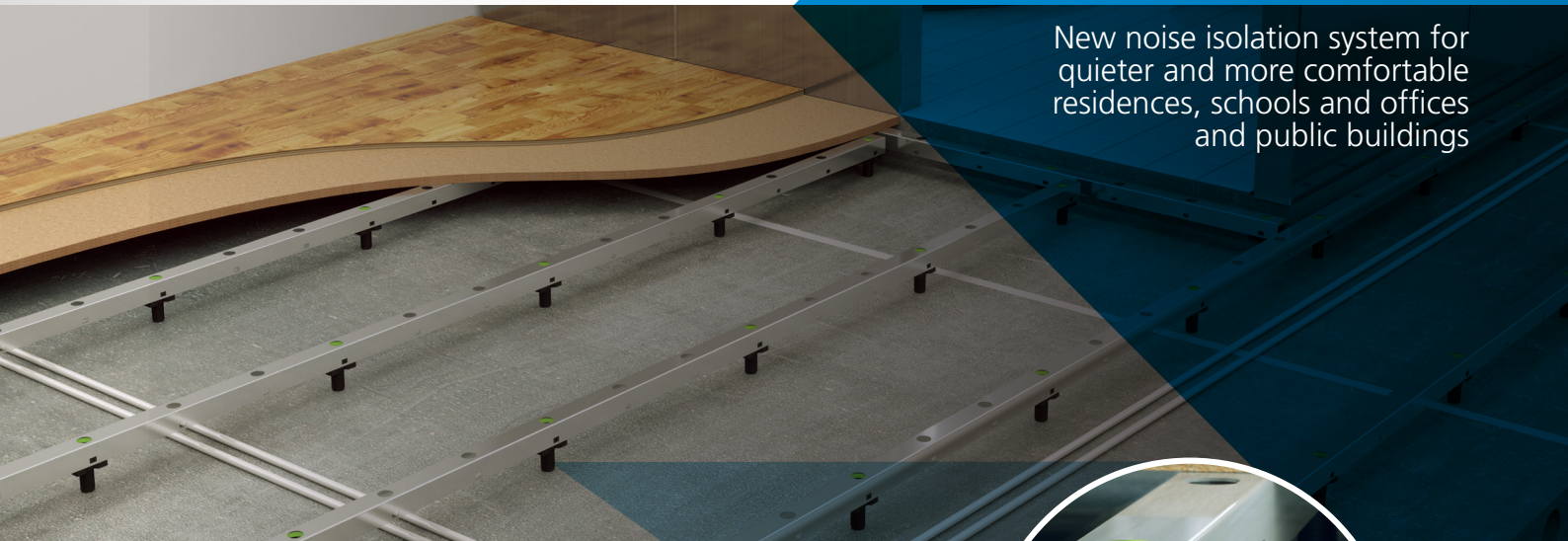




ACOUSTIC AND TECHNICAL FLOOR **GRANAB®**

New noise isolation system for
quieter and more comfortable
residences, schools and offices
and public buildings



GRANAB manufactures subfloor systems for homes, offices, schools and public buildings, with over 4,500,000 m² of subfloor system installed.

The patented steel subfloor system has damping elements for effective impact sound reduction and airborne sound insulation.

The system meets the requirements of EKS, the European construction standards, and type-approved by the SP Technical Research Institute of Sweden and technically approved by SINTEF in Norway with respect to sound-dampening properties, dynamic loads and strength.

GRANAB is a leading developer of acoustic subfloor systems and this brochure provides information on the range of solutions to achieve required sound insulation.

A versatile system suited to any large or small project. Welcome to GRANAB!



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Steel

What makes Granab's subfloor systems unique is that they are light, strong, stable, quiet, robust and easy to install. The systems are designed with non-deformable galvanised steel girders. They retaining their shape and are not affected by humidity or temperature variations. The support block, damping element and level adjustment screw are also made from inorganic material that is not affected by moisture. Granab systems eliminate risks such as that of creaking or sag due to the effects of drying and moisture on girders, which can arise with girders made of organic materials such as wood.



Advantages

Granab subfloor systems improves the quality of homes, offices, schools and public buildings and makes them more environmentally friendly: they are constructed with non-deformable galvanised steel floor girders and an effective sound-dampening resilient suspension system. The subfloor system is secured to the subflooring and set at the desired height. Surface flooring made from chipboard and parquet or carpet is laid over the system.

With 20 years' experience and a strong focus on sound, we are European market leaders in this type of flooring. The systems are type-approved by the SP Technical Research Institute of Sweden and technically approved by SINTEF in Norway with respect to sound dampening properties, dynamic loads and strength.

Different types of damping elements allow us to achieve different sound properties.





Effective impact sound dampening and **airborne sound insulation** for all conceivable sound classes.

Dry, fast installation method. Installed directly on untreated subfloors without wet surface levelling. No chemical additives or long drying times.

The Granab system is environmentally friendly, consists entirely of **inorganic materials**, and is not affected by variations in humidity or temperature.

Flexible line routing in the space between the surface flooring and subfloor.

Low weight. The Granab system's weight is 5 kg/m². By contrast, conventional topping solutions have a weight of 100–200 kg/m²

50% less CO² impact than concrete.

Adapted comfort for better living and working environments.

Effective logistics on site.

Variable construction heights from 30 to 420 mm, excluding floor covering. Special heights up to 1000 mm.

Ensures secure calculation.

Ventilation systems for ventilated subfloors.

Designed for various **floor heating systems**.

The system **makes future modifications** or renovations easy.

Provides **comfortable, environmentally friendly** and **creak-free floors**.

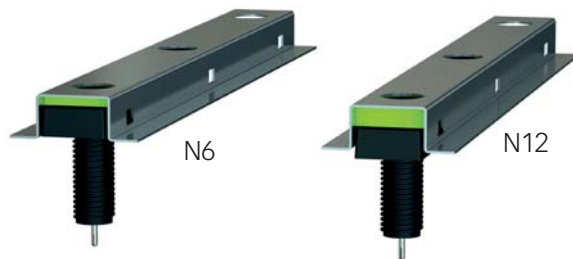
A good range of options for end customers.

System options

Granab subfloor systems are available in three different systems: 3000N, 7000N and 9000N. All the systems are designed with galvanised steel girders with dampening elements. The choice of system is determined by the height that the floor is to be built to and the sound insulation required.

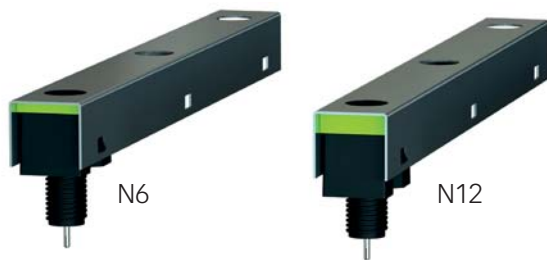
Granab subfloor system 3000N

Flexible construction heights from 30 to 140 mm



Granab subfloor system 7000N

Flexible construction heights from 50 to 420 mm



Granab subfloor system 9000N

Flexible construction heights from 70 to 420 mm



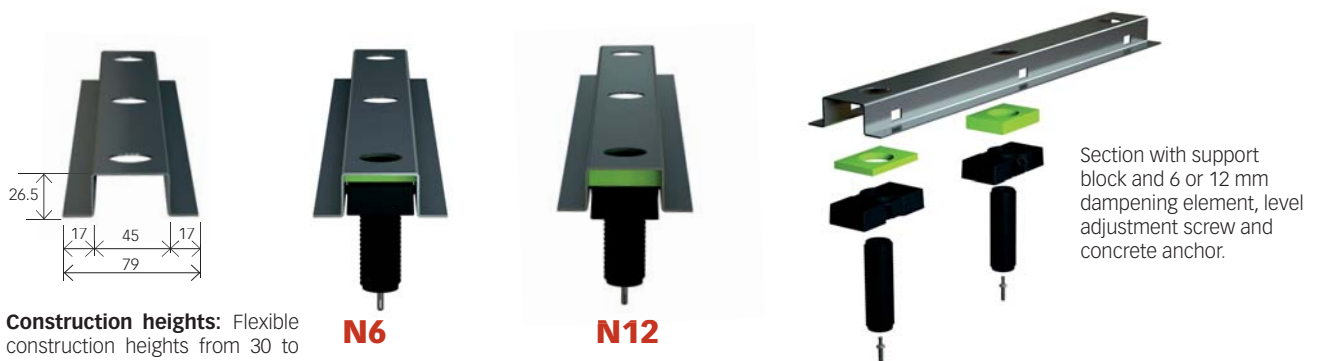


Radisson Blu Waterfront Hotel – Stockholm



Granab subfloor system 3000N

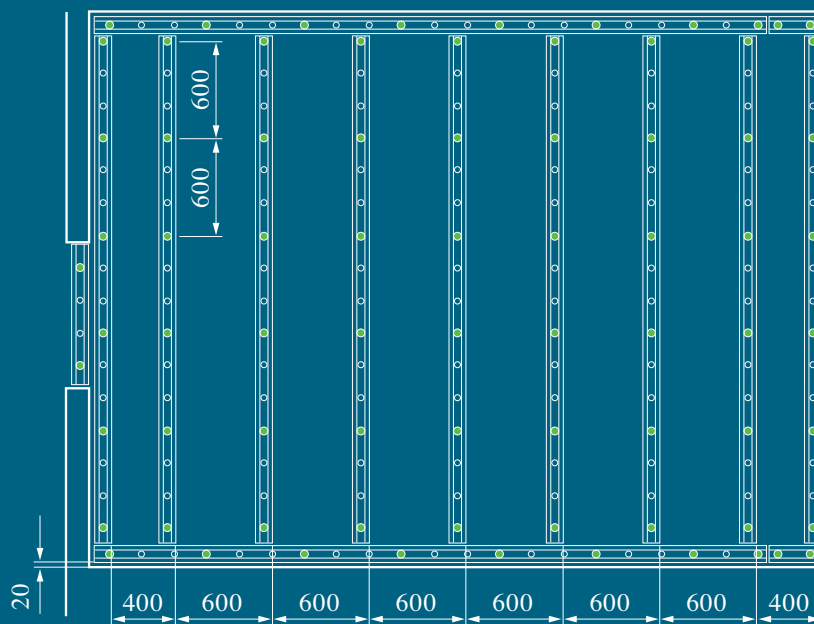
FOR ADJUSTABLE HEIGHTS FROM 30 TO 140 MM, EXCLUDING FLOOR COVERING.



