TECHNICAL MANUAL

CORK CONSTRUCTION & DECORATION MATERIALS

CULTURE,
NATURE,
FUTURE.

CONTENTS

CULTURE, NATURE, FUTURE.

Knowledge passed from Generation to Generation

Cork has protected, inspired and fascinated mankind for thousands of years. The discovery of cork's potential and excellence has led to various industries passing this knowledge on from generation to generation, without cutting down a single tree.

Synonymous with Good Wine

Cork has been the preferred wine closure for centuries and is chosen by over 70% of winemakers worldwide, for approximately 12 billion bottles produced annually.

100% Environmentally Friendly

Cork is a 100% natural, sustainable and recyclable material. Cork oaks have a unique ability to absorb CO_2 from the atmosphere. It is estimated that the cork oak forests can absorb up to 14 million tons of CO_2 per year.

Biodiversity Hotspot

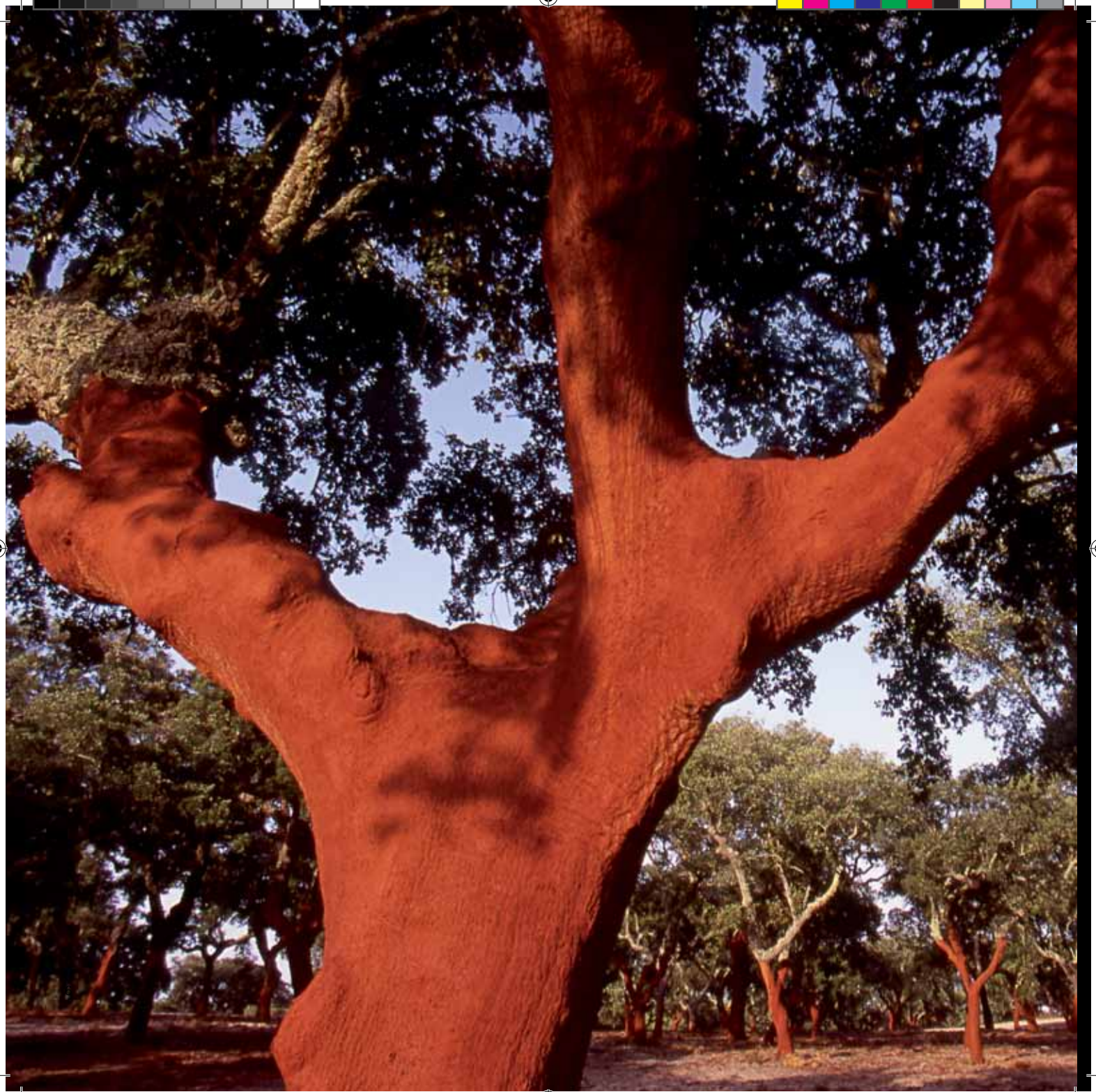
The cork oak forest is one of the 35 global biodiversity hotspots and a habitat for some of the most endangered species on the planet. It helps to control erosion, regulates the hydrological cycle and contributes to fighting desertification and global warming.

Innovation, Technology and Quality

High-tech materials for the aerospace industry, polymer compounds for the transport sector, top-level sports equipment, benchmark architecture and design works are just a few examples of how cork is used which demonstrates the versatility of this complex material.

Added Value

Since there is no future without people, the cork industry is a truly social, environmental and economic pillar for the millions of inhabitants of the western Mediterranean basin. Thanks to the cork oak forest and products made from cork, it is possible to show that sustainable development may not be a utopia.



Cork is the material that covers the trunks and branches of the cork oak (Quercus suber L.), a tree related to the oak, which is the only tree capable of naturally regenerating its bark after it is removed. Cork is harvested by experienced professionals at intervals of nine years, which causes no damage to the tree. It is not necessary to fell the cork oak to obtain cork.

01. PREFACE

Many cork oaks growing together create what is known as the "Montado" cork forests, a name given to them in the 14th century that refers to the biodiversity found in this environment, since the term "montado" in Portuguese refers to animals that can be "mounted."

