# BUILDING TOGETHER

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# BUILDING
## TECHNICAL REQUISITES

Society is increasingly demanding better quality in building construction. These demands have a direct impact in terms of structural safety and fire protection measures. However, there are other aspects linked to people's wellbeing, such as noise protection, thermal comfort, or accessibility for people with reduced mobility. All the same, given its direct impact on space configuration, the building process involves a commitment to functionality, economy, harmony, and environmental balance.

TECHNOLOGY CENTER LEITAT, BARCELONA
PICH-AGUILERA ARQUITECTOS. PICHARCHITECTS

FACTORY, HEADQUARTERS AND LOGISTIC CENTER DANOSA, SPAIN


“WE HAVE MADE
A DEAL WITH
NATURE
TO LIVE IN
HARMONY

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DANOPOL PVC PRODUCTION LINE - DANOSA, SPAIN


# INNOVATIVE METHODS OF **CONSTRUCTION**

DANOSA is a manufacturer with an extensive range of products aimed at covering different technical requirements for building, such as water tightness, heat and acoustic insulation, energy saving, and fire safety.

In addition, evaluating the sustainable use of resources and the environmental impact of the building, form part of the criteria that drive new product development and the design of new construction systems, whether for new builds or restoration.

“ WE PROVIDE ANSWERS AND SOLUTIONS FROM

# INNOVATION AND KNOWLEDGE

QUALITY CONTROL LABORATORY - DANOSA, SPAIN

With over 50 years experience in the sector across 5 continents, DANOSA has a range of system solutions to guarantee water tightness, thermal insulation of building enclosures, acoustic insulation of interior spaces, and appropriate natural lighting and fire protection, where necessary.

A range of renowned European bodies technically guarantee and certify DANOSA products and systems using the European Harmonized Standards (EC mark) and the European Technical Assessment (ETA), complying with the accepted quality standards throughout the European Union, providing peace of mind and assurance to all construction agents.

# WATER TIGHTNESS

## WATERPROOFING

As a manufacturer of construction products and construction system design, DANOSA aims to improve the wellbeing of building users, avoiding the risk of structural deterioration in buildings, and minimize the environmental impact of our solutions.

In this sense, our waterproofing systems fulfill the function of protecting against humidity, reducing the foreseeable risk of the unwanted water or humidity entering buildings and their enclosures due to water deriving from atmospheric precipitations, flooding, the ground or condensation, with the means to prevent its penetration.

Investing in quality waterproofing systems leads to fewer building maintenance and restoration costs, as well as safeguarding the building's structural safety and usability conditions.

# WATERPROOFING SYSTEMS

Waterproofing systems comprise waterproof membranes made of welded prefabricated flexible membranes.

DANOSA markets a comprehensive range of waterproofing membranes, using different material technologies such as BITUMEN, PVC, TPO, EPDM, and liquid products based on polyureas and polyurethanes.

When defining the most suitable waterproofing system for each project, the following requires consideration whether a new build or restoration: the areas requiring waterproofing and their possible uses, the type of support for the waterproofing and how it interacts with the waterproofing membrane, and its installation and climatic and technical factors.

Depending on the number of layers in the system, we differentiate between single layer membranes with one impermeable layer and two layer systems when the tightness depends on two waterproof layers of the same material.

There are different waterproofing systems depending on the interaction between the waterproofing support and the membrane:

**FULLY ADHERED:** the waterproofing membrane remains completely adhered to the support. These type of systems offer the following benefits:

- Better performance against road traffic
- Higher membrane stability against heat fluctuations
- Better performance against wind suction
- They do not require heavy-duty protection
- Better resistance against mechanical damage
- Better resistance against water penetration in case of leaks
- Better incident localization in case of leaks
- Great versatility and adaptation to any kind of slope and geometric shape

**BALLASTED:** in this case, the waterproofing membrane is not adhered to its support and remains loose laid under ballast, such as gravel or pavement. These type of systems offer the following benefits:

- Faster application
- The membrane is not associated with any possible movement of the support
- Better water vapor diffusion

**SEMI-ADHERED:** the waterproofing membrane is installed partially adhered over the support. These type of systems offer the following benefits:

- Better performance with low dimensional stability supports
- Better water vapor diffusion
- They do not require heavy duty protection

**MECHANICALLY FIXED:** these kind of waterproofing systems are used mainly on metal deks offering the following benefits:

- Increased stability against long-term wind suction
- They do not require heavy duty protection
- Better water vapor diffusion
- High resistance to long-term extreme wind action
- The membrane is not associated with any possible movement of the support

BITUMINOUS MEMBRANE PRODUCTION LINE - DANOSA, SPAIN

# PRODUCT RANGE

**GLASDAN-ESTERDAN-POLYDAN MODIFIED BITUMINOUS MEMBRANE**

The DANOSA modified bituminous membrane product range comprises bituminous mastic, a reinforcement, and different exterior or interior finishes. Each membrane has different characteristics depending on the configuration of those 3 elements:

The bituminous mastic provides the seal to the membrane and establishes its durability. There is a range of DANOSA formulations for bituminous mastics. Details of the ELAST and POL ranges follow.

**The ELAST range** membranes are manufactured from modified bitumen with SBS (styrene-butadiene-styrene) elastomeric polymers that give the following properties to the membrane:

- Elastic behavior
- Self-healing properties
- Excellent welding at high and low temperatures
- Easy to apply to details and flashing
- Easy to repair in the event of accidental damage
- High product durability

**The POL range** membranes are manufactured from modified bitumen with APP (atactic-polypropylene) plastomeric polymers that give the following properties to the membrane:

- Plastic behavior
- Excellent welding at high temperatures
- Easy to apply to details and flashing
- Easy to repair in the event of accidental damage

Reinforcements mainly provide the product its mechanical properties. We make the following differentiations:

**The GLASDAN range,** manufactured with high dimensional stability fiberglass felt reinforcement.

**The ESTERDAN range,** manufactured with polyester felt reinforcement that gives the membrane mechanical properties.

**The POLYDAN range,** manufactured with heavy polyester felt reinforcement that gives the membrane outstanding mechanical properties.

Fiberglass can be added to polyester reinforcement for additional strength for certain uses. This technology enables us to supply membranes with excellent characteristics without needing to use double reinforcements.

There are different types of finishes for both the top and bottom surfaces:

The name **P** refers to products with a minimal thickness polyethylene film finish.

The name **GP** refers to products with minimum thickness polyethylene film on the bottom surface and mineral granules on the top surface for exposure to external conditions, and in some cases, to enable the pouring of hot asphalt-based agglomerates directly onto the surface.

The name **PARKING** refers to products with excellent mechanical characteristics with a minimum thickness polyethylene film on the bottom surface and a protective geotextile on the top surface that enables the pouring of concrete or hot asphalt-based agglomerate directly onto the surface.