Construction heights: Flexible construction heights from 30 to 140 mm, excluding floor covering.



General installation drawing, subfloor system 3000N in residential spaces



NB: The c/c distance between girders is determined by the choice of floor covering. For other types of premises, see the c/c distance between floor girders on pages 18–19.

Nacka Forum Flats – Stockholm



Granab subfloor system 7000N

FOR ADJUSTABLE HEIGHTS FROM 50 TO 420 MM, EXCLUDING FLOOR COVERING.

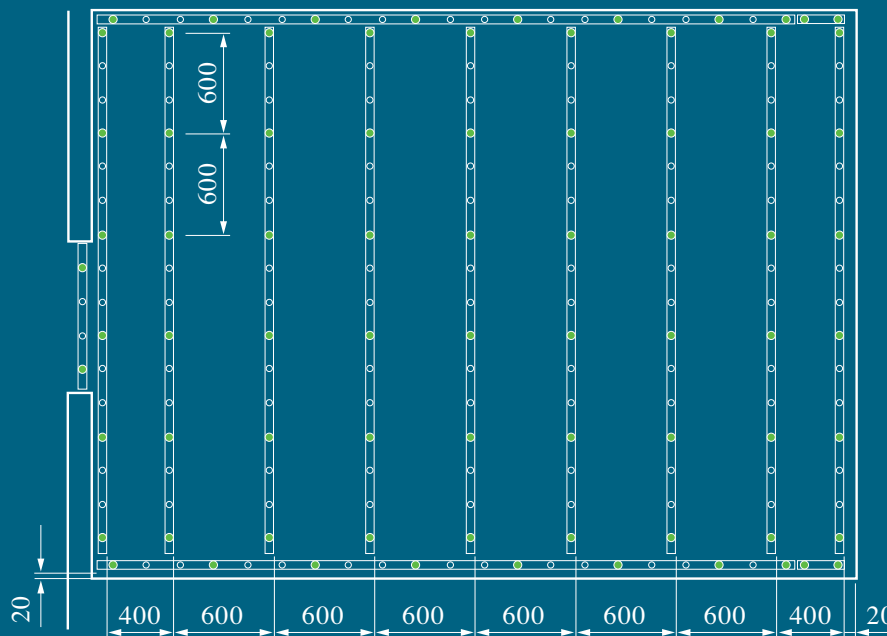
system
7000



Construction heights: Flexible construction heights from 50 to 420 mm, excluding floor covering.



General installation drawing, subfloor system 7000N in residential spaces



NB: The c/c distance between girders is determined by the choice of floor covering. For other types of premises, see the c/c distance between floor girders on pages 18–19.

Clarion Post Hotel, Gothenburg



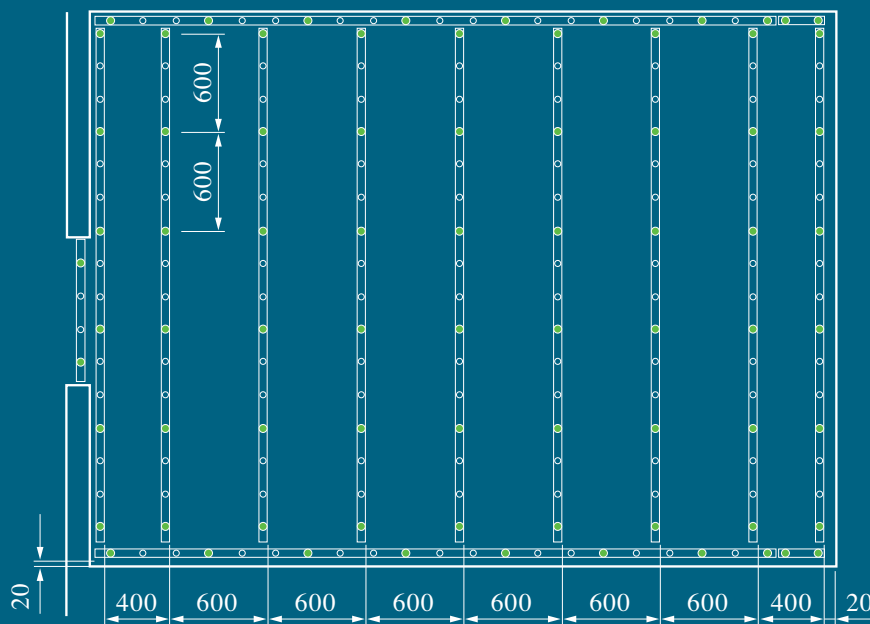
Granab subfloor system 9000N

system
9000

FOR ADJUSTABLE HEIGHTS FROM 70 TO 420 MM, EXCLUDING FLOOR COVERING.



General installation drawing, subfloor system 9000N in residential spaces



NB: The c/c distance between girders is determined by the choice of floor covering. For other types of premises, see the c/c distance between floor girders on pages 18–19.



Expertise

A detailed close-up photograph of an owl's face, focusing on its large, intense orange eyes and sharp black beak. The owl's feathers are intricately patterned with brown, tan, and black spots and streaks. The background is dark, making the owl's features stand out.

Our extensive experience and comprehensive technical resources makes it easy to plan a new floor, whatever the requirements. We prepare plans and installation drawings for each room or building unit with detailed dimensions and locations of all included girders. Straightforward installation instructions and our technology bank are at your disposal for the installation.

Granab subfloor systems are tested and type-approved

More than 4,500,000 m² of Granab's patented and type-approved subfloor systems have been installed in homes, offices, schools, shops and public buildings. Granab systems are type-approved, tested and certified by the SP Technical Research Institute of Sweden and SINTEF in Norway with respect to sound-dampening properties, dynamic loads, durability and comfort properties. Granab systems are tested annually in various projects with respect to sound insulation and deflection properties, and an extensive technology bank with test documentation is available to our customers.

Shape permanence

Granab systems are designed with non-deformable galvanised steel girders. They retain their shape and are not affected by humidity or temperature variations. Other composite parts in the systems are also made of inorganic materials that do not absorb moisture. With guaranteed shape permanence, Granab systems eliminate risks such as that of creaking or sag due to the effects of drying and moisture on girders, which can arise with battens made of organic materials such as wood.

Sound insulation

Granab systems provide very effective impact and airborne sound insulation. Granab systems have been tested and type-proved for their sound-insulation properties by the SP Technical Research Institute of Sweden and SINTEF in Norway. Granab systems have also been tested in a large number of completed residential projects with respect to impact and airborne sound insulation for sound class B, as well as sound class A in certain projects.

Comfort

In a good living and working environment, it is important that floors are not hard or entirely rigid as this can cause pain in the back and legs. With their integrated impact-dampening effect, Granab systems provide comfortable floors with documented deflection properties for point loads.

Installation

The quality of the installed floor is dependent both on the choice of floor covering and on the correct installation of the Granab system and the floor covering. Granab has detailed installation instructions for the Granab systems in a separate brochure along with checklists for installation. Installation of flooring over a Granab system must be carried out in accordance with the flooring manufacturers' instructions. Laminated wooden floors must always be laid under controlled forms in compliance with the range of temperatures and relative humidity percentages stipulated by the respective manufacturers and suppliers of the flooring material.

Subfloors

Hollow core slabs: Granab systems are commonly installed on hollow core slabs when the objective is to attain sound class A or B for dwellings without additional topping.

In situ cast subfloors: With Granab systems, subflooring can be cast thinner. A cast subflooring of approximately 300 mm can be reduced to approximately 200 mm, when structural factors permit, with retained or improved sound insulation. This produces a lighter overall construction and improved overall economy. Flexible line routing in the space between the subfloor and floor covering also facilitates future renovations.

Wooden subfloors: Granab systems are installed directly on wooden subfloors so as to achieve improved impact and airborne sound insulation for the overall construction. Granab systems are, for example, widely used in steel and timber frame.

Planning and installation drawings

Granab prepares plans and installation drawings for each room or building unit with detailed dimensions and locations of all included girders. Girders are prepared off-site to exact lengths as per installation drawings, mounting blocks fitted and packaged by room for quick and easy installation.



Planning instructions for various load conditions, Granab subfloor systems

The unique design of the Granab systems – with components made from inorganic materials, steel girders, dampening elements and adjustment screws of various lengths – permits installation in many project types and entails considerable benefits. Homes, offices, schools, hotels and public buildings are frequent projects. The dampening elements, which provide progressive resilience, also makes the systems an excellent choice for floors in sports centres and other multi-purpose areas.

**system
3000**





Recommended c/c distance between floor girders (sections) and support blocks

1. Rooms in dwellings, hotels, hospital rooms and staff rooms, c/c distance girders (sections), 600 mm.
2. Assembly rooms such as classrooms, rooms in childcare centres, lecture halls, office rooms, premises for restaurants, cafés and dining halls, c/c distance girders (sections), 400 mm.
3. Open areas in libraries, spaces with fixed seating such as in churches, theatres and cinemas, c/c distance girders (sections), 400 mm.
4. Spaces without fixed seating in churches, concert halls, theatres, cinemas, museums, exhibition halls, retail areas in department stores and shops, gyms, sports centres, dance halls, corridors in schools, etc., c/c distance girders (sections), 300 mm.