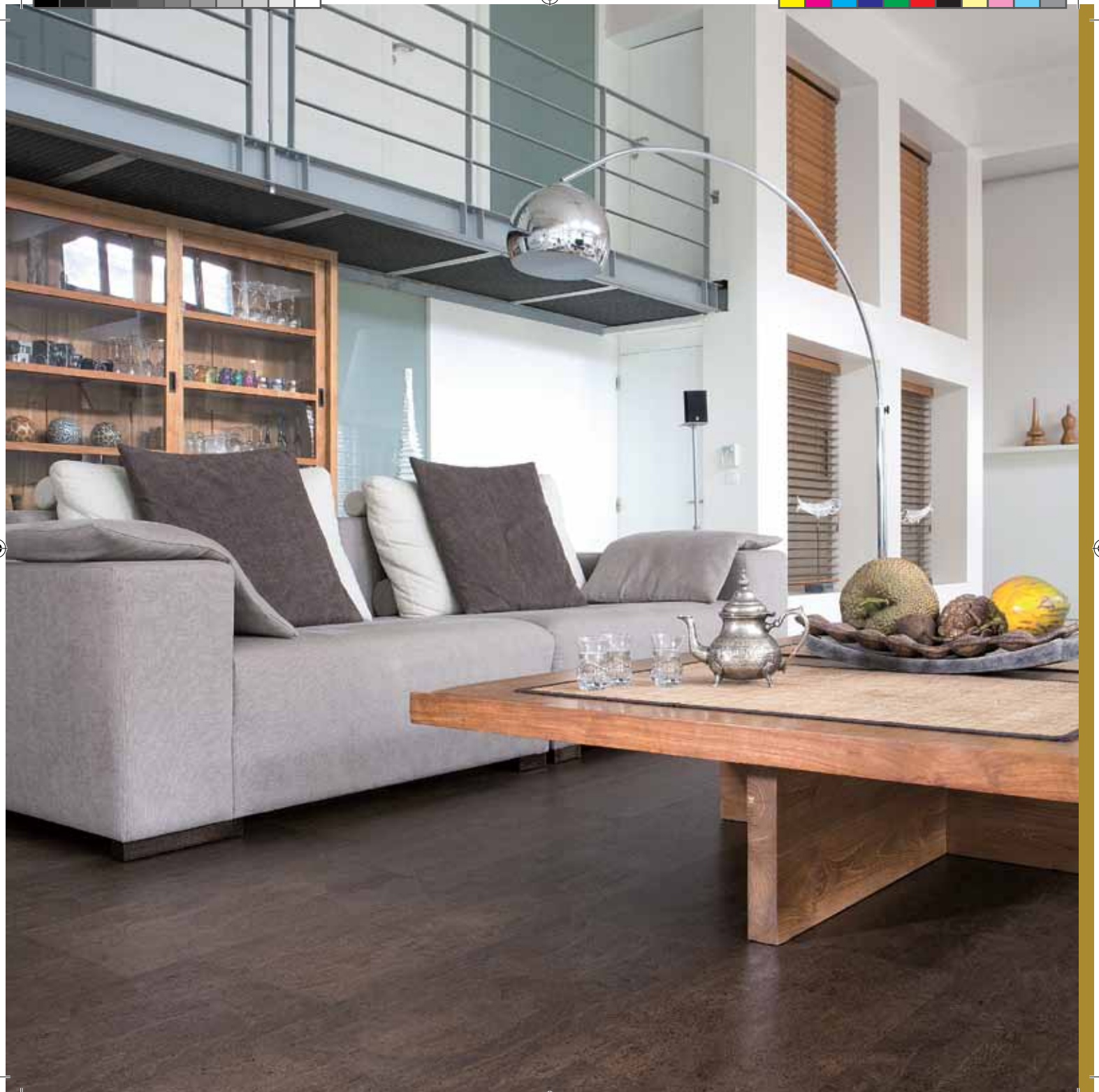
The Montado is essentially distributed among southern Mediterranean and North African countries; yet it is Portugal that holds the greatest concentration with over 30% of the world's total.

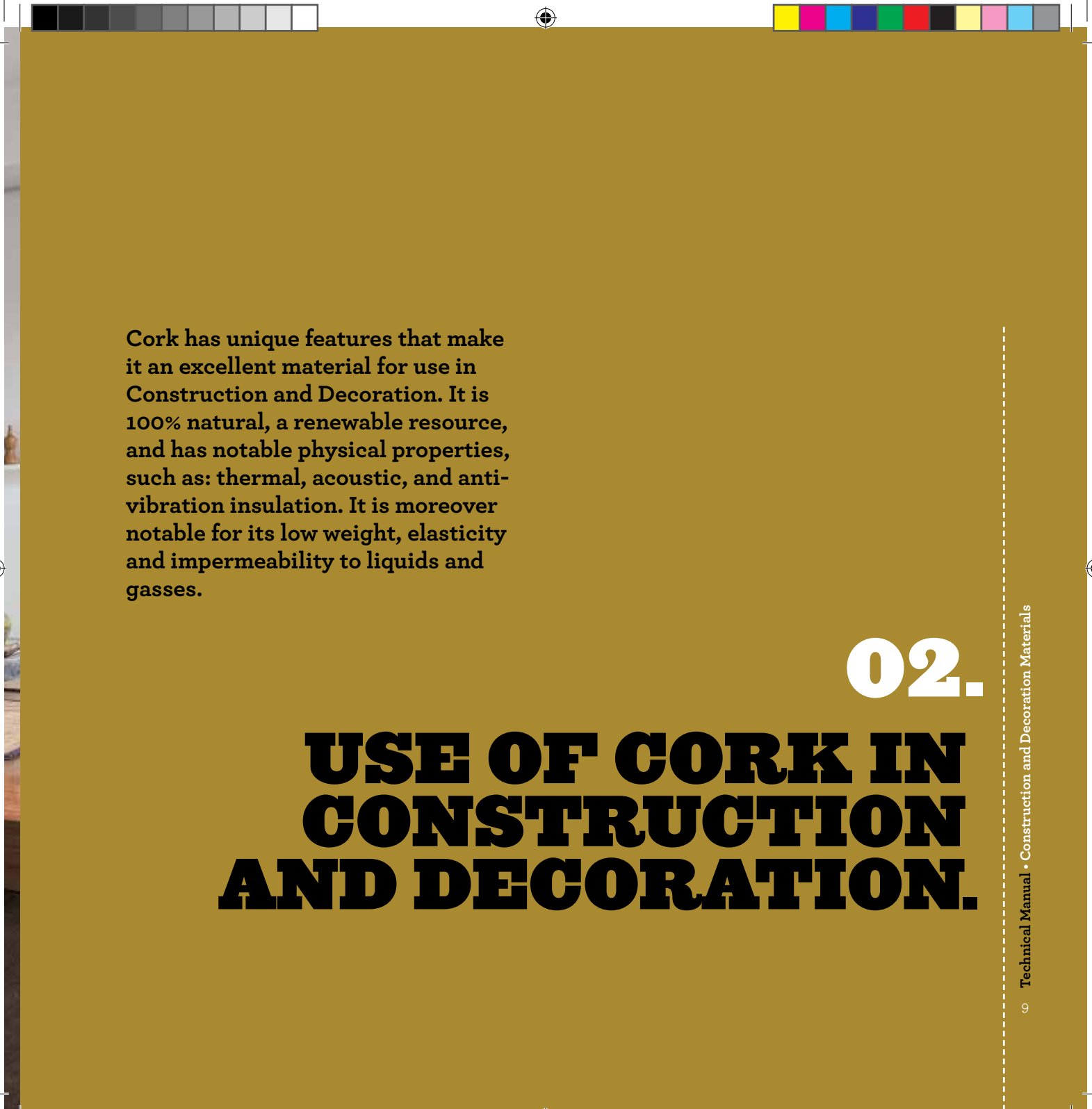
The cork oak is a spontaneous species that currently occupies an area greater than one-third of Portugal's territory (around 730 thousand hectares), but it is mostly concentrated in the south, in Alentejo.