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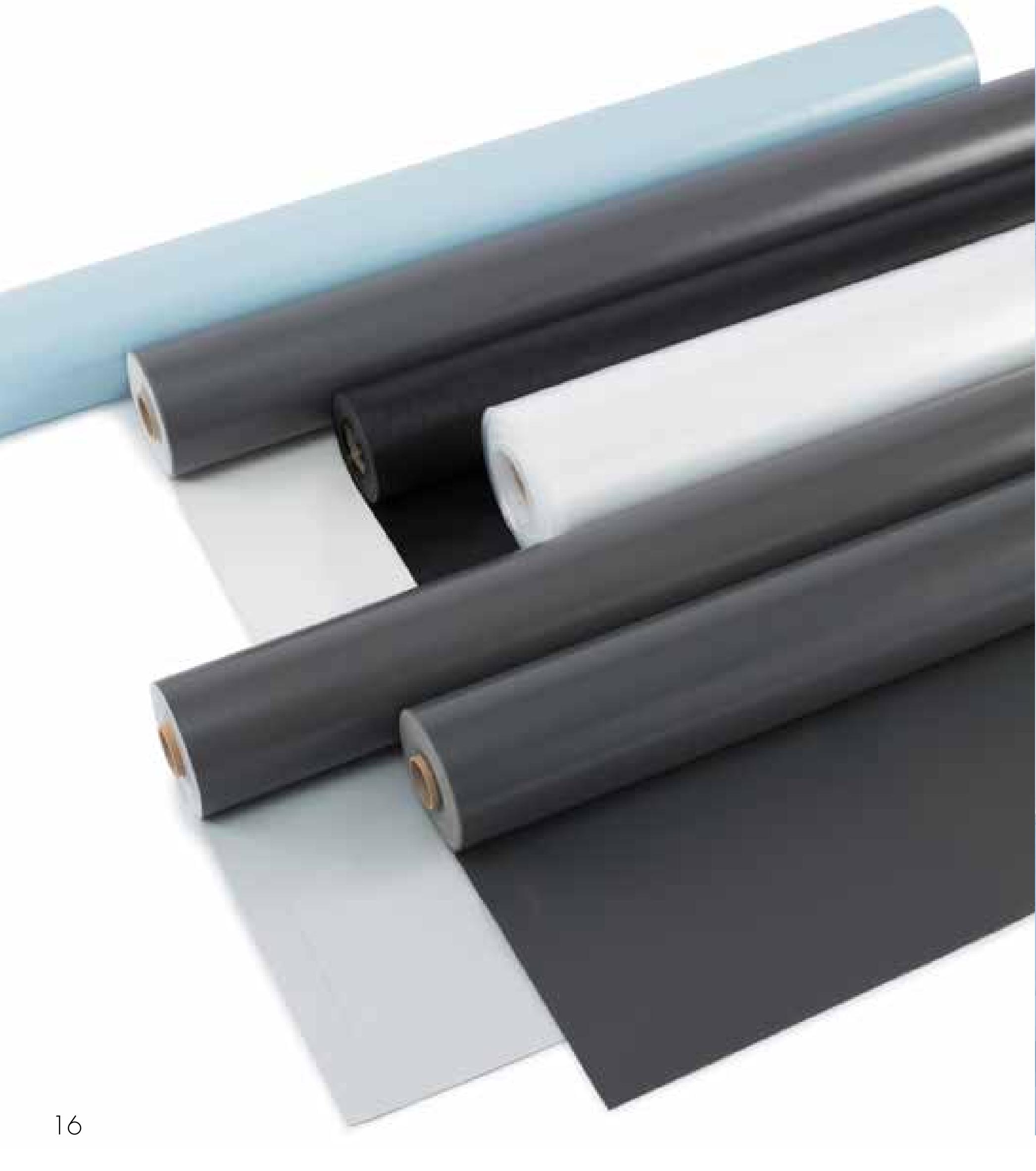
## SYNTHETIC MEMBRANES

## DANOPOL PVC MEMBRANES

The DANOPOL PVC (polyvinyl chloride) membranes comprise a rigid plastic material with additives such as high molecular weight plasticizers, stabilizers, and others, which give the product its flexibility and durability against outdoor conditions and ultraviolet radiation.Depending on the constructive system, there are different membrane's reinforcements: fiberglass veil (**DANOPOL FV**), specially recommended for loose laid-ballasted systems; or polyester mesh (**DANOPOL HS)** which increases the membrane's mechanical properties and it is intended to be used in mechanically fixing systems.

Besides, there are special formulations such as for drinkable water tanking waterproofing (**DANOPOL DW**)

or high reflectivity cool-roof solutions, whose purpose is to save energy concerning building's acclimatization (**DANOPOL HS COOL ROOFING**)



DANOPOL PVC membranes have the following benefits:

- Single-ply waterproofing solutions
- High flexibility at low and high temperatures
- Excellent tensile strength properties
- Superior flexibility and workability than other single ply membranes
- Self-extinguishing behavior in case of fire
- Easy and controlled welding using hot air (no fire needed during installation)
- UV resistant product for outdoor applications
- High product durability
- High solar reflectance in DANOPOL COOL ROOFING solutions

# COMPLEMENTARY PRODUCTS

## GEOTEXTILES

The **DANOFELT** product range has two product classes based on the type of fiber in the geotextile. This differentiates **PY** products manufactured in polyester and **PP** products manufactured in polypropylene.

These geotextiles are used as auxiliary layers in different waterproofing systems to fulfill different functions such as filtration, separation, drainage, protection, water vapor diffusion, and to even prevent layers from adhering within the constructive system. Thanks to their excellent characteristics they can also be used in civil works such as roads, traffic areas, railways, soil movements, foundations, retaining structures, drainage systems, erosion control works such as coastal and embankments, reservoirs, dams, canals, tunnels, underground structures, and solid waste dumps.

## DRAINAGE

The **DANODREN** product range is based on high-density polyethylene (HDPE) nodular membranes. One of the standout products in the range are the **PLUS** membranes that incorporate a polypropylene geotextile and **R-20** membranes for green roofs that allow water retention.

These drainage elements are used as auxiliary layers in a range of waterproofing systems to fulfill different functions, such as an anti-capillary action barrier in underground structures or drainage systems.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# ENERGY SAVING

## THERMAL INSULATION

As a manufacturer of construction systems and construction system design, DANOSA aims to achieve rational energy use in buildings, reducing consumption to sustainable limits, whether in new builds or restoration, to achieve suitable usability conditions enabling comfortable and healthy use of the home or building.

In this sense, our insulation products will provide a thermal covering for the building with properties that restrict the energy demand required to achieve thermal comfort and reducing the risk of humidity appearing from surface and interstitial condensation.

Investing in quality thermal insulation systems means significantly reducing building energy demands and passively contributing to the building's comfort and usability. According to Plataforma de Edificación Passivhaus (PEP), which originated in Germany, we can reduce a building's energy demand by up to 75% for all types of climatic situations using suitable thermal insulation without thermal bridges.

Additionally, the European Union proposed the Nearly zero-energy buildings concept, which both champions energy excellence in terms of construction means, such as PEP and the original German Passivhaus Standard Institute do, where thermal insulation products are given a very prominent role, along with  contemplating the active equipment and installations that contribute to the building's thermal comfort.