**system
7000**

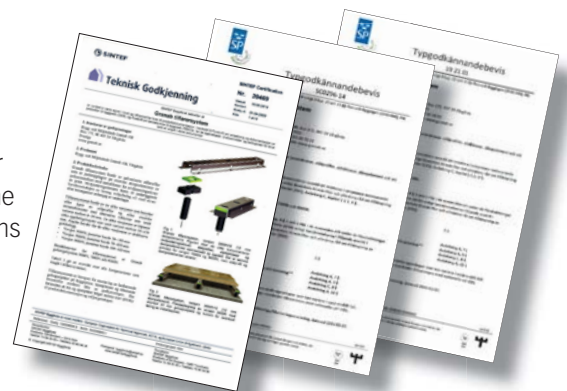
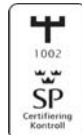


Granab Subfloor Systems type-approved by the SP Technical Research Institute of Sweden and SINTEF in Norway

Granab Subfloor Systems 3000N, 7000N and 9000N have been tested and certified by the SP Technical Research Institute of Sweden and SINTEF in Norway with respect to load capacity, stability and durability with verified values for sound-dampening characteristics.

Granab subfloor systems meet the requirements of 8 chapter 4 sections 1 and 5 of the PBL (Swedish Planning and Construction Act) in the regards and under the conditions specified in the type-approval and are therefore approved by the Swedish National Board of Housing, Building and Planning's Building Regulations (BBR) and its regulations and general advice on the application of European construction standards (EKS).

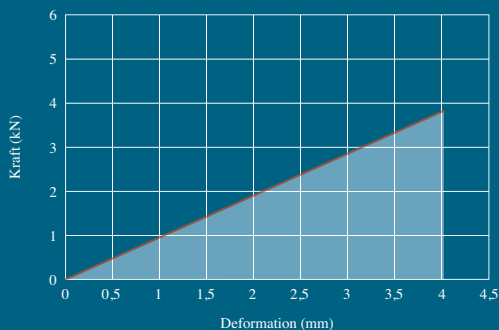
Certificate and type-approval SCO296-14
Certificate and type-approval 19 21 01
Technical approval no. 20469



Evaluation documentation:

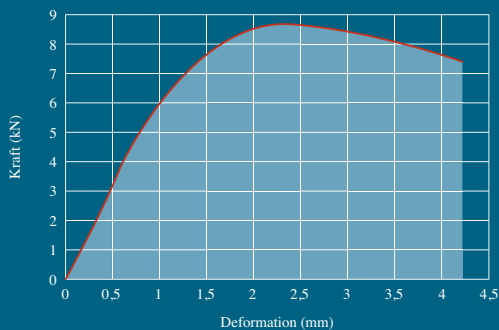
Reports 4P02040, 3P04159-A, 3P04159-C, 3P04159-E, 4P02605-B, P302700C, 3P03903, P501330-1, P705473, PX05294A, PX05294B, 4P00999, 3P05281 and statement P503562 from the SP Technical Research Institute of Sweden.

Tested and certified by the SP Technical Research Institute of Sweden and SINTEF in Norway



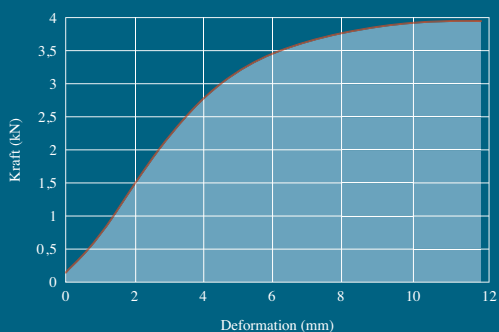
1. Deflection properties

Besides the subfloor construction and c/c distance between the girders, deflection during application of point loads on floors laid on a Granab system is also dependent on the choice of floor covering and how installation is performed. The respective flooring manufacturers provide information about deflection for each type of floor covering.



2. Load testing, 1 separate support block/level adjustment screw

Load testing of the support block was conducted by placing a support block with an adjustment screw between two steel sheets and applying a load using a hydraulic press. Force and deformation were registered. During testing, only 10 mm of the adjustment screw was threaded into the support block.



3. Deflection testing, section with spliced sheet (without dampening pad)

The deflection test was conducted by placing a steel rail in a hydraulic press with two support blocks fitted at a c/c distance of 600 mm. A point load was then applied on the steel rail between the support blocks. Force and deformation were registered.



4. Fatigue testing of installed Granab floor construction

Fatigue testing was conducted over a support block by applying a pulsating load of between 0.1 Fk and 0.6 Fk 10,000 times at a frequency of 1 Hz. Fk was the characteristic value from support block load testing. A total of two fatigue tests were conducted over the support blocks at the outer corners of the test floor. The load was pulsated between 0.1 and 0.6 Fk with Fk set at 8.5 kN. Both load tests were conducted without any lasting deformations or damages.

Granab Subfloor Systems, materials, environmental impact, durability, specific product properties

Granab subfloor systems

Granab Subfloor Systems are designed for easy removal when necessary and for subsequent reinstallation as complete units. All parts can be recycled.

Floor girders

Material: Galvanised steel or alternatively untreated steel, thickness 1.5 mm.

Environment: The thin steel plate is a part of the ecosystem and is processed into new steel in electro-steel works.

Functional durability: Galvanised steel has extremely long durability.

Dampening elements

Material: Elastomer, GRAB-310.

Environment: No environmental impact, recyclable into new polyurethane products GRAB-310's resistance to short-term extreme overloads is very high and the material springs back entirely if overloaded. The long-term creep has no effect on the material's dynamic E-modules.

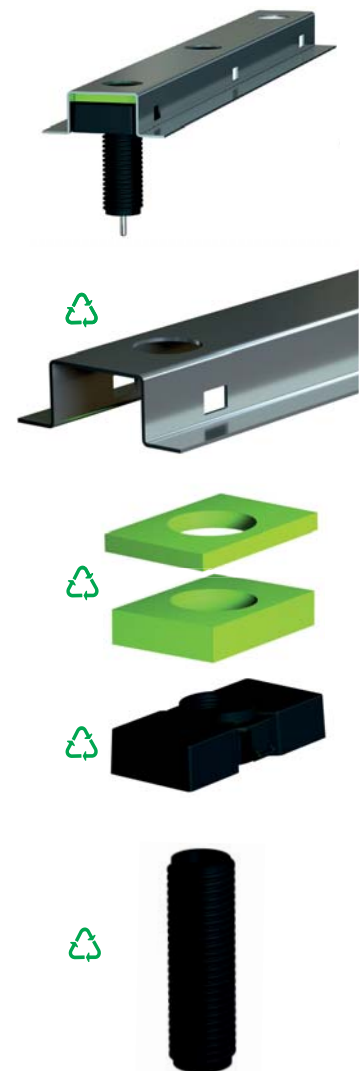
Functional durability: Elastomer has extremely long durability. Not affected by ozone, UV radiation or by commonly occurring chemicals.

Support blocks with adjustment screws

Material: Polypropylene, Granab standard, according to DIN 53444

Environment: No environmental impact. Recyclable into new basic material.

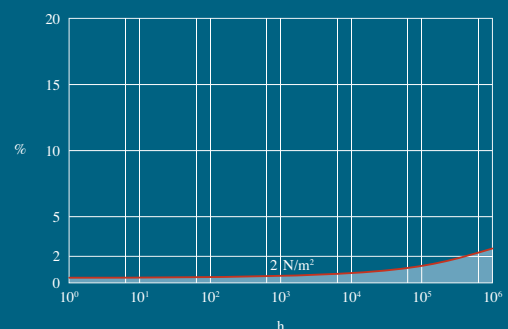
Functional durability: Very long according to the diagram.



Dampening elements

Resilient durability:	Total deflection (momentary + long-term creep) at 106 h (114 years)		Dynamic E-module
GRAB-310	Relative thickness	For 12 mm thickness	Change
P V	≤ 17% ≤ 18%	≤ 2 mm ≤ 2.2 mm	≈ 0% ≈ 0%

Support blocks with adjustment screws



Examples of alternative floor coverings

Follow the instructions for installation and laying from the respective chipboard and parquet manufacturers.

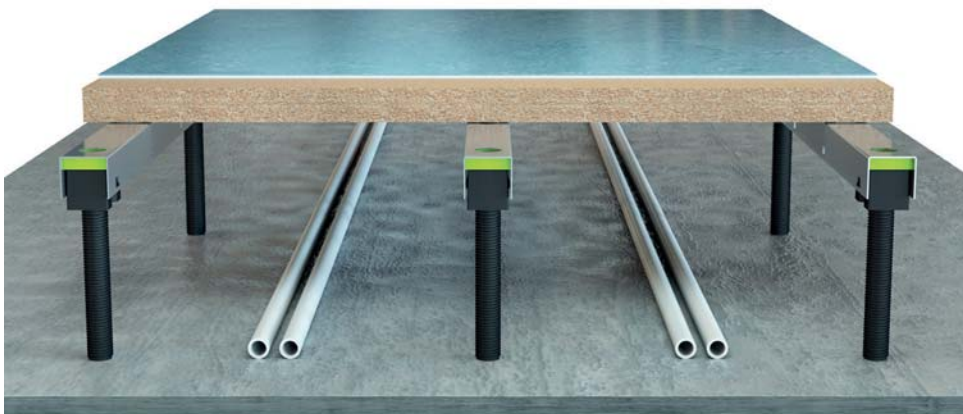
22 mm chipboard & 15 mm parquet



22 mm chipboard & carpet



38 mm chipboard & carpet



22mm chipboard, 6mm cement board & tiles





Tiled surfaces

Granab subfloor systems are the best solution for tiled surfaces in halls, kitchens and wet rooms for both homes and public buildings.