The Montado is home to an endless variety of animal and plant species and has greatly contributed to maintaining a regular hydrologic cycle while protecting the soil and preventing desertification.

It is also important to note that the Montado helps capture carbon dioxide (CO_2), the gas responsible for global warming, by holding up to 14 million tons of CO_2 per year.

Cork is further classified as an eco-efficient material with a life cycle where waste from the manufacturing process is reused as biomass to produce new products. During the cork production process (as in the case of the pure expanded cork agglomerate which requires only steam from heated water as a means of agglutinating the grains without the need for chemical additives,) no waste is released into the environment. In fact, even the cork powder produced from the system is used as biomass in producing steam or electric energy.





Cork has unique features that make it an excellent material for use in Construction and Decoration. It is 100% natural, a renewable resource, and has notable physical properties, such as: thermal, acoustic, and anti-vibration insulation. It is moreover notable for its low weight, elasticity and impermeability to liquids and gasses.

02.

USE OF CORK IN CONSTRUCTION AND DECORATION.

02.1 - Introduction

Cork has come to be widely used in construction as a material for producing parquet style floor, wall or ceiling coverings, expansion joints, air cavity fillings, refrigerator chambers, heating and air conditioning tube coverings, and machine foundations that absorb vibrations and noise. Thus, a well-insulated building provides greater comfort and is therefore more energy efficient, resulting in greater savings.

Regarding its use in industrial areas, especially when used as insulation (for improving machine performance and preventing waste of energy and wear), it substantially increases the yield of workers who are given a more pleasant working environment.

In recent years, due to health and environmental problems found in connection with the production and use of certain products (i.e. asbestos fibers and chlorofluorocarbons or CFCs, which are used as agents for expanding certain plastic and ureia-formaldahyde foam cells and may release irritants), there is a renewed interest in thermal insulation solutions that use a pure expanded agglomerate, especially in countries such as Austria, Switzerland, Germany, the United Kingdom, Italy, and Russia.

Every year new cork-based products come onto the market, such as new flooring collections which are visually similar to other materials (wood, leather, stone, etc.); products with different textures (smooth or wavy) in various colors and sizes that allow for a combination of floorings from different collections to make decorating easier; and products for use on walls, in a variety of colors and textures.

02.2 - Green Building

Although awareness of climate changes are evolving, in the construction industry there is a continued need to use the principles of Ecological Architecture - a type of architecture aimed at improving Environmental quality, reducing the negative impact of buildings on the Ecosystem, and contributing to adherence to guidelines through protocols and International Treaties.

According to statistical data, the construction industry has a significant impact on the Environment and so in an effort to minimize this impact, innovative concepts are being created in North America and Europe, amongst others.

The concept of Green Building is another new trend that is used in the residential and commercial sectors to significantly reduce negative impacts on the Environment and the people living in it.

The term Green Building was born from a growing concern with the high rate of consumption of natural resources, such as power and water, and with building in the context of large cities.

This new chain of thought is aimed at gaining philosophical integration in looking at both the efficacy of production methods, and the sustainable use of natural energy resources, in an attempt to cut or eliminate defects in the process of producing and consuming resources.

In an effort to extend use of environmentally friendly materials in building and minimize the effects of heat transmission by conduction in buildings, it is necessary to consider the thermal resistance of building elements and incorporate naturally obtained insulation materials.

Cork can play an important role in this respect since it is not only a natural product, but its production process is extremely environmentally friendly. Even cork powder is used as biomass. It is harvested manually in the Montado region and, after it has been used for a particular purpose, cork can be reused and recycled.

Because of its characteristics, pure expanded agglomerate sheets have been used in insulation for roofs, walls, and outdoor coverings, in an effort to contribute to reducing energy consumption and the loss of heat into the Environment.

The compound agglomerate is used in new flooring concepts, wall covering, furnishing and other applications that use cork as a means of extolling it as a material capable of adapting to and performing its function in harmony with other materials.

Thus, the growing use of ecological materials is synonymous with a philosophy of "innovation geared towards the future" which not only complies with European guidelines and laws, but can also be used in new buildings or to remodel old ones.

02.

02.3 - Use of Cork in Construction

Cork is used in Construction as a response to the current needs for comfort and to environmental concerns for using green materials that do not harm the Environment.