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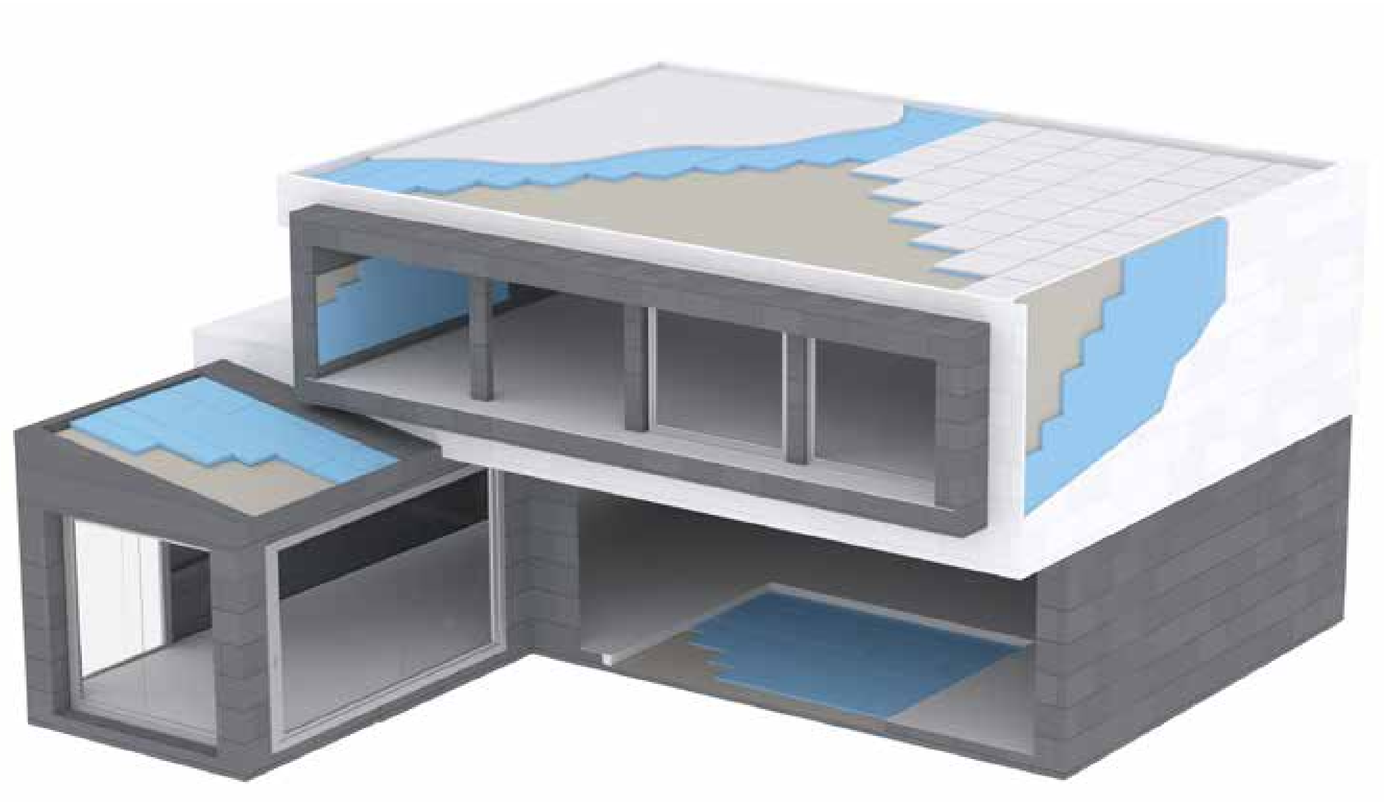


# BASIC CONCEPTS OF THERMAL INSULATION

From the energy standpoint a building is characterized by the hygrothermal properties of the construction products that comprise its thermal covering. Products for enclosures are defined by their thermal conductivity (W/m·K) and the resistance factor to water vapor diffusion μ.

Thermal conductivity is an intrinsic physical property of materials that measures heat conduction capacity. The lower the thermal conductivity, the better an insulation the material is. Materials are considered insulations when their thermal conductivity is under 65 mW/m·K. It is important to understand that the lower a material's thermal conductivity, less thickness will be required to comply with the same thermal transmittance U (W/m$^2$·K) demand.

When it comes to choosing the right insulation materials, factors that could degrade the hygrothermal properties over time need considering. This is the case for any humidity-based pathology, which occur so often in buildings. Water may not be "used" as a construction material per se, but it inevitably has an unwanted role in construction, whether in its liquid form or its even more hazardous solid form (ice). That is the case with rainwater infiltrations, snow, ice, condensation, capillary action from the ground, the water used in the building construction, etc. As a result, construction material thermal conductivity increases when they absorb water. This detrimental effect can occur with some thermal insulations, given that water can replaced the confined air or gas that constitutes the insulation. Water transmits 25 times more heat, and ice under the relevant conditions, transmits 90 times more heat

It therefore involves selecting insulation materials that absorb a minimal amount of water in order to sustain the product's insulating properties throughout the building's useful life.

# PRODUCT RANGE

DANOPREN's thermal insulation product range is made from hard extruded polystyrene foam (XPS) panels, free of CFC, HCFC, and HFC blowing agents, for use throughout the building's thermal covering in accordance with regulation EN 13164.

These hard panels are manufactured by an extrusion process giving the product a closed cell structure and following differentiating characteristics compared to other thermal insulations used in construction:

- Low thermal conductivity: between 0.032 and 0.037 W/m·K
- Minimal water absorption with immersion: 0.7%
- Minimal water absorption by diffusion: 3%
- High mechanical resistance to pressure: between 300 and 500 kPa
- Exceptional resistance to long term pressure without fatigue (fluency)
- Self-extinguishing product in case of fire
- Excellent dimensional stability
- Excellent resistance to water absorption with respect to freeze-thaw cycles
- High resistance to water vapor diffusion

### THERMAL INSULATION ON FLAT ROOFS

**DANOPREN TR** is the product for this purpose, with ship-lap edge resistant to pressure of 300 kPa, used both on inverted and traditional roofs. When requiring both thermal insulation and accessible pavement, the **DANOLOSA** product can be added to the project, a 50 x 50 cm insulated slab with a 300 kPa compressive resistance XPS base and  35 mm of porous concrete on top as pavement.

### THERMAL INSULATION ON PITCHED ROOFS

**DANOPREN TL** is a 300 kPa compressive resistance XPS board, grooved surface on top side, with ship-lap edge, used on pitched roofs to receive tiles directly with mortar.

The **DANOPREN CH** is a 300 kPa compressive resistance XPS board, with butt edge, used on pitched roofs for tiles, installed on wooden battens.

### THERMAL INSULATION ON THE EXTERIOR OR INTERIOR OF FACADES

The **DANOPREN FS** product is used in this case with butt edge with a 200 kPa compressive resistance, with applications on facades with ETICS (External Thermal Insulation Composite System) and thermal bridges.

### THERMAL INSULATION IN FACADES WITH A CAVITY

The **DANOPREN PR** product is a 200 kPa compressive resistance XPS board, with tongue and groove edge, used to fill cavity wall, with or without ventilation.

### THERMAL INSULATION ON FLOORS

The **DANOPREN CH** product is used in this case, with butt edge resistant to a pressure of 300 kPa, used on both horizontal surfaces in general, as well as floors.

### THERMAL INSULATION IN UNDERGROUND STRUCTURES

The **DANOPREN 500** product is a 500 kPa high compressive resistance XPS board, ship-lap edge, used on horizontal supports with high demands in terms of resistance to pressure, such as foundations, slabs and parkings

VILLAFRANCA HOUSE. MARTA GONZÁLEZ ARQUITECTOS

# NOISE PROTECTION

# ACOUSTIC INSULATION

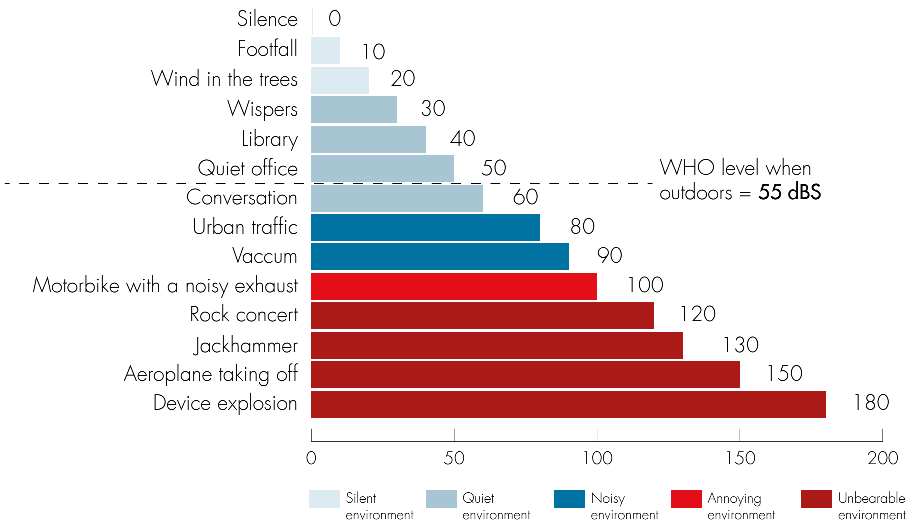
As a manufacturer of construction systems and construction system design, DANOSA aims to limit the risk of annoyance or illnesses caused by noise to users of buildings under normal usage conditions.