Granab systems consist entirely of inorganic material and are impervious to moisture, which are essential characteristics for use in wet areas.



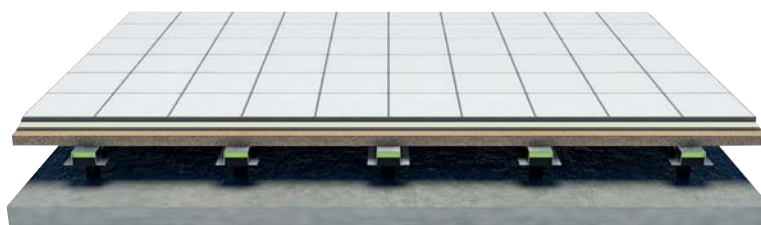
Principle in wet rooms with tiles on Granab



A: Chipboard flooring,
22 mm.

B: Sheet of inorganic
material.

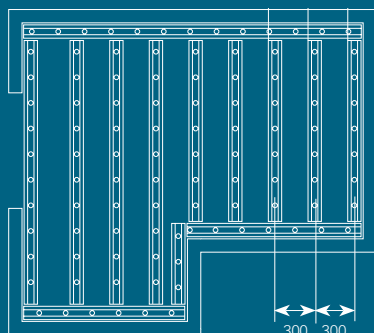
C: Floor levelling
compound.



Example design: Granab subfloor system, c/c 300 mm, with 22 mm chipboard, sheet of inorganic material, moisture barrier and tiles.

Testing of Granab subfloor systems with tiled surfaces

Granab subfloor systems with tiling have been tested by the SP Technical Research Institute of Sweden with respect to deflection and strength properties.



General drawing for tiled area.
The system is installed with a c/c 300 mm.



Bathroom modules

Off-site prefabricated bathrooms are becoming increasingly common in residential construction to improve speed and quality.

A Granab system combined with a modular bathroom entails a complete solution with many benefits, including effective sound insulation.

The level difference between the subfloor and module can be easily adjusted with the Granab system.





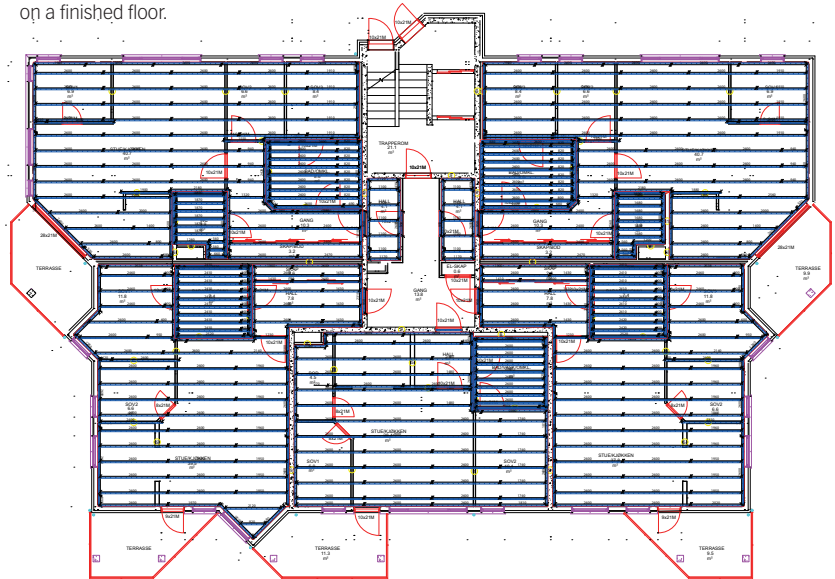
Planning, effective logistics

Delivery optimisation

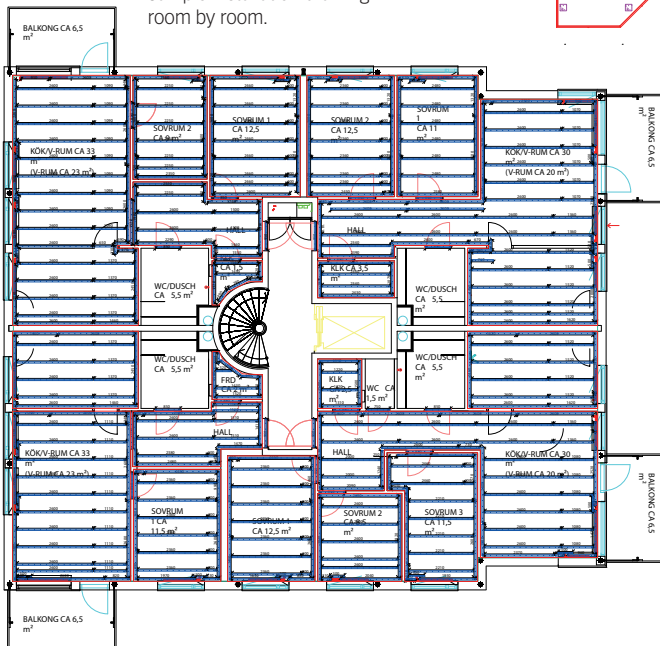
Granab systems are packed and delivered with pre-cut and dimension-adapted floor girders and factory-fitted support blocks and dampening elements. Each girder is labelled with a room name and length that matches the information on the installation drawing for each flat or other agreed-upon space subdivision.

Granab systems are packaged in bundles on EUR pallets with a maximum length of either 2600 mm or 3800 mm.

Sample installation drawing with walls on a finished floor.



Sample installation drawing room by room.



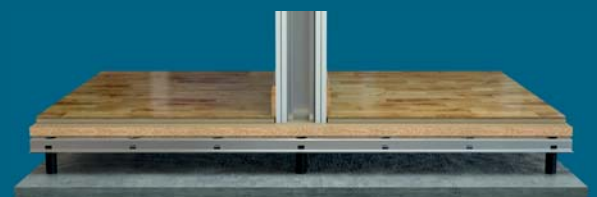
Intra-transport in conjunction with framework construction.

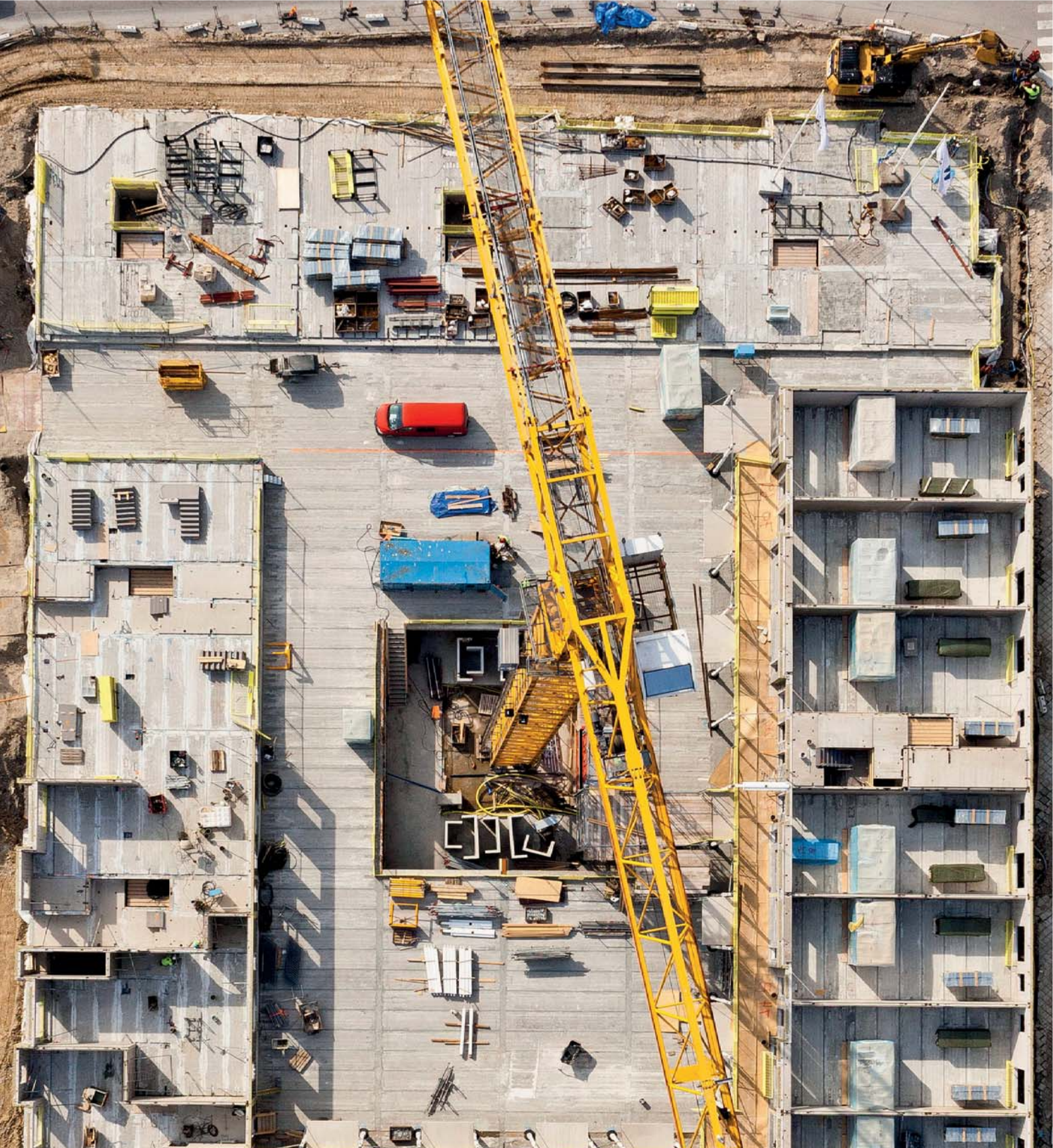
Because Granab systems consist of inorganic materials and are not affected by moisture or temperature variations, they can be delivered while the framework is still under construction. Granab girders can be produced with a maximum length of 2600 mm – the same length as for a bundle of plasterboard. The plasterboard for the walls can be moved in along with the wall girders, which are placed on stands above the Granab girder packages.