Cork coverings are one of the most comfortable and recommended options for flooring in any living area, since cork works to absorb the noise of impact and improves quality of life.

Cork is notable for being one of the best solutions in terms of health because of its resistance to humidity. People who suffer from allergies and asthma are advised to use cork because it does not gather static electricity, and therefore does not attract dust, pollen, or small fibers.

Another advantage of this type of flooring is its ability to regulate room temperature as a result of its performance as a thermal and acoustic insulator. It provides comfort in places that require special care such as conference rooms, theaters, movie theaters, commercial buildings, hospitals, schools and kindergartens as well as other areas aimed at individual well-being.

Products available on the market are made of one of two types of agglomerates: pure expanded agglomerate and compound agglomerate, which are produced differently and have different functions. These agglomerates along with other materials can further create new products and uses.

02.4 - Cork products

02.4.1 - PURE EXPANDED AGGLOMERATE

Pure expanded agglomerated cork, commonly known as "black agglomerate", uses falca cork, virgin or reproduction cork, as a raw material. Falca is ground up into granules, placed in autoclaves and undergo expansion by being exposed to steam from water heated to 350-370 ºC. The granules exude a resin (suberin), which allows for agglomeration without the use of any foreign additives.

Thus a block of expanded cork is obtained which, after stabilization, is rectified and cut into plates of varying thicknesses.

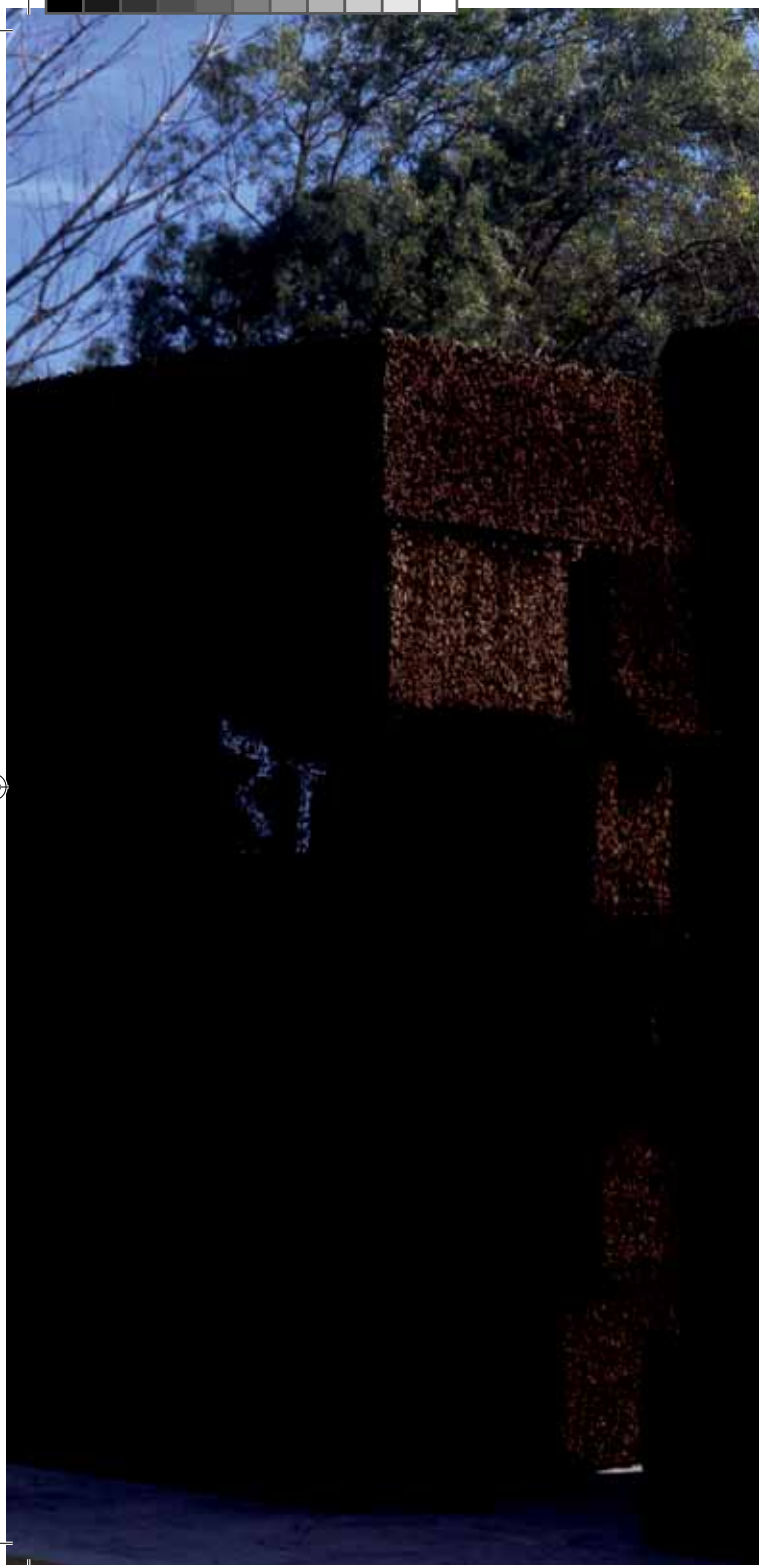
Expanded agglomerated cork is an excellent technical solution for vibration, thermal and acoustic insulation. Cork has closed cells, so the pores are not interconnected to exterior openings. As such, sound absorption is weak. However, black agglomerated cork has open pores between the granules of cork, as the greater the volume fraction of these pores, the lower the density of the agglomerate. This specific feature helps to improve the absorption of sound and mechanical energy.

In its role as a thermal insulator, expanded agglomerated cork helps to protect against temperature fluctuations, reducing energy loss and moisture condensation on the surface of walls and ceilings. In the field of acoustics, the material's absorption capacity contributes to the reverberation time reduction as well as reduces the transmission of sound impact. Thus, applying agglomerated cork to the floor or wall ensures the partial or total absorption of sound energy and hence reduces reflected sound. In addition, expanded agglomerated cork can be applied as a vibration buffer for large machines, reducing the vibration transmission to the structure and building foundation.