Our insulation products will help give the construction elements used in interior spaces of buildings suitable acoustic characteristics to reduce the transmission of airborne noise and impact noise.

Noise pollution is an increasingly significant problem in modern society, deriving from the development of industrial activities, transport, construction, and leisure or recreational activities. Noise pollution has a series of effects on everyday activities, interfering with spoken communication and affecting sleep, rest, and relaxation, limiting concentration and generating conditions that can lead to hearing loss, anxiety, or cardiovascular illnesses.

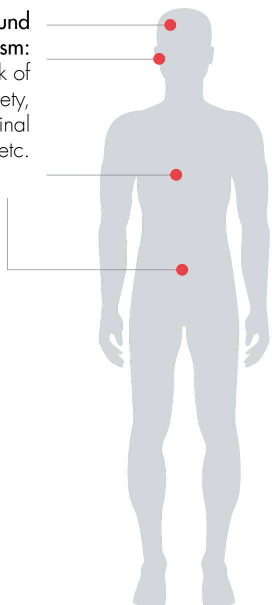
## HEALTH AND NOISE LEVELS

In decibels (dBs)




The World Health Organization (WHO) recommends maximum levels below 55 dB when outdoors and 30 dBA in interior environments to prevent people experiencing health problems. For reference, the different noise levels and their effects on health are shown below.

**Effects of prolonged sound on the organism:**
Stress, sleep issues, lack of rest, hypertension, anxiety, headache, gastrointestinal problems, etc.



**120 dB**

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# BASIC CONCEPTS OF ACOUSTIC INSULATION

**Sound** is an elastic wave that transmits through a medium and the human ear can perceive through the air. The audible frequency range is between 20 Hz and 20 kHz.

**Frequency** is the number of times per second a particular point of the wave has the same energy. There are low, medium, and high frequencies. Low frequencies are deep bass sounds whilst high frequencies are high-pitched sounds. Low frequencies are more difficult to insulate against because they carry more energy than high frequencies.

An intuitive way to understand this phenomenon is using **wavelength**, looking at the size of the waves at a certain frequency. For example, a 100 Hz wave measures 3.4 m in the air, so it is clearly difficult to insulate against.

**Noise** is the subjective perception of sound. It occurs, therefore, with an unwanted or annoying sound, i.e. a sound may be pleasant or unpleasant depending on the sensitivity or activity of the receptor at any given moment. To sum up, noise is any sound energy capable of changing physical or psychological comfort and interfering with the normal development of human activities.

The **decibel** is used to measure noise or sound levels. The decibel expresses the number of times greater a noise is, so it is a relative measurement. That is, a 10 dB higher noise means it produces 10 times more noise; a 20 dB higher noise means it produces 100 times more noise; a 30 dB higher noise means it produces 1000 times more noise, etc.

The human ear does not perceive the different frequencies in the same way, with perception highest with the middle frequencies, with the units weighted on that basis to ensure it is as close as possible to what is actually heard. For that reason, decibel A (dBA) is defined as a measured sound level unit with a filter that first removes part of the low and very high frequencies. This means measured exposure in dBA is a good indicator of the hearing risk to building users.

As a result, acoustic insulation aims to create a set of construction systems capable of reducing or preventing the transmission of airborne and structuralborne noises from one space to another or from outside to inside a space. This will then achieve the required or desired acoustic quality within the architectural solutions.


When one speaks of isolation, one always takes into consideration two different enclosures, so it is considered an noise emitted in the emitting room, the ways of propagation of sound, and how they are perceived-immission noise-in the receiving room. Therefore, the acoustic insulation will be defined as the difference between the emission noise level (L1) and the immission noise level (L2).

$D = L_1 - L_2$, where
$L = 10 \log ( L_e/L_{ref} )$ dB

The different levels used to quantify noise are:

Airborne noise between spaces: $D_{nT,W}$ (dB); Construction element airborne noise: $R_A$ (dB)

Impact noise between spaces: $L'_{nT,w}$ (dB); Construction element impact noise: $L_{n,w}$ (dB)

Airborne noise between a space and outside: $D_{2m,nT,W,tr}$ (dB); Airborne noise of the construction element and the outside $R_{W,tr}$ (dB).

Assessing insulation between spaces requires considering both the direct route through the separation wall and the indirect or side transmissions caused by vibration of the elements connected to the separation element. Looking at transmissions, acoustic insulation comprises a box in box system.


Acoustic insulation systems in buildings are based on the following principles:

## ACOUSTIC ABSORPTION

This is based on dissipating sound energy, transforming it into heat in static cavities in walls and ceilings. It is mainly effective at middle and high frequencies as part of acoustic insulation systems. It normally involves using porous or fibrous materials alone or in combination with other materials, with the thickness of the layer and its distance from the support important.

## THE MASS LAW

The mass law indicates that doubling the mass of a wall per unit area will increase soundproofing of a single leaf partitionby 6 dB. It is used for low insulations. Please note that the law of mass action does not work for all frequencies. There are three different areas of acoustic insulation on a simple wall. An area of low frequencies that causes resonance in the system, which reduce the insulation, another area of mid frequencies where the aforementioned law of mass action applies, and finally an area of high frequencies where there is a loss of insulation at the critical frequency as a consequence of the coincidence effect.



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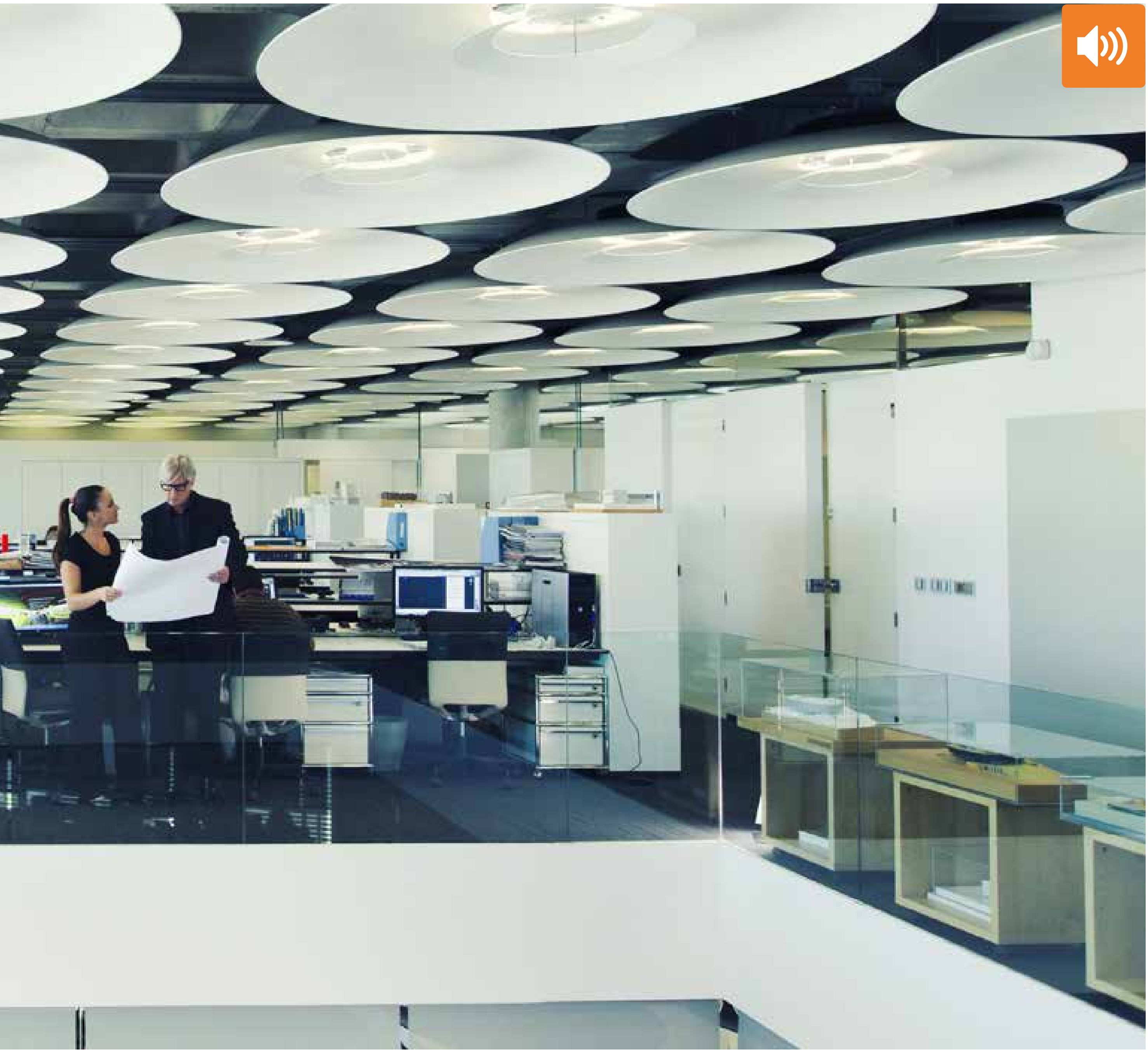