By lifting the materials into place during framework construction and erecting the interior walls above the Granab system, production is more efficient and costs for logistics are minimised.

INTERIOR WALLS FOR FINISHED GRANAB SUBFLOORS

Walls for flats or other subdivisions are first erected from floor to ceiling. It is advisable to erect interior walls within a flat or subdivision on finished Granab subflooring, including the chipboard. Erection of interior walls in this manner permits the chipboard to be installed more quickly and entails less waste as a result of working with larger, continuous floor surfaces. Material consumption for the interior walls is lower and installation of both the Granab floor and interior walls goes significantly faster.





Packaged and labelled for each flat.



Girders are pre-cut to the correct lengths for each room unit.



Granab ventilated subfloors

Avoid moisture, mould and stale indoor air with a Granab system and underfloor ventilation.

A large number of single-family dwellings and other buildings are subjected to moisture damage each year in the basement, or elevated moisture content in basement slabs. To make sure buildings are fresh, it is important that moisture from concrete floors in basements or bottom slabs is removed through ventilation and not built into the floor construction.

Besides performing checks and taking possible measures involving new drainage and filling materials around the foundations, the wooden joists or plastic floor covering installed or placed directly on the basement floor must be removed, and the concrete floor is then dried. Granab systems with galvanised steel floor girders are made entirely from inorganic materials and adjusted up from the concrete floor to the desired height. The air in the space between the subfloor and surface flooring is then continuously ventilated, leaving a dry, pleasant environment.



If there is uncertainty and risk concerning humidity content or emissions from the bottom slab or subfloor construction, air gaps under the finished floor should be ventilated using mechanical ventilation in combination with fitting a moisture barrier under the floor girders. In its standard configuration,



System 3000N with moisture barrier above the girders.

the height of the Granab system is adjustable from 30–420 mm and provides an open airflow under the girders. The space under the floor constitutes a separate “room unit” (sealed box), which is ventilated independently or in special cases combined with other ventilation.



System 7000N with moisture barrier above the girders.



Granab ventilated subfloor principle

Separate mechanical ventilation in the "room unit" under the floor using an exhaust fan that draws air out via perforated air ducts of, for example, standard spiral ducting. Inlet air to the ducts is obtained via a filter-equipped air terminal device that takes inlet air from the respective room units. Additional inlet air can be obtained with, for example, an additional outdoor air valve.



Order Granab's ventilation brochure

Granab can provide ventilation planning that also includes function, operation and maintenance instructions. Installation of ventilation is conducted by a local HVAC installer or building contractor. Order more information from us.

Installation of Granab ventilated subfloors



1. The old flooring is removed.

2. The concrete slab is cleaned of all organic material.



3. The Granab subfloor system with underfloor ventilation and insulation is installed.

4. The new floor is laid. Done!



Underfloor heating installed in the Granab system

Underfloor heating is installed in Granab systems in an increasing number of residential projects.

Granab systems with steel floor girders are entirely non-deformable and not affected by temperature variations, which is a major advantage in avoiding subsequent floor construction problems.

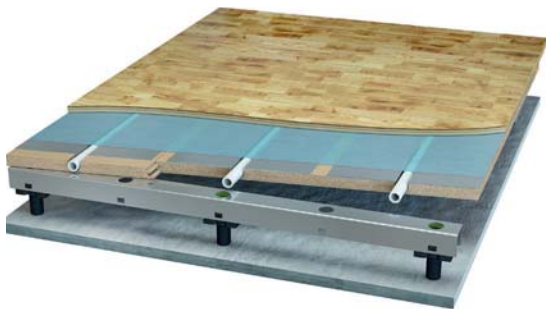
Most available floor heating systems can be installed in combination with Granab Subfloor Systems 3000N and 7000N, which provide significant benefits.



When choosing waterborne underfloor heating, two alternative primary systems are installed in Granab Subfloor Systems 3000N and 7000N:

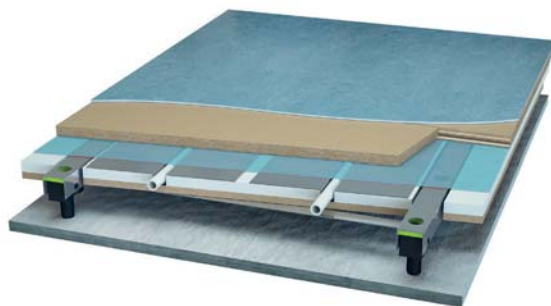
Underfloor heating in 22 mm chipboard flooring with grooves.

Grooved 22 mm chipboard flooring that is glued and screwed in place on the Granab girders.



Underfloor heating in sealed floor heating units

Heating coils are installed in the floor heating units. The sealed unit/floor plate is fitted parallel to the subfloor system's girders and on the sealed unit brackets, which are mounted between the girders (System 7000).



Recessed convectors



On many residential projects, solutions with recessed convectors are preferred: for example, when there are glazed floor-to-ceiling facades and downdraughts need to be avoided, but an attractive solution without visible radiators is also desired. In these cases, installing a Granab subfloor system is highly beneficial in that the space between the subfloor and finished floor can be utilised.

The Granab system improves the quality of homes, schools and public buildings and makes them more environmentally friendly.



Granab systems in attics and when adding extra floor levels

Granab subfloor systems have shown their advantages in projects that prioritise low weight in combination with effective impact and airborne sound reduction, for example when constructing an extra floor level.

Granab systems have a low weight per square metre. Granab systems weigh only around 5 kg per square metre, compared with conventional topping, that can have a weight of 240 kg per square metre with a topping height of 10 cm.



Granab systems on wooden subfloors

Granab subfloor systems can also be installed on wooden subfloors. For fixing, wood screws are used instead of concrete anchors. Contact Granab for more information.





Quiet

Granab subfloor systems dampen both impact sound and airborne sound effectively. This prevents noise disturbances from neighbours. In addition, the floors do not creak, which they can do in other types of joisted floors. The sound insulation and stability have been tested by the SP Technical Research Institute of Sweden and SINTEF Byggforsk in Norway, and the entire subfloor system is type-approved by SP. The test results from SP mean that the planner can determine the type of sound insulation that should be installed in a building. Field measurements in finished buildings confirm that most building structures with Granab floors installed will comply with sound class B, and in some cases even sound class A.

Impact and airborne sound insulation

Impact and airborne sound insulation in homes and offices

Granab systems provide effective impact and airborne sound insulation. Effective insulation against sound from surrounding spaces is important for a good living and working environment. Investigations show that in older structures, residents are often disturbed by impact sounds, loud music, slamming doors and staircase traffic, as well as noise from running water, lifts, ventilation and traffic. A good sound environment has become a prioritised requirement when constructing new buildings.

Documentation of Granab systems' sound-insulating properties

Granab systems have been developed in close collaboration with researchers and acoustic consultants in the building industry to satisfy highly placed demands on impact and airborne sound insulation in homes, offices and schools. Granab systems function as supplementary insulation for building frameworks both in new construction and remodelling projects. The impact and sound insulating function of the systems has been carefully documented by means of laboratory measurements and a large number of field measurements in completed buildings. In this way, values for sound reduction could be established, permitting sound insulation in buildings to be verified with calculations. Calculation of sound insulation in completed buildings shall be conducted according to the Swedish and European standard SS-EN 12354, Parts 1 and 2 with input data from Granab.

Input data for concrete subfloors is in the BASTIAN database, as well as at www.bastian.nu For timber or steel joist floors, contact Granab. A number of examples of acoustic measurements in the SP Technical Research Institute of Sweden's impact-sound lab, as well as vertically between flats with Granab subfloor systems installed on hollow-core slabs HD/F 120/19 and HD/F 120/27 in buildings, are presented on pages 42-47.

Applicable sound class limits for dwellings		
Regulation	Highest permitted impact sound level	Lowest permitted airborne sound insulation
AppDoc E	62 _(L_{nT,w})	45 _(DnT,w+C_{tr})
SWE, class C SWE, class B	56 _(L_{nT,w}+C_{ISO}) 52 _(L_{nT,w}+C_{ISO})	52 _(DnT,w+C_{ISO}) 56 _(DnT,w+C_{ISO})
FIN, NOR Denmark	53 _(L_{nT,w})	55 _(R_w)

Accredited sound measurements in completed building with a Granab system on hollow-core slabs HD/F 185 mm and HD/F 270 mm			
Examples of measurement results	Impact sound $L'_{n,w} + C_{1,50-2500}$	Airborne sound $R'_w + C_{150-3150}$	Remarks
Granab system, height 65 mm incl. floor covering laid on HD/F 270 mm	46 dB	65 dB	System 3000 Also see measurement results for alternative configurations of Granab systems on pages 44-46.
Granab system, height 70 mm incl. floor covering laid on HD/F 185 mm	51 dB	58 dB	
Granab system, height 150 mm incl. floor covering laid on HD/F 185 mm	47 dB	61 dB	
Granab system, height 165 mm incl. floor covering laid on HD/F 270 mm	50 dB	59 dB	System 7000 page 47

Sound classifications for residential properties in various countries. Defined by national standards for each country as follows:

Norway	NS 8175
Sweden	SS 25267
Denmark:	DS 490 (2001).
England:	Part E of Building Regulations 2010. BIP 2133:2007 BS 8233:2014
Finland:	SFS 5907. Valtionneuvoston päätös No 993 1992.
France:	Guide Qualitel (200).
Holland:	NEN 1070 (1999). NPR 5070:2004.
Iceland:	IST 45 (2003).
Spain	Technical Building Code (TBC) and Building Act 38/1999 (LOE).
Germany:	VDI 4100 (1994). E DIN 4109-10 (2002).
Austria:	ÖNORM B 8115:2002.