Corks main features are:

1. 100% natural and renewable resource;
2. Industrial process without the use of additives;
3. Density of 100-120 kg/m3 (standard);
4. Excellent heat transfer coefficient – 0.038/0.040W/mk;
5. Good acoustic insulation (aerial and percussive noises);
6. Excellent mechanical properties;
7. Excellent dimensional stability;
8. Behaves well in fire and when it undergoes combustion it does not emit toxic gasses;
9. Practically unlimited durability, without losing features;
10. Totally recyclable and reusable.

Cork is a natural solution for sustainable construction.



02.4.2 - COMPOUND AGGLOMERATE

The main raw material used in compound or "white agglomerate" is obtained by grinding the waste/byproduct from the manufacture of cork stoppers. These granules are bonded by a joint action of pressure, temperature and resin (synthetic or of plant origin) and are produced in sheets, blocks or cylinders. By adding resins and additives technical agglomerated products with diverse applications are obtained, including:

1. In the electrical industry, as an insulant;
2. In construction, as flooring and as wall and roof coverings;
3. As an acoustic and thermal insulator for wall and floor coverings;
4. In expansion joints;
5. As a friction component and for polishing crystals;
6. Office equipment and educational products;
7. On shoe soles and inserts;
8. In manufacturing items, especially homeware articles;
9. For furniture, rigid panels and rigid parts for dividers;
10. In fishing bobbers and life jackets;
11. For hockey pucks, golf and cricket balls;
12. For protection from radioactive isotopes;
13. For valves on wind instruments.

02.4.3 - CORK COMPOUND WITH RUBBER

This is a compound agglomerate of carefully selected cork that is compressed with rubber. This mix combines the resilience of rubber with cork's properties of mechanical resistance and dimensional stability, which results in a flexible, elastic, yet solid product. Because of its precision and resistance, it is used in engine joints, in the automobile and naval industry, in the electro-mechanical industry, and in manufacturing anti-slip flooring.

02.4.4- OTHER CORK COMPOUNDS

Cork is capable of generating a wide variety of products given its ability to integrate with other materials such as rubber, plastic, asphalt, cement, plaster, casein, resins and glues, and other products that are intended for specific applications.

In addition to being an environmentally friendly material and easily recyclable, the fiber obtained from coconuts together with expanded agglomerated cork presents exceptional acoustic performances in the substantial reduction of impact and air-borne sound levels.

02.4.5-GRANULES

Expanded (black)

Expanded (black) granules are natural granules with thermal and acoustic characteristics. They are used to fill empty spaces in floors, light screeds, interior dividing walls, and for other specific uses. This type of granule is light (60/65 kg/m3) and can be supplied in different sizes.

Non-expanded

Natural cork granules can come in variable grain (granule) sizes and can have a density (or volume mass) of 40 to 100 kg/m3 or more, depending on their quality. The industry usually provides granules in specific sizes and densities according to use.

Cork granules are traditionally used to manufacture agglomerates, for both the construction materials and cork stopper industries. However, there are many other uses where cork granules are used alone or along with other materials, making the most of cork's extraordinary characteristics. Cork granules are used in everything from agriculture to construction, environmental protection, energy, and the military industry, and have countless industrial uses in areas such as automotives, electronics, chemicals, metal mechanics, and others.

The materials made of cork can be used in various divisions of the house, as insulation or as a decorative wall and floor covering element.

03.

USE OF CORK IN BUILDING CONSTRUCTION.

Cork can be used in different areas of a house or building as an insulant or simply for decoration. Image 1 provides an example of its uses.

Image 1 - 3D house with uses of cork

3.1 - Insulation in Inclined Roofs

In the building area, the pure expanded agglomerate or ICB (Insulation Cork Board) finds its most "sophisticated" use in thermal insulation for terrace coverings, playing the role of a thermal insulant and supporting the water-proofing system.

Dimensional stability, resistance to high temperatures (needed for the sheets either to adhere to the support base or for the water-proof membranes to adhere to the sheets) and mechanical characteristics (compression and cohesion), which characterize the pure expanded agglomerate account for undeniable advantages (image 2) (see in attachment – Product 1 sheet).

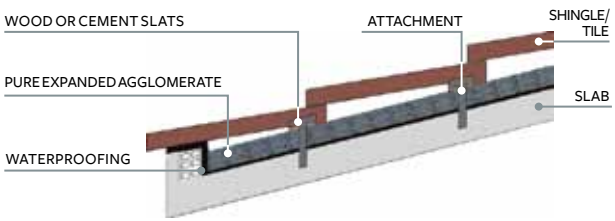


Image 2 – Use of pure expanded agglomerate in inclined roof insulation

3.2 - Insulation of Flat and Metallic Roofs

Insulation of flat and metallic roofs is a procedure that requires consideration of several factors: thermal insulation, reduced heat transfer, and protection against infiltration of water and humidity (image 3).

In the case of metallic roofs, pure expanded agglomerate proves to be an excellent product because it is resistant, allowing for secure installation methods to be used that make the roof resistant to wind as well as traffic loads, especially during the construction phase.

Not only can it bear permanent pressure without the risk of damage, pure expanded agglomerate represents an excellent thermal insulant, thus preventing the sudden variations in temperature to which this system is subject, while providing stability for water-proofing since its lack of capillarity means it does not absorb water.

Pure expanded agglomerate is used for roofs where reducing weight results in imposition (roofs with resistant metallic structures), requiring use of self-protected water-proofing membranes, and moreover if they show signs of the aforementioned advantages in comparison with other thermal insulants.

On accessible terraces, the features favorable to acoustic insulation and insulation from percussive noises (people circulating, objects falling) that pure expanded agglomerate presents can also be used to great advantage (see attachment – Product sheet 2).

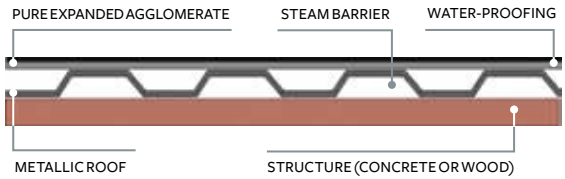


Image 3 – Use of pure expanded agglomerate in flat roof insulation

3.3 - Façade Insulation

The transfer of energy between the inside and the outside is a determining factor in a building's energy performance, regardless of the temperature control system that is used. The first decision is in choosing building solutions for the outside covering that are appropriate for the local climate.