THE MASS-SPRING-MASS EFFECT

Insulating using the mass-elastic-mass effect would involve placing an elastic material between both surfaces that would act as a spring, opposing the movement between them. This material would act as an internal absorption chamber to mid and high frequencies. For low frequencies, it would depend on the distance to the wall and require large cavities.

THE MEMBRANE RESONATOR EFFECT

One way of obtaining low frequency insulation without increasing the cavity thickness involves using multilayer materials based on the membrane resonator effect. A membrane resonator is an element capable of vibrating at the same rhythm as the perturbation, which causes deformations and movements to occur in the form of the energy transforming from sound to dynamic energy. Looking specifically, this is applicable to the low frequencies area, selecting a semi-rigid element of low resonance frequency.

The anti-resonance effect involves installing a plastic membrane between fixed masses, such as two gypsum boards in walls and ceilings. This provides the sound dampening effect given that on receiving the impact as if it was putty, the material would deform, reducing or displacing the resonance frequencies of the construction solution. This would minimize the insulation losses at low and high frequencies explained in the law of mass action section. Overall, there is 3 to 4 dBA improvement when comparing systems with and without a membrane with an anti-resonance effect.


VILLAFRANCA HOUSE. MARTA GONZÁLEZ ARQUITECTOS


# PRODUCT RANGE

### PRODUCTS TO INSULATE AGAINST IMPACT NOISE

Products that base their acoustic efficiency by acting as a dampener inside a mass-spring-mass system. There are 3 main product classes for impact noises:

IMPACTODAN: Closed cell cross-linked polyethylene foam for installation under mortar used on floors to increase the acoustic insulation from impact noise.

CONFORDAN: Aluminum foal coated cross-linked polyethylene foam for installation under wooden flooring to increase the acoustic insulation from impact noise.

FONODAN 900: Cross-linked polyethylene foam heat welded to a high density acoustic membrane installed under wooden flooring to increase the acoustic insulation from impact noise and reduce the sound of the finish.

### PRODUCTS TO INSULATE AGAINST AIRBORNE NOISE

#### Multi-layered products

These product combine membrane resonators, which mainly insulate against low frequencies, with porous materials that mainly insulate sound at mid and high frequencies. There are 3 multi-layer product classes:

DANOFON: Comprised of a high density acoustic membrane attached to recycled cotton absorbent material on both sides. Mainly used in air cavities in partitions between users in ceilings and walls.

ACUSTIDAN: Comprised of an acoustic membrane with one surface of recycled cotton absorbent material. Mainly used in air cavities in linings as an absorbent for low frequencies in ceilings and walls.

SONODAN PLUS AUTO-ADHESIVE: A composite formed of two layers: The first layer comprising a lattice polyethylene heat welded to a self-adhesive high density acoustic membrane, and a second layer comprising of a self-adhesive high density membrane and a mineral wool. Ideal for impulse noises at low frequencies (music) in walls and ceilings.

#### Acoustic membranes

Anti-resonance elements that modify or reduce resonance frequencies in light systems such as gypsum boards in walls and ceilings, or metal sheeting in building roofs.

M.A.D.: A high density bituminous membrane ready finished in an anti-stick plastic installed between gypsum boards or stuck to metal membranes.

SYNTHETIC M.A.D.: A high density EPDM synthetic membrane installed between gypsum boards or stuck to metal membranes.

FONODAN 50: A cross-linked polyethylene foam strip heat welded to a high density acoustic membrane installed in the uprights and channel of the gypsum panel profile or under wooden battens in wooden floors and roofs.

FONODAN BJ: A cross-linked polyethylene foam strip heat welded to a high density acoustic membrane installed in rainwater drainpipes. Installing double layers adds the mass-spring-mass effect on insulating the pipe.

# NATURAL LIGHTING

## LIGHTING, ACCESSIBILITY, AND VENTILATION

As a manufacturer of construction systems and construction system design, DANOSA aims to achieve rational energy use in buildings, reducing consumption to sustainable limits, whether in new builds or restoration.

In this sense, our lighting systems contribute to buildings having installations that optimize the use of natural light in areas that meet certain conditions. In addition, they aid roof access and ventilation of interior spaces.

Investing in natural lighting systems means significantly reducing energy demand in buildings, approximately 30% in the case of lighting, as long as it provides the required light level for users to carry out their activities. In addition, a feature of natural light is its high performance when viewing colors, it has a proactive effect in people's behavior given it influences their health and wellbeing, improving productivity in workplaces.

## BASIC CONCEPTS OF LIGHTING

Skylights are used to enable natural light to enter correctly through building roofs, and they often act as ventilators. These products comprise a base and a translucent dome that can be made of polymethyl methacrylate (PMMA) or cellular polycarbonate (PC). This transparent dome lets visible sunlight pass through easily. The transparency quantifies as luminous transmittance, which is the percentage luminal intensity that passes through the material.

## PRODUCT RANGE

**NATURAL LIGHT PRODUCTS**

There are 2 product classes for lighting:

DANOLIGHT: A fixed skylight to provide the most light. It can be used with any type of roof. Comprised of a bivalve methacrylate (PMMA) dome and a base of glass-fiber reinforced polyester (GFRP).

DANOLIGHT PLUS: A fixed skylight to provide the most light. Mainly used for metal roofs and comprises a cellular polycarbonate (PC) dome and a galvanized steel base, with thermal insulation outside

.

**LIGHTING AND ROOF ACCESS PRODUCTS**

DANOEXIT: A fixed skylight that can open and used to access the roof and provide the most light. It can be used with any type of roof. Comprised of a bivalve methacrylate (PMMA) dome and a base of glass-fiber reinforced polyester (GFRP). It opens manually, up to a 90° angle.

DANOEXIT PLUS: A skylight that can open and used to access the roof and provide the most light. It can be used with any type of roof. Mainly used for metal roofs and comprises a cellular polycarbonate (PC) dome and a galvanized steel base with thermal insulation outside. It opens manually, up to a 90° angle.

**LIGHTING AND VENTILATION PRODUCTS**

DANOVENT MANUAL: A skylight that can open and used for natural ventilation and to provide the most light. Comprised of a bivalve methacrylate (PMMA) dome and a base of glass-fiber reinforced polyester (GFRP). It opens 45°, using a crank.