- Impact sound should be as **low** as possible.
- Airborne sound insulation should be as **high** as possible



Sound class description, dwellings, according to SS 25267

Sound class A: The sound class corresponds to very good acoustic conditions.

Sound class B: The sound class corresponds to significantly better acoustic conditions than sound class C. This sound class should be applied when a good living environment is requested and is the most common class.

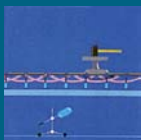
Sound class C: The sound class provides satisfactory acoustic conditions for a majority of residents and can be applied as a minimum requirement according to the Swedish Board of Building, Planning and Housing's directives.

Remarks: The functional requirements in this standard are adapted to the respective sound classes on the basis of extensive practical experience of subjectively perceived acoustic environments in dwellings. It should be noted, however, that building constructions – for both practical and financial reasons – cannot be designed to entirely avoid audible sound from adjoining spaces from all types of activities. Audible sound can occur, for example, from jumping or substantial impact on a floor. This may even occur in buildings that fulfil the higher sound classes

Walking noise: Walking noise is addressed in SS 25268 (version 2 2007) and referred to there as "impact sound in same room". The requirement stipulates that walking noise shall be limited in spaces in which several persons are present more than temporarily, such as in large office spaces, nursery schools, etc. Guidelines for measurement and assessment of percussive sound are included in the SIS technical report 2007:15 (www.sis.se). The degree of walking noise is dependent on the floor covering used. Contact Granab for more information prior to planning.

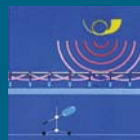
To ensure that planned sound classes are attained both vertically (between floors) and horizontally (on the same floor) in completed buildings, all components of the building construction must function in the correct manner. An acoustic consultant should be engaged to review planned building constructions (construction documents). During the construction phase, installation should be checked according to our checklists.





Definition, impact sound level:

The sound pressure level in a another room from a standardised impact sound device that hammers on a floor.



Definition, airborne sound insulation:

The separating construction's capability to reduce sounds that reach the construction through the air.

Conditions

Granab subfloor systems, including floor coverings, can be configured for various sound requirements.



Granab subfloor systems are constructed with non-deformable steel girders and an effective resilient suspension system. The subfloor systems are secured to stable subfloors with screws and set at the desired height. Floor coverings of the parquet or chipboard of your choice can be glued, screwed or laid floating. Hollow-core elements and solid subfloors do not require the application of levelling compounds when they are complemented with a Granab subfloor system, which means shorter construction times, reduced building humidity and increased flexibility.

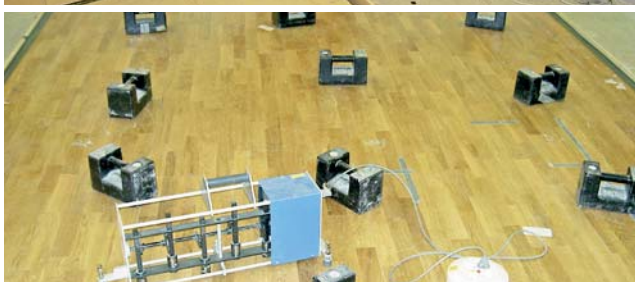
In order to fulfill the intended sound class between rooms in buildings with Granab subfloor systems in both vertical and horizontal directions, it is important:

- That the slabs and walls provide suitable conditions, which can be verified by calculating the sound insulation of unfinished floors and walls according to EN 12354 or by measuring the sound insulation during the production phase according to the standard methods. Measurements are made before the underfloor system is installed with temporary actions taken during measurement to prevent airborne sound leakage between measurement spaces.
- That Granab subfloor systems are installed by trained installers and in accordance with Granab's installation instructions and checklists.
- That Granab systems and the floor coverings are floating and do not have rigid contact points against the building framework.
- That sound leakage through joints and installations in floors and walls is prevented.
- That flank transmission via attached constructions – exterior walls, subceilings, etc. – is prevented.
- That sound transmission via ventilation ducts between flats does not occur.
- For more information, see Granab's general delivery and sales terms.

Impact sound reduction in the lab

Granab subfloor systems have been tested by the SP Technical Research Institute of Sweden on a reference subfloor of 16 cm concrete according to the Swedish and international standard SS-EN ISO 10140. The impact sound tests were conducted with 15 mm parquet flooring on flooring paper, Granab's subflooring of 22 mm chip-board flooring that was glued and screwed to the 7000 system's steel sections, green Sylodyn® dampening pads and spacer screws in the concrete subfloor. The dampening pads are built in under the steel sections and permit movements in the floor without impact sound being transmitted via the screws to the concrete subfloor. By comparing measured impact sound levels for completed floors with the levels attained for the lab's concrete subfloor alone, the SP Technical Research Institute of Sweden can present improvement values for the Granab system (ΔL_w) that were calculated in the one-third octave band according to ISO 717-2.

The improvement values from the lab can be used for calculating impact sound levels in buildings with other types of concrete subfloors in accordance with SS-EN 12354-2. Values for Granab systems and various concrete subfloors are in the database for the calculation programme BASTIAN. When calculating impact and airborne sound insulation in subfloors between rooms, the programme takes into consideration the effects of areas and room volumes, as well as adjoining structural elements, which allows both simple and cost-effective engineering of a building's sound insulation. The calculation results have been compared with a large number of values from field measurements and have been shown to conform well to average values. Granab recommends maintaining a 1 dB margin when engineering to acoustic requirements in completed buildings in accordance with SS 25267/-68.



Guidance in the choice of floor coverings and upper flooring on thin concrete subfloors according to SP's guidelines "Stegljudstestade golvbeläggningar" (Impact sound tested floor coverings) (SP Report 2012:47)

In SP's appendix, classification is conducted of floor coverings' impact sound dampening on thin concrete subfloors. The classification is conducted in seven different floor covering classes with descriptions of impact sound dampening for the respective floor covering classes. The highest floor covering class is class 8A, which the Granab systems fulfil by a wide margin. Wooden floors and carpet on a thin elastic mat normally fulfil impact sound class 7, which results in sound class C on the same floor. Weighted impact sound dampening is defined in SS-EN ISO 717-2.

Floor covering class	ΔL_w , dB	Significance/Application. Floor coverings in the group
8A	25–28	Can fulfil sound class A between dwellings when they are laid on concrete subfloors.

For a full description, please refer to SP's report (www.sp.se)



System 3000 N12



System 7000 N12



To facilitate comparisons of various floor solutions for dampening impact sound, there is a classification system in SP's guidelines "Stegljudstestade golvbeläggningar" (Impact sound tested floor coverings) (SP Report 2012:47). The impact sound classification is based on the weighed summation value ΔL_w calculated by the SP Technical Research Institute of Sweden from 16 values in the one-third octave band (100–3150 Hz) according to SS-EN ISO 717-2. Buildings with concrete floors and coverings in impact class 7 normally fulfil BBR's requirements (sound class C).

Granab systems produce ΔL_w 29 dB, which fulfils the highest impact sound class 8A. Floors in this class normally fulfil impact sound requirements for sound class A in buildings with heavy concrete floors.

ΔL_w with
Granab subfloor systems

29 dB

Impact and airborne sound reduction, vertical, System 3000N12

Sound insulation measurements

Granab subfloor system installed on HD/F 270 mm.

Accredited sound insulation measurements according to: SS 02 52 54 - SS-ISO 717/1 and SS-ISO 717/2 conducted by Ingemansson Technology AB.



Configuration

Granab subfloor system installed on HD/F 270 mm and 22 mm chipboard & carpet

Measurement results

Impact sound: $L_{nw}+c$ 46 dB Airborne sound: R_{w+c} 65 dB



Configuration

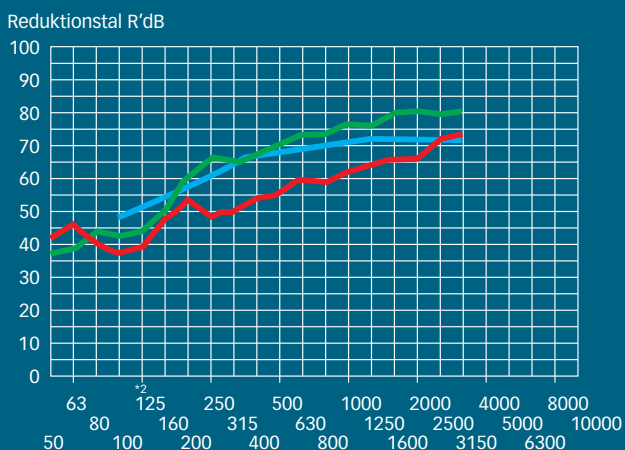
Granab subfloor system installed on HD/F 270 mm and 22 mm chipboard & 15 mm parquet

Measurement results

Impact sound: $L_{nw}+c$ 43 dB Airborne sound: R_{w+c} 65 dB

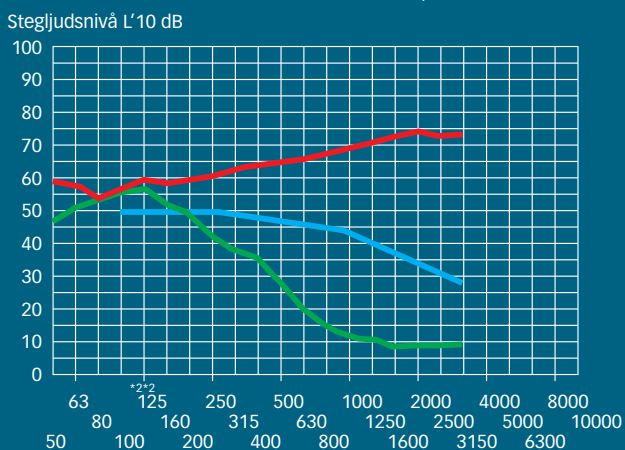
System 3000, airborne sound

Reference curve
0 measurement. B1-A1 Vertical $R'_{w+c} = 58$ dB
System 3000. B1-A1 Vertical $R'_{w(8)} = 59$ dB
 $R'_{w(8)} = 67$ dB
 $R'_{w+c} = 65$ dB



System 3000, impact sound

Reference curve
0 measurement. B1-A1 Vertical $L'_{n,w+c} = 84$ dB
System 3000 B1-A1 Vertical $L'_{n,w(8)} = 84$ dB
 $L'_{n,w(8)} = 46$ dB
 $L'_{n,w+c} = 46$ dB



Impact and airborne sound reduction, vertical, System 3000N12

Sound insulation measurements

Granab subfloor system installed on HD/F 185 mm.