In order to reduce thermal insulation problems in buildings, many European countries have developed insulation systems for application on façade exteriors, whether in retrofitting buildings, where the vertical covering has the aforementioned symptoms (signs of unsatisfactory thermal insulation, etc.), or in new constructions. These systems represent an excellent solution, both for energy conservation as well as from an overall building standpoint.

One possible solution for use on external walls is thermal insulation of simple walls using ETICS (External Thermal Insulation Composite System) adhered covering or using the façade, a continual or non-continual independent covering attached to punctual supports. Another solution is thermal insulation of double walling using insulation that totally or partially fills the insulant box.

The ETICS system presents a high-quality technical solution that is characterized by:

1. Reduced thermal bridges, which translates into a less thick thermal insulant that has the same global heat transfer coefficient;
2. Less risk of condensation;
3. Increased thermal inertia inside buildings, since most of the wall mass is found inside of the thermal insulant. As a result, thermal comfort is improved in the Winter (increasing the useful hours of sunlight) and in the Summer, due to the capacity to regulate the temperature indoors;
4. Water savings due to the reduced need to heat and cool the indoor environment through the reduced gradient of temperatures that are subject to the indoor layers of the wall;
5. Allows for thinner outdoor walls, increased living area;
6. Lowers the weight of walls and permanent loads over the structure;
7. Increased protection throughout the walls from weathering through atmospheric agents (thermal shock, liquid/water, solar radiation, etc.);
8. Improved water-proofing of walls;
9. Allows for changes to the look of façades and placement during construction without disrupting building occupants;
10. Provides a large variety of finishing solutions.

Application of the ETICS system includes the following phases:

1. Assembly of sides and pedestal profiles;
2. Glue preparation;
3. Glue application;
4. Placement of insulation, or pure expanded agglomerate in this case;
5. Reinforcement of singular points;
6. Application of the reinforced base;
7. Application of the primary layer;
8. Application of final covering

Photograph 1 – Prepared façade / insulated with cork for placement of ETICS finishing

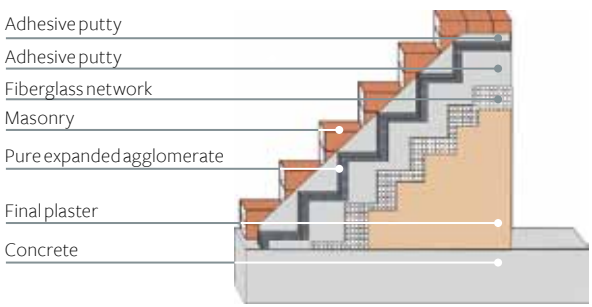
The standard size of pure expanded agglomerate sheets is 1000 x 500 mm and with a thickness of 30mm or greater (depending on the project specifications).

Sheets of pure expanded agglomerate are used by attaching them with special glue placed directly over the plaster, with or without mounts, which can be overlapped or use simple application. It can also be applied directly to structures (wood, iron, or aluminum) (image 4).

Furthermore, thermal insulation for simple exterior walls prevents thermal bridges, allowing the necessary thermal inertia in the walls to be used to maintain a more or less constant temperature indoors, regardless of season.

The use of pure expanded agglomerate sheets on the façade as an external covering is a less costly solution since thermal insulation applied to double walls uses only part of the wall's thermal inertia, requiring correction of thermal bridges and making the walls thicker, increasing the weight on the structure and the foundations (see attachment – Product sheet 3).

Image 4 – Use of pure expanded agglomerate on façades - ETICS

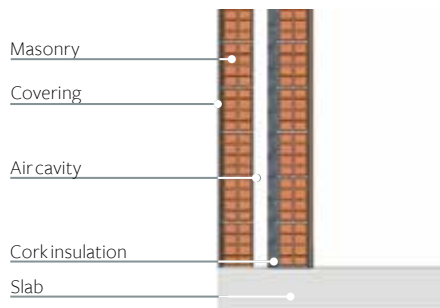


3.4 - Insulation of Indoor Walls

3.4.1 For Insulation of Walls (air cavities)

The application of pure expanded agglomerate in double wall insulation (with air cavities) offers excellent thermal insulation over a long period of time as well as excellent acoustic comfort. Double walls with air cavities are susceptible to humidity problems, which is why it is vital to create a trough at the bottom of the air cavity, over the slab, exiting to the outside, thus creating ventilation in the air cavity which, along with the barrier made by the pure expanded agglomerate, eliminates humidity problems (image 5 and 6).

Image 5 – Use of pure expanded agglomerate in wall insulation (with air cavity)



In thermal insulation for double walls, sheets of pure expanded agglomerate are placed inside the intermediate wall space, totally or partially filling it.

Total filling, which is easier to perform at the construction site, puts the agglomerate at risk of coming into contact with water, which may accidently enter through the outside surface of the wall (or through condensation).

Yet, the best solution from a technical and economic point of view is to install the insulant on the outside of the inside wall, between the sheets of ICB and the outside surface, thus maintaining an air space that drains and is ventilated to the outside. One of the ways that thermal insulation can be done from the inside consists of combining sheets of ICB with sheets of gypsum board by using glue (cement glue, liquid nails, or special mortars by Mapei, Fassa Bartolo, KaraKol, etc.) or by using mechanical installation (using thermal bushings), giving it mechanical protection and making it resistant to fire (see attachment – Product sheet 4).

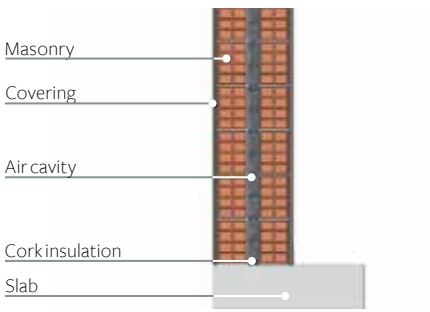


Image 6 – Use of pure expanded agglomerate in wall insulation

3.5 - Covering for Indoor Walls

Using sheets of cork agglomerate for indoor wall coverings is a current option that allows for improved conditions of thermal and acoustic comfort in any space (image 7).