DANOVENT ELECTRIC: A skylight that can open and used for natural ventilation and to provide the most light. Comprised of a bivalve methacrylate (PMMA) dome and a polyester base (GFRP). It opens 45°, using an electric motor.

DANOVENT PLUS ELECTRIC: A skylight that can open and used for natural ventilation and to provide the most light. Mainly used for metal roofs and comprises a cellular polycarbonate (PC) dome and a galvanized steel base with thermal insulation outside. It opens 45°, using an electric motor.

DANOLIGHT PRODUCTION LINE- DANOSA, SPAIN

# FIRE PROTECTION

## SMOKE EXTRACTION

As a manufacturer of construction systems and construction system design, DANOSA also aims to reduce the risk of a building's users experiencing harm from an accidental fire to acceptable limits.

In this sense, our smoke extraction systems through ventilators in the roof will help a building's occupants leave or get to a safe place under safe conditions in the event of a fire.

# BASIC CONCEPTS ABOUT SMOKE EXTRACTION

In the event of a fire, heat and smoke extraction systems, considered active protection, create and sustain a smoke-free layer above the floor, removing the smoke. They also perform the function of removing the hot gases produced by a fire during its phases of development. There is now widespread use of these systems to create smoke free areas under floating layers of smoke. Their importance has become patently clear when it comes to evacuating users from buildings and other works, limiting fire damage and the subsequent financial loss, given they prevent smoke from accumulating, aid the extinguishing work with better visibility, reducing the temperature of the ceilings, and delaying the lateral extension of the fire. The heat and smoke extraction systems need to function correctly in line with the corresponding maintenance program in order to achieve these benefits.

# PRODUCT RANGE

**LIGHTING AND SMOKE EXTRACTION PRODUCTS**

DANOSA EVACUM S.E. 24 V: A skylight that can open for smoke extraction in the event of a fire, with the dome automatically opening when a temperature of 91°C is reached when a thermal fuse breaks. It also opens electrically when indicated from the control panel and fire control unit. Hydraulic pistons open the door. Mainly used for metal roofs and comprises a cellular polycarbonate (PC) dome and a galvanized steel base with thermal insulation outside.

DANOSA EVACUM S.E. PNEUMATIC: A skylight that can open for smoke extraction in the event of a fire, with the dome automatically opening when a temperature of 68°C is reached when a thermal fuse breaks. It also opens when indicated from the control panel and fire control unit. Compressed air or $CO_2$ from gas bottles open the door in an emergency. Mainly used for metal roofs and comprises a cellular polycarbonate (PC) dome and a galvanized steel base with thermal insulation outside.

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# SUSTAINABILITY

An important population growth is expected in the next years. This data is relevant in terms of being aware that the materials used in building and their environmental impact need considering with a view to obtaining gas emission and energy consumption reductions.

## ENVIRONMENTAL PRODUCT DECLARATIONS (EPDS)

Consumers' growing demand for rigorous environmental data on the design, construction, and maintenance of construction systems in the building has led to the introduction of the European environmental regulation called Environmental Product Declarations (EPDs).

An Environmental Product Declaration (EPD) is a standardized document, verified by an independent agent, which provides quantified and verifiable information about a product's environmental impact. The purpose of these tools is to assess the life-cycle environmental impact of products in accordance with the international standard EN ISO 14025. In this sense, EPDs provide objective, transparent, comparable, and additional information on the environmental impact of DANOSA's products, through life-cycle analysis (LCA) from raw material extraction through manufacturing to the end of their useful life in buildings.

This information enables all the building's agents to have environmental information on the products, previously unavailable during decision making. In addition, it enables us to introduce new ecodesign criteria as manufacturers of building materials.

## GREEN BUILDING CERTIFICATIONS

Green building certifications look to promote more sustainable construction with the subsequent financial, environmental, and social benefits for all the building agents. Based on different scoring criteria, buildings receive a certain classification indicating their environmental performance.

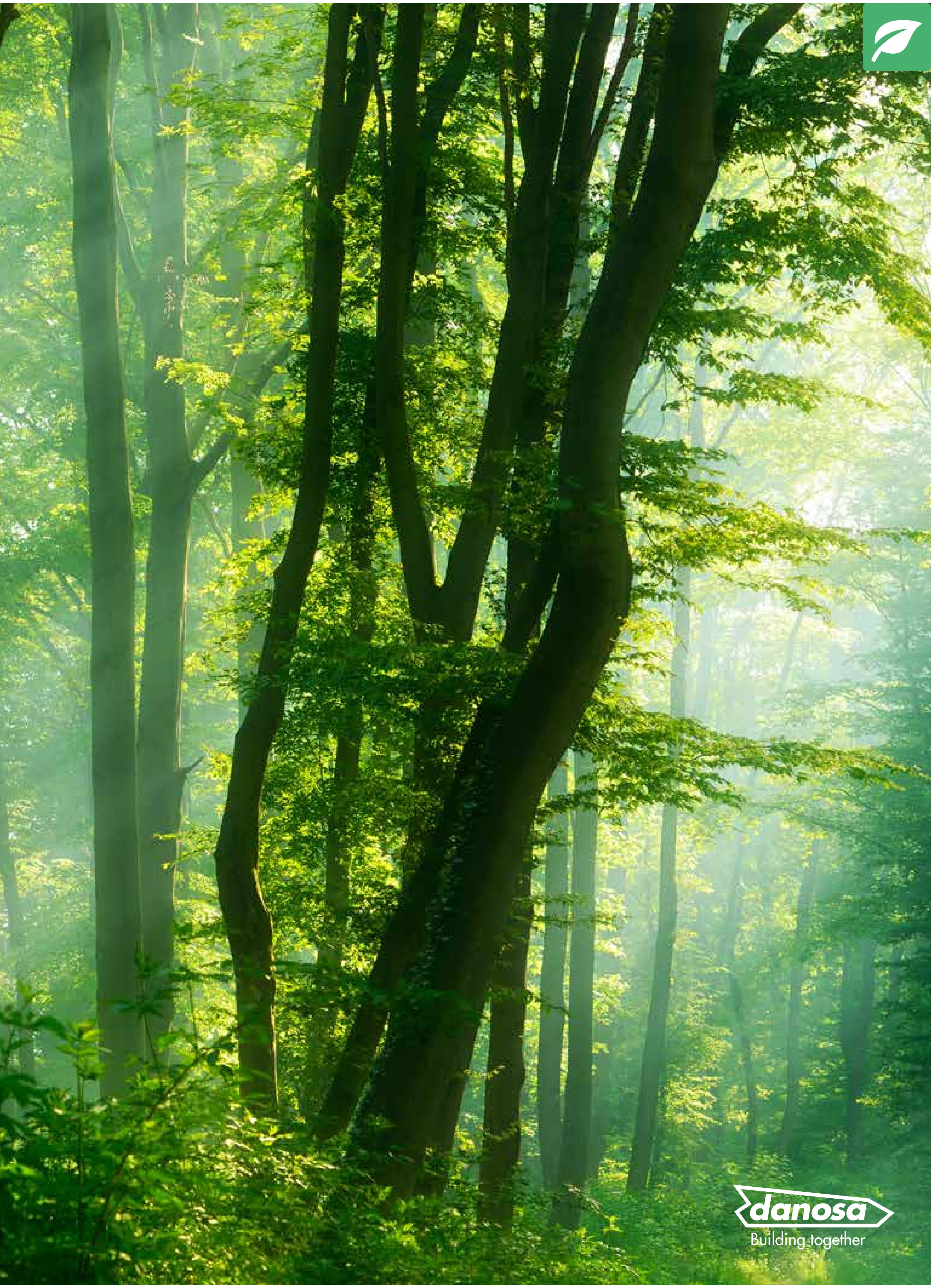
Used widely around the world, these certificates contain information on the environmental performance of the products contained in the building throughout their useful life. Environmental Product Declarations (EPDs) contain this information.