Accredited sound insulation measurements according to SS-EN ISO 140-4-7 conducted by KM Akustikbyrå.



Configuration

Granab subfloor system installed on HD/F 185 mm and 22 mm chipboard & carpet

Measurement results

Impact sound: $L_{nw}+c$ 51 dB Airborne sound: $R_{w}+c$ 58 dB



Configuration

Granab subfloor system installed on HD/F 185 mm and 22 mm chipboard & 15 mm parquet

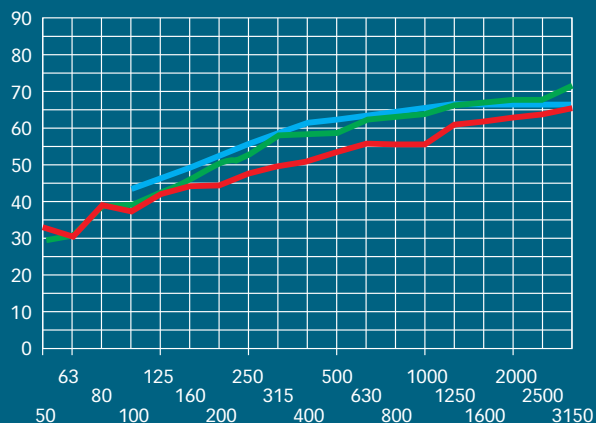
Measurement results

Impact sound: $L_{nw}+c$ 48 dB Airborne sound: $R_{w}+c$ 59 dB

System 3000, airborne sound

Reference curve	
0 measurement. Vertical	R'_{w} = 57 dB
	$R'_{w}+c$ = 55 dB
System 3000 Vertical	R'_{w} = 62 dB
	$R'_{w}+c$ = 58 dB

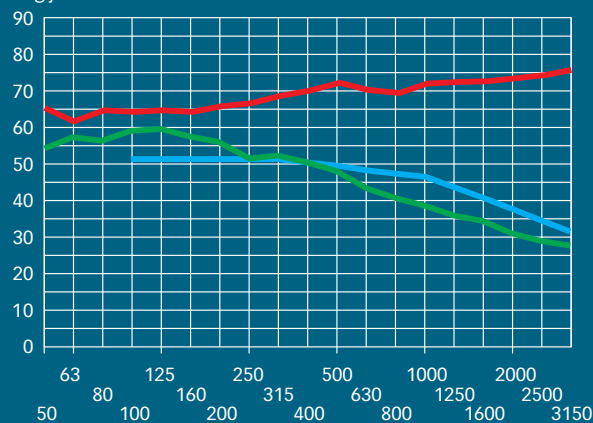
Reduktionstal R' dB



System 3000, impact sound

Reference curve	
0 measurement. Vertical	$L'_{n,w}$ = 80 dB
	$L'_{n,w}+c$ = 67 dB
System 3000 Vertical	$L'_{n,w}$ = 49 dB
	$L'_{n,w}+c$ = 51 dB

Stegljudsnivå L' 10 dB



Impact and airborne sound reduction, vertical, System 3000N12

Sound insulation measurements

Granab subfloor system installed on HD/F 185 mm

Accredited sound insulation measurements according to SS-EN ISO 717/1, 717/2 conducted by J&W Akustikbyrå.



Configuration

Granab subfloor system installed on HD/F 185 mm with 22 mm chipboard above.

Measurement results

Impact sound: $L_{nw}+c$ 47 dB Airborne sound: R_w+c 61 dB



Configuration

Granab subfloor system installed on HD/F 185 mm and 22 mm chipboard, and 15 mm parquet above.

Measurement results

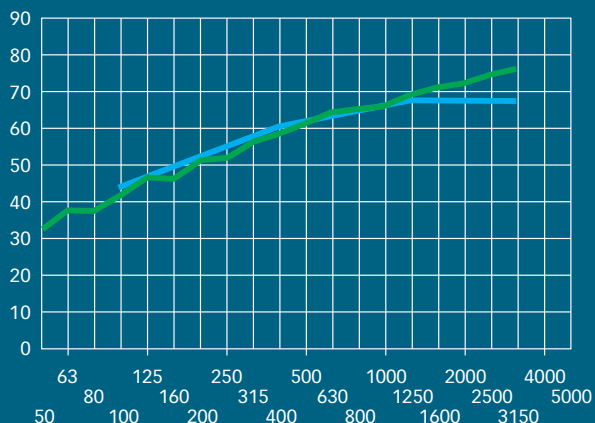
Impact sound: $L_{nw}+c$ 46 dB Airborne sound: R_w+c 63 dB

System 3000, airborne sound

— Reference curve
— System 3000 Vertical

$R'_w = 64$ dB
 $R'_w+c = 61$ dB

Reduktionsstal R' dB

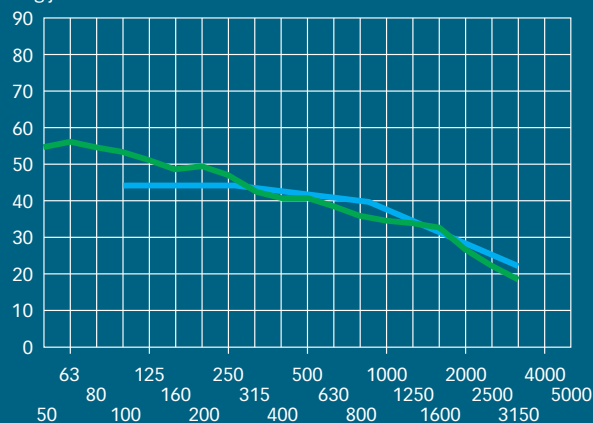


System 3000, impact sound

— Reference curve
— System 3000 Vertical

$L'_{n,w} = 42$ dB
 $L'_{n,w}+c = 47$ dB

Stegljudsnivå L'_{10} dB



Impact and airborne sound reduction, vertical, System 7000N12

Sound insulation measurements

Granab subfloor system installed on HD/F 270 mm.

Accredited sound insulation measurements according to SS-EN ISO 140-4-7 conducted by KM Akustikbyrå.



Configuration

Granab subfloor system installed on HD/F 270 mm and 22 mm chipboard & carpet.

Measurement results

Impact sound: $L_{nw}+c$ 50 dB Airborne sound: R_w+c 59 dB



Configuration

Granab subfloor system installed on HD/F 270 mm and 22 mm chipboard, and 15 mm parquet above.

Measurement results

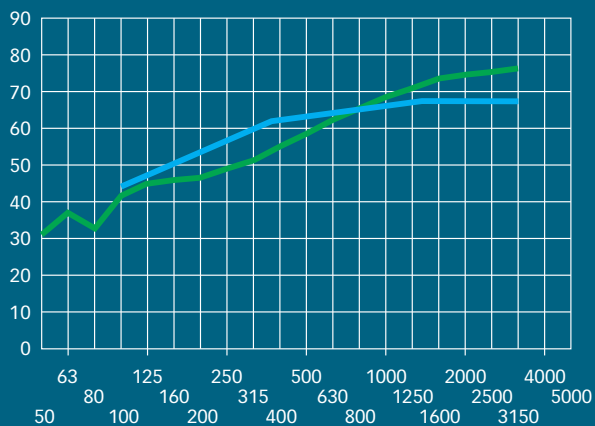
Impact sound: $L_{nw}+c$ 48 dB Airborne sound: R_w+c 61 dB

System 7000, airborne sound

— Reference curve
— System 7000 Vertical

$R'_w = 62$ dB
 $R'_w+c = 59$ dB

Reduktionstal R' dB

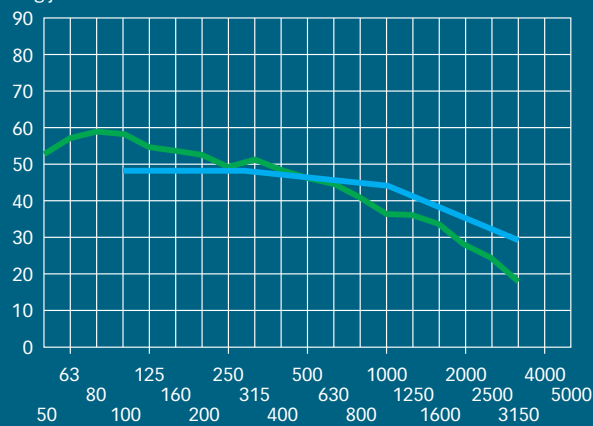


System 7000, impact sound

— Reference curve
— System 7000 Vertical

$L'_{n,w} = 47$ dB
 $L'_{n,w}+c = 50$ dB

Stegljudsnivå L'_{10} dB



Offices and public buildings

Impact and airborne sound insulation

Granab subfloor systems are installed in many office projects. Flexible line routing between subfloors and floor coverings entails major benefits, while the Granab system also creates a good acoustic environment. Granab systems fulfil the acoustic requirements for offices in accordance with SS 25268 by a very wide margin.