The material can be supplied in 3mm thick sheets in natural state (for on-site finishing) or with varnish, wax or oil surface treatments. A sure investment in terms of design, these kinds of wall coverings can be chosen based on a wide and thorough range of looks, all of which are based on cork (see attachment – Product sheet 5).

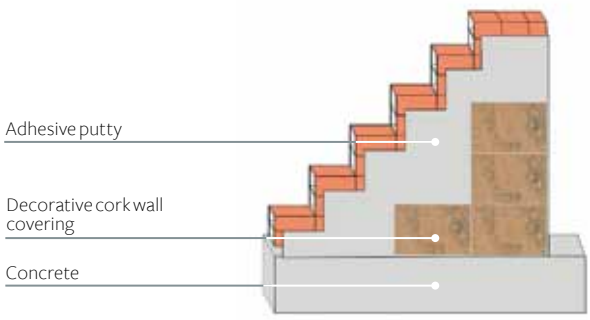


Image 7 – Use of cork for internal wall coverings

3.6 - Floors

In recent years, construction professionals have increasingly used cork in order to take advantage of its exceptional characteristics. In fact, cork floors are shock absorbent and will retain their original shape when exposed to normal compression. In addition, they reduce noise due to the natural absorption capacity of cork.

Cork floors are comfortable, natural, ecological, hygienic, durable and easy to maintain. The focus on design and on the use of the most advanced technologies in the preparation and treatment of surfaces has allowed for a wide variety of available textures, colors and shapes that follow the trends in fashion.

Using cork by itself or in combination with other materials such as wood, vinyl, and leather provides a wide range of elegant and sophisticated looks that allow for the most varied environments to be created, enriched by the unique qualities of cork.

However, to obtain satisfactory results it is necessary to understand the types of cork flooring available including:

FLOATING | **GLUE-DOWN**

Both are available in natural state (for on-site finishing) or with varnish, wax or oil finishes.

03.

3.6.1 - FLOATING FLOORING

Floating cork floors are made up of decorative layer, an agglomerate cork layer, an intermediate layer of HDF (an agglomerate of high-density wood fibers) and a lower layer of agglomerated cork. The panels, which may have thicknesses varying from 10 to 12 mm, are cut to size and the edges are milled to a profile that allows for the mechanical interlocking of the panels without the use of glue. This type of pavement is applied directly on the floor, without being glued, hence the name "floating".

This product's biggest advantage is its easy installation and the fact that it can be used over existing floors (see attachment – Product sheet 6).

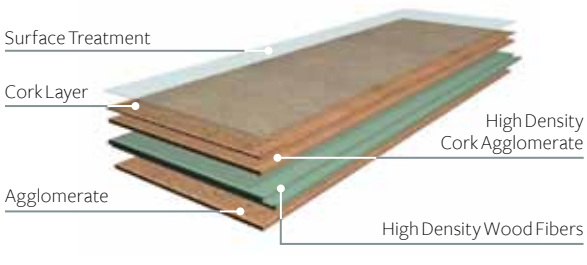


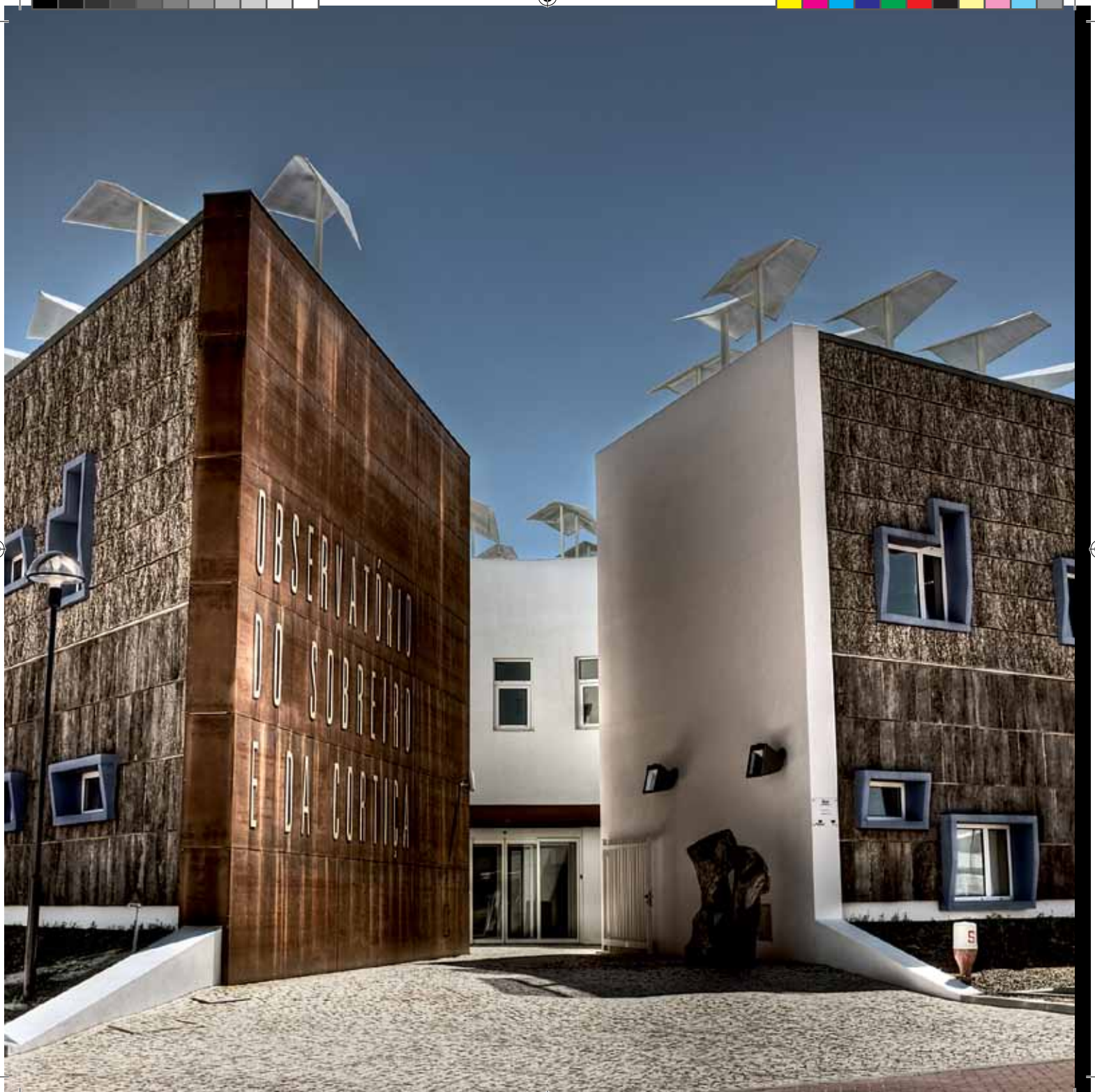
Image 8 – Composition of a floating cork panel