**LEED®**

LEED® (Leadership in Energy and Environmental Design) is a green building certification system developed by the United States Green Building Council at the end of the 1990s in the United States of America to promote buildings with sustainable criteria and high efficiency. It is one of most used certifications worldwide. The criteria are based on 8 different categories: project location and transport, sustainable location, water use efficiency, energy and the atmosphere, materials and resources, interior environmental quality, innovation, and regional priorities.

**BREEAM®**

BREEAM® (Building Research Establishment Environmental Assessment Method) is a sustainability assessment system developed by the BRE (Building Research Establishment) at the start of the 1990s in the United Kingdom based on 9 categories: management, health and wellbeing, energy, transport, materials, waste, water, land use, and ecology and pollution.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# REFURBISHMENT

Experts in sustainable buildings see restoration as the main method for changing the current model given that it can lead to up to 80% $CO_2$ emission savings from the buildings to which it is applied.

Therefore, building restoration has become a leading driver in the building sector. DANOSA develops and proposes comprehensive construction systems adapted to the new restoration and energy efficiency demands.

## WATERPROOFING PATHOLOGIES

Ensuring a building is watertight using a good waterproofing system means making the best investment to protect the building's structure and contribute to improve the health conditions for its users.

Usually less than 1% of a building's entire budget is allocated to waterproofing. As such, restoration and new build project decisions should clearly invest in quality waterproofing systems.

A range of causes can lead to humidity pathologies:

- Infiltration: when water penetrates into permeable enclosures through surface porosity. These pathologies can derive from the degradation of construction elements over time.
- Penetration: when water penetrates into enclosures through fissures, cracks, joints, joins, etc. due to a lack of continuity in the waterproofing system, seals, or construction elements.
- Condensation: when water vapor inside or outside buildings condenses on its enclosures. These mainly derive from unsuitable thermal insulation or heat bridges.
- Capillarity: produced when water moves through a porous enclosure, generally vertically and upwards, due to the intermolecular cohesive forces between water molecules being less than the liquid adhesion to the enclosure's capillaries. These pathologies usually appear in a building's buried structures.

Waterproofing systems can be used to ensure water tightness in roofs, buried structures, and water tanks. All the same, applying the necessary thermal insulation will prevent humidity through condensation.

## ENERGY DEMANDS IN BUILDINGS

From over 25 million residential buildings comprising the housing stock in Spain, 97% either do not have any type of thermal insulation (55%) or rather have a very ineffective thermal covering (42%). 48% of the energy consumed in a building comes from heating and air conditioning. This means that the large majority of building users in Spain live in poor conditions in terms of health and thermal comfort, along with their buildings being real energy devourers.

Currently 17% of Spain's overall energy consumption is used by buildings. 10% corresponds to domestic consumption and 7% to the service industry. Improving a building's thermal insulation derives in 30% energy, financial, and $CO_2$ emission savings on heating and air conditioning consumption through the reduction of losses.

Significant restorations of existing buildings are a great opportunity to take effective measures to passively increase the thermal comfort of the thermal covering, as well as reducing the energy demand in buildings from heating and air conditioning.

For over 50 years, the extruded polystyrene foam (XPS) used in DANOPREN's products has helped to improve the thermal comfort of building users along with helping to significantly reduce energy demand in buildings. Compared to other thermal insulations, DANOPREN stands out for its high resistance to pressure and minimal water absorption, making this product the best thermal insulator in terms of durability given its thermal properties remain intact over time.


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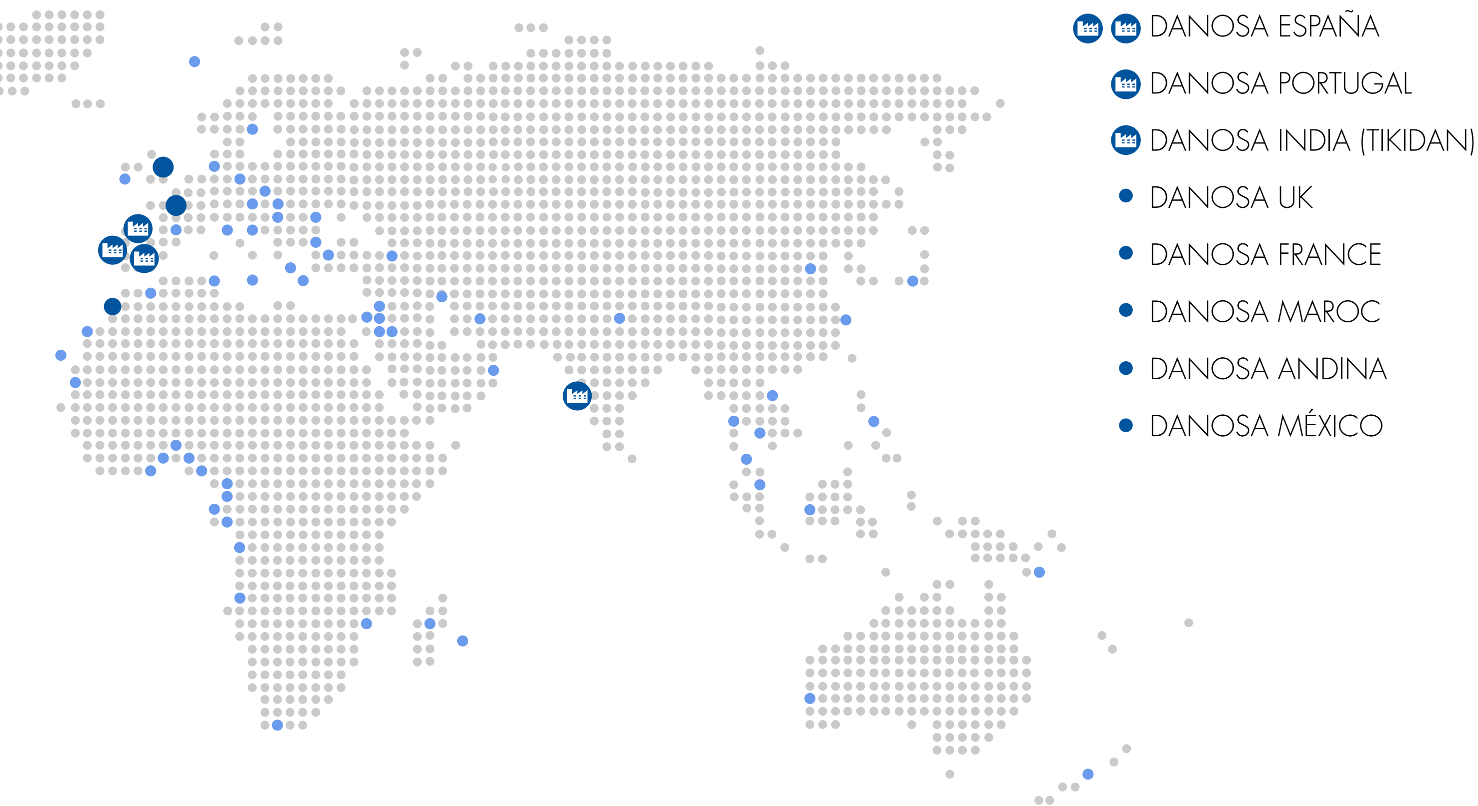
# WE THINK GLOBALLY AND ACT LOCALLY

DANOSA offers a fast international service and minimalizes lost time until the material arrives at the final destination.

- Central logistics 13.000 $m^2$
- Automated robotic logistics store that is unique in the sector.
- Capacity to manage 80 pallets per hour.
- Capacity to store 7.000 pallets.