Pleasant, comfort-adapted floors for a better working environment

In a good working environment, it is important that floors are not hard or rigid as this can lead to pain in the shoulders, back and legs. Granab systems, with their integrated impact-dampening effect, provide comfortable floors with a documented degree of deflection for point loads.



Office floor

Granab subfloor system 7000N, including 22 mm chipboard & 15 mm parquet. Light weight wall erected continuously on Granab system, including surface layer.

Measurement results

Impact sound: L_{nw} 59 dB
Airborne sound: R_w 56 dB



Example – planning electrical, datacom, telecom – offices

System description – electrical.

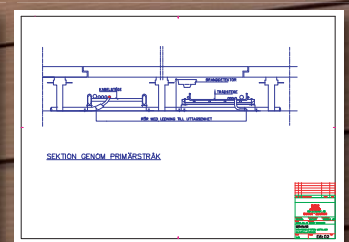
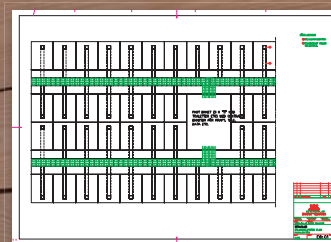
Granab subfloor systems permit the distribution of supply systems for power, telecom, datacom, etc. Premises larger than 1000–2000 m² are divided into supply zones.

Spaces – central units.

The supply zone is equipped with a fixed unit (a so-called island with toilets etc.) where central units for power, telecom, datacom, fire alarms etc. are placed.

Canalisation – line routes.

The cable networks are run on cable trays or baskets under the floor along a primary route from the central units and on to the supply zone. The floor is equipped with access hatches over the route. From the primary route, the cables are run in installation conduits to the equipment locations (outlets). The system can be potential-equalised.



Airborne sound insulation in accordance with SS 2 52 68 Lowest total airborne sound insulation between spaces R_w (dB)

Type of space	Sound class B	Sound class C
Office room	35	35
- along corridor	30	30
Interview/conference room	44 ¹⁾	44
- along corridor	35 ²⁾	35

¹⁾ For special requirements, 48 dB.

²⁾ For rooms with glazed walls, 5 dB lower is acceptable.

Acoustic requirements, offices, according to SS 2 52 68

Impact sound levels in accordance with SS 2 52 68 Highest impact sound level between different spaces, L'_{nw} (dB)

-Type of space	Sound class B	Sound class C
Office room, interview room conference room, break room.		
- along corridor	64	68
" from other space	60	68

Sustainable

Granab subfloor systems are environmentally friendly, consist entirely of non-organic materials, and are not affected by variations in humidity or temperature. Granab systems provide comfortable, environmentally friendly and creak-free floors, and comprehensive sustainability tests have been carried out at the SP Technical Research Institute of Sweden.

Pleasant, comfort-adapted floors with Granab systems for a better working and living environment.

In a good living and working environment, it is important that floors are not hard or entirely rigid as this can cause pain in the shoulders, back and legs. With their integrated impact-dampening effect, Granab systems provide comfortable floors.

Granab systems provide pleasant and comfort-adapted floors for improved living and working environments. Floor constructions with parquet or other

floor coverings on girders entail less elastic deflection in the floor layer when point loads are applied.



Pleasant, comfort-adapted floors with Granab systems for a better living environment

In a good living and working environment, it is important that floors are not hard or entirely rigid as this can lead to pain in the shoulders, back and legs. With their integrated impact-dampening effect, Granab systems provide comfortable floors with a documented degree of deflection for point loads. Besides the subfloor construction and c/c distance between the girders, deflection during application of point loads on floors laid on a Granab system is also dependent on the choice of floor covering and how installation is performed. The respective flooring manu-

facturers provide information about deflection for each type of floor covering. Deflection of the finished floor construction with a point load of 1 kN should not exceed 2–3 mm according to the SP Technical Research Institute of Sweden. Testing and certification are conducted by the SP Technical Research Institute of Sweden. Contact Granab about full type-approval no. 192101. Granab systems with 22 mm chipboard and either 15 mm or 22 mm parquet have been tested in a number of residential projects by the SP Technical Research Institute of Sweden with respect to deflection of the completed floors. The results show an average



Testing methodology for completed floors

The SP Technical Research Institute of Sweden has developed a measurement method and device with digital deformation sensors for reliably and easily measuring the deflection of completed floors. Please contact us at Granab for information about the measurement device and instructions for use. Point-load deflection for Granab systems is in compliance with the applicable standards and recommendations.

For the entire finished floor construction (including the floor covering) to attain the expected level of comfort – besides the choice of floor covering laid over the Granab system – it is important that both the Granab system and floor covering are installed by trained installers and floor-layers, and that the installation instructions and checklists are carefully followed.



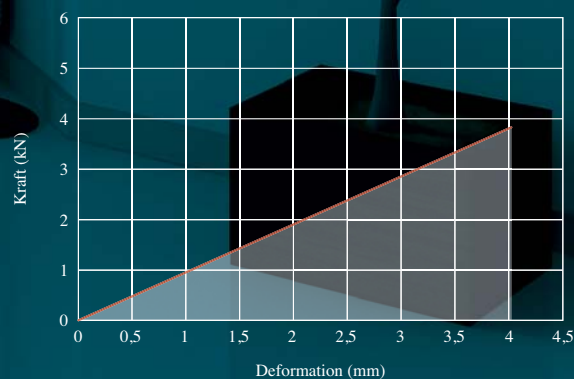
ter working and living environment.

deflection within 2 mm of other measurement points in each flat with a point load of 1 kN. Documentation from measurements conducted by the SP Technical Research Institute of Sweden with alternative floor coverings from a large number of field measurements in completed residential projects can be provided by Granab upon request, as well as figures from lab measurements conducted by the SP Technical Research Institute of Sweden and measurements from a large number of assembled test floors in Granab's testing facility with alternative floor coverings. All measurement results are within the margins for recommended values.

Granab systems with 22-mm chipboard and both 15-mm or 22-mm parquet have been tested in a number of residential projects by the SP Technical Research Institute of Sweden with respect to deflection of the completed floors. The results show an average deflection within 2 mm of other measurement points in each flat with a point load of 1 kN. Documentation from measurements conducted by the SP Technical Research Institute of Sweden with alternative floor coverings from a large number of field measurements in completed residential projects can be provided by Granab upon request, as well as figures from lab measurements conducted by the SP Technical Research Institute of Sweden and measurements from a large number of assembled test floors in Granab's testing facility with alternative floor coverings.

All measurement results are within the margins for recommended values.

Sample test measurements and laboratory tests of deflection when point loads are applied.



Homes



Offices



Schools





Gyms



Sports halls



Terraces



Easy

Granab subfloor systems are easy to work with and lightweight, and they require minimal installation expertise. They can be installed with simple tools and are easy to adapt to different heights and floor construction needs.

Installation example

High height

The level of the Granab subfloor system 7000 can be adjusted up to 420 mm as standard. If more height up to 1000 mm is required, a Masonite beam or steel Z-section is installed above the Granab system.

7000N high with steel Z-section.



7000N high with Masonite beam.



Plastic film

The plastic film is best installed above the subfloor system.

Installation, floating 22 mm chipboard



For detailed information, order our installation instructions



Installation tools Granab subfloor systems



Concrete drill bit for concrete anchors



Cat. no.: 8710. 100 mm



Cat. no.: 8720. 250 mm short



Cat. no.: 8740. 460 mm long



Cat. no.: 8840/8841. (with 100 mm drill bit)

Cutter for recessing adjusting screwed in girders



Cat. no.: 8600.

Screwing tool for adjusting floor girder heights (for screwdrivers)



Cat. no.: 8100. Short model



Cat. no.: 8200. Long model

Accessories Girder spacers



Cat. no.: 9300 Tool: Girder spacing 300 mm.



Cat. no.: 9400 Tool: Girder spacing 400 mm.



Cat. no.: 9500 Tool: Girder spacing 500 mm.



Cat. no.: 9600 Tool: Girder spacing 600 mm.

Mandrel for installation of concrete anchors (one of each included)

 Mandrel for recessing in predrilled holes. Cat. no.: 850 C. Length: 1000 mm

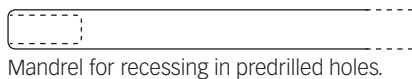
 Mandrel for final fixation. Cat. no.: 850 C. Length: 1000 mm

 Mandrel for recessing in predrilled holes. Cat. no.: 850 B. Length: 450 mm

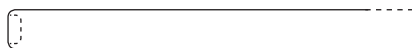
 Mandrel for final fixation Cat. no.: 850 B. Length: 450 mm

 Mandrel for recessing in predrilled holes. Cat. no.: 850 A. Length: 250 mm

 Mandrel for final fixation Cat. no.: 850 A. Length: 250 mm



Mandrel for recessing in predrilled holes.



Mandrel for final fixation



Insulation bracket

Cat. no.: 0440 (for 40 mm insulation plate)

Cat. no.: 0480 (for 80 mm insulation plate)

T-wrench for manually adjusting floor girder heights



Cat. no.: 8300.



CATALOGUES AMC



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Optimized structure borne noise decoupling systems for architectural acoustics.



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