives launched towards establishing a self-sufficient water supply for production		• Self-sufficient water supply for production
Social Fairness	✓ CSR reporting to UN Global Compact from 2010 ✓ C2C introduced throughout the organisation ✓ **C2C silver level**	✓ CSR reporting according to GRI G4 ✓ C2C principles introduced into the value chain ✓ **C2C gold level**	• CSR report according to GRI G4 verified by a third party		• CSR management system audited by a third party • **C2C platinum level**	• Value chain influenced to improve CSR
Overall Certification	✓ C2C certified according to version 2.1.1 of the C2C product standard ✓ **C2C silver certificate**	✓ C2C recertified according to version 3.1 of the C2C product standard ✓ **C2C silver certificate**	• **C2C gold certificate**	• **C2C gold certificate**	• **C2C gold certificate**	• C2C business • **C2C platinum certificate**

The Troldtekt History

1855
J. C. Seidelin opens the first dedicated store for building materials in Aarhus, Denmark.

1884
Louis Hammerich takes over the business and expands the range to include wholesale products and begins to import building materials from abroad.

L. Hammerich Specialforretning i Bygningsartikler is transformed into Aktieselskabet L. Hammerich & Co. The public limited company has registration number 645, and is one of the oldest surviving public companies in Denmark.

1911
The business has grown, and A/S L. Hammerich & Co. moves into modern new premises in Aarhus. Poul Hammerich, Louis' son, takes over leadership of the company.

1931
A/S L. Hammerich & Co. acquires A/S Troldhede Pladeindustri in Troldhede near Herning. Troldtekt® fibreboard and cement-bonded wood wool panels are manufactured here, and a registered trademark is acquired in 1936.

1935
Poul Hammerich takes the initiative to found the 'Grosserer L. Hammerich og Hustru Ellen, f. Lisbergs Legat' foundation to support families and staff. Poul Hammerich dies at a young age, but the foundation is subsequently realised.

1936
Svend Hammerich joins the company management and helps re-establish its position following the difficult war years.

1947
The fourth generation of the Hammerich family, Peter Hammerich, joins the company management.

1977
The product range is extensively restructured, with a 100% focus on Troldtekt and a few trade goods. All warehouse facilities are moved to Troldhede, while sales and administration are moved to new offices in Aabyhøj near Aarhus. Peter Hammerich leaves the company.

1982
Thorkild Bjerglund Andersen, who has been on the company advisory board since 1973, purchases A/S L. Hammerich & Co.

1988
A/S L. Hammerich & Co. moves to Aarhus Savværk's former premises on Søren Nymarks Vej in Højbjerg.

1993
Space has again become too limited, and A/S L. Hammerich & Co. moves to an old manor south of Aarhus, which Thorkild Bjerglund Andersen has renovated and farms the land surrounding. Huge investment is made to streamline and modernise the production plant in Troldhede.

1998
The new millennium marks the beginning of a period of strong product development. Troldtekt is no longer just acoustic panels, but acoustic solutions with integrated lighting, sound and decoration.

2000
A/S L. Hammerich & Co. and A/S Troldhede Pladeindustri merge under the name A/S L. Hammerich & Co., with sales and administration south of Aarhus and production in Troldhede.

2003
Thorkild Bjerglund Andersen's heirs take over the company and carry on the family-owned enterprise under the leadership of a professional advisory board.

2005
Following a business succession, A/S L. Hammerich & Co. moves to more contemporary premises in Tranbjerg near Aarhus, and the company name is abbreviated to L. Hammerich A/S.

2008
The 75th anniversary of the production of Troldtekt panels is marked by changing the company name to Troldtekt A/S. Troldtekt receives the Danish Building Industry Environment Award the same year for its focus on the environment and sustainability throughout the product's entire life cycle.

2010
Troldtekt qualifies for Cradle to Cradle certification in the silver category and prepares a roadmap for developing Cradle to Cradle quality at Troldtekt through to 2022.

2012
Troldtekt A/S receives the CSR Awards' Strategy Prize for a solid and strategic approach to CSR and for CSR being rooted in all parts of the business - including the top management and the business strategy.

2014
The company's first foreign subsidiary, Troldtekt Deutschland GmbH, is set up in Hamburg. The strategic focus on export markets leads to further investments in production facilities in Troldhede.

2015
The company's second foreign subsidiary, Troldtekt AB, is set up in Malmö and production capacity is expanded further.

2016

Troldtekt®