FACTORY, HEADQUARTERS AND LOGISTIC CENTER DANOSA, SPAIN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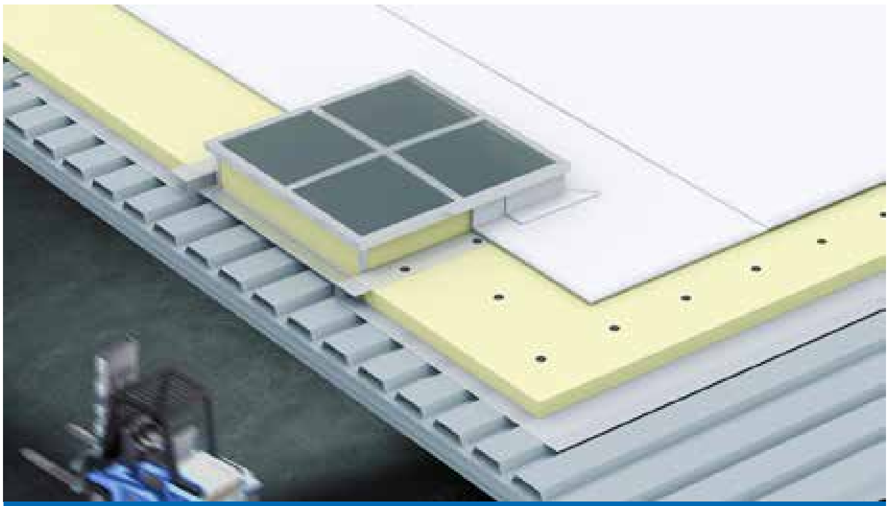
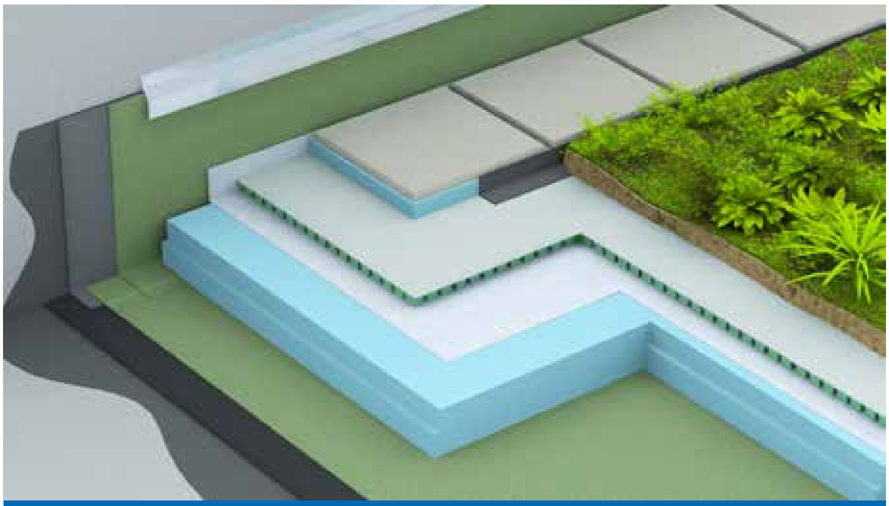
# “ WE PRESCRIBE THE BEST CONSTRUCTIVE SYSTEMS IN FUNCTION OF EACH PROYECT NEEDS

Our international technical team offers technical advice to all building agents:

- Constructive system definition
- Products technical support
- Fulfillment of normative requirements
- BIM® materials and systems libraries
- Autocad® constructive details
- Price databases
- Technical requirements sheets
- Installation advice
- Technical training programs
- Active participation in technical sector events

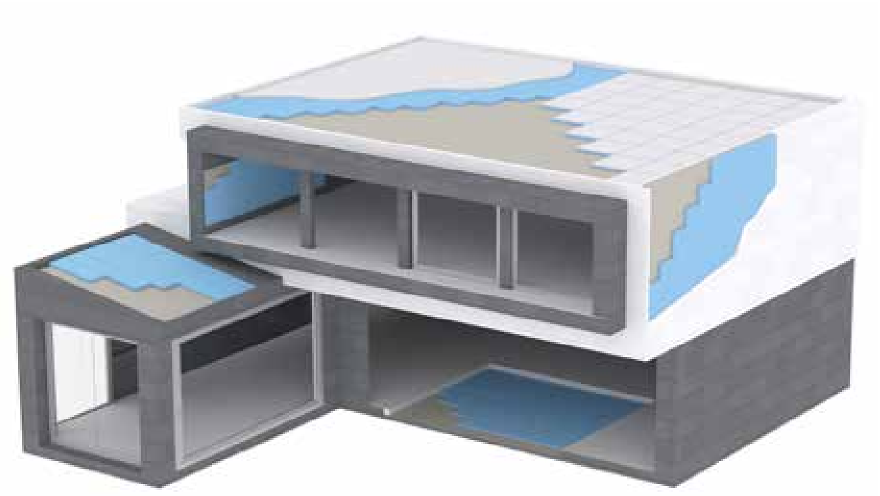


**REFLECTIVE FLAT ROOFS**
**Complete Cool Roofing solution to improve energy efficiency**



**GREEN ROOFS**
**Complete solution for minimising the urban heat island effect**

**BASEMENT STRUCTURES**
**Complete solution for improving the liveability of basements**



**THERMAL INSULATION**
Solutions to improve building energy efficiency

**ACOUSTIC INSULATION**
Complete solution designed to improve acoustic quality inside buildings

**BRIDGES FOR VEHICULAR TRAFFIC**
Complete high-performance solution for improving infrastructure security

# WORLDWIDE PROJECT REFERENCES
**www.danosa.com**


El Dorado International Airport - Bogotá, Colombia


Four Towers Business Area - Madrid, Spain


Hanoi Museum - Hanoi, Vietnam


Sea Museum - Biarritz, France


Charles de Gaulle International Airport - Paris, France


Terminal T4 Barajas Airport - Madrid, Spain

Blau Museum - Barcelona, Spain


Puerta de Europa - Madrid, Spain


Portia Wine Cellar - Gumiel de Izán, Spain

Mohammed V International Airport - Casablanca, Morocco


Hotel Four Seassons - Marrakech, Morocco

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**DANOSA** ESPAÑA
Factory, Head Office and Logistic Centre
Polígono Industrial, Sector 9
19290 Fontanar - Guadalajara, España
**T** (+34) 949 888 210 **E** info@danosa.com

**DANOSA** UK
Unit 12, Admiral Park
Airport Service Road
PO3 5RQ Portsmouth, Hampshire, United Kingdom
**T** (+44) 8450 740 553 **E** uk@danosa.com

**DANOSA** MAROC
14, Bd de Paris, 5ème Etage
Bureau nº 48
Casablanca, Maroc
**T** (+212) 522 221 153 **E** maroc@danosa.com

**DANOSA** MÉXICO
**T** (+00) 52 155 356 769 52 **E** mexico@danosa.com

**DANOSA** FRANCE
23, Route de la Darse - Bât XIII A
94380 Bonneuil-Sur-Marne, France
**T** (+33) 0 141 941 890 **E** france@danosa.com

**DANOSA** PORTUGAL
Zona Industrial Da Zicofa. Rua da Sismaria, Lote 12.
2415-809 Leiria, Portugal
**T** (+351) 244 843 110 **E** portugal@danosa.com

**DANOSA** ANDINA
Cra. 7 #82-66, Oficina 311
Bogotá D.C., Colombia
**T** (+57) 317 372 9559 **E** andina@danosa.com

**TIKIDAN** INDIA
Tikitar Estate, Village Road, Bhandup (West)
400 078, Mumbai, India
**T** (+91) 22 4126 6666 **E** info@tikidan.in


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