3.6.2 - GLUE-DOWN CORK FLOORING

Cork floors that are meant to be glued-down are composed of a single sheet (dense) of high-density agglomerated cork or a decorative sheet of high density agglomerated cork. The sheets are cut into tiles of various sizes (600 x 300mm being the most common, but also 300 x 300mm) and different thicknesses ranging from 3.2 mm to 6 mm.

Tiles are usually also supplied with a surface treatment that makes them resistant to use.
When installing this glue-down system, the subfloor should be level and waterproofed (see attachment – Product sheet 7).

Image 9 – Composition of a glue-down cork panel


OBSERVATÓRIO
DO SOBREIRO
E DA CORTIÇA

Observatory Cork Oak and Cork | 2001

04. REFERENCE PROJECTS.

Cork and its use in construction have increasingly captivated architects who have used it as a choice and a reference when in retrofitting buildings or creating new projects. Here are a few examples.

4.1 - Portugal Pavilion in Hannover Expo 2000

Location - Coimbra - Portugal

Designed by - Architects Álvaro Siza Vieira and Eduardo Souto de Moura

Project - The Pavilion is an exhibition space that was conceptualized for Expo 2000 in Hannover, Germany. Today, it is located in Coimbra and is used for cultural activities such as exhibits and concerts sponsored by the Coimbra City Council.

Use of cork - Sheets of pure expanded agglomerate (reference MDFACHADA) and high-density cork (around 160 kg/m3) sheets, are used as external coverings on some of the façades that make up the building. The architects' aim was to apply the black agglomerate in a visible manner for the first time.

4.2 - Quinta do Portal Warehouse

Location - Sabrosa - Portugal

Designed by - Architect Álvaro Siza Vieira

Project - The Quinta do Portal, built in the Pinhão River valley, joins tradition with innovation. It is where internationally award-winning wines are produced and is special to the Douro area as a sophisticated warehouse for aging. The project was developed with the aim of including a cellar, store, and auditorium in just one space.

Use of cork - The external covering materials chosen by the architect served to integrate the building into the landscape. Among the coverings used in the construction of this building, the stone (schist) on the lower part and the pure expanded agglomerate (reference MDFACHADA) above it and following the entire façade stand out.

04.

4.3 - Portugal Pavilion in Shanghai, China 2010

Location - Shanghai – China

Designed by - Architect Carlos Couto

Project - The Portugal Pavilion is an edgy prism shape that is divided into three interior zones: protocol room, business center, and the technical area. Its theme: "Portugal, a square for the world, Portugal, energies for the world."

Use of cork - The Portugal Pavilion in Shanghai used pure expanded agglomerate (reference MDFACHADA) as a covering material on all of the building's façades.

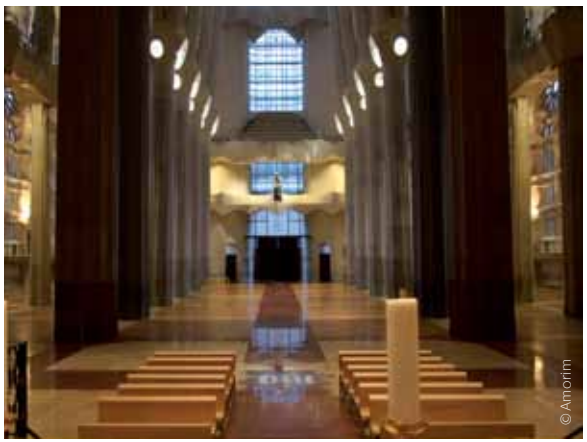
4.4 - Sagrada Familia

Location - Barcelona – Spain

Designed by - Architect Jordi Bonet i Armengol

Project - It is Barcelona's most famous calling card and one of the most visited monuments in the whole world, receiving millions of tourists every year. The Sagrada Família, created by Catalan architect Gaudí and considered by many to be his master work, is a Catholic temple of impressive grandiosity whose architecture amazes anyone who sees it.

Use of cork - Cork flooring as a covering material chosen by the architect. In addition to the features that make it comfortable and visually appealing to visitors, cork's capacity for acoustic absorption was a determining factor in its selection as a flooring option, a very important feature in a project of this kind.



4.5 - Matrix, Vision 450

Location - South Africa

Designed by - Matrix Yachts

Project - This project of the interior transformation of a top-of-the-line luxury yacht was designed based on the most advanced and demanding construction standards. The exceptionally spacious and sophisticated interior reveals luxurious details and the best in finishings.

Use of cork - The cork flooring was selected in response to the needs of a market segment that is extremely demanding in terms of both aesthetics and technical performance levels.

4.6 - Green House Hotel

Location - Cape Town, South Africa

Designed by - M&B Architects&Interiors

Project - The Hollow on The Square, M&B House is the first "green hotel" to open in Cape Town, South Africa. Created by M&B Architects&Interiors, it is based on the principles of eco-efficiency. All of its decorative materials reflect inspiration from natural elements and make the space extremely comfortable and welcoming.

Use of cork - As a covering, cork flooring was used in the corridors on 3 floors, in the elevator, in the north-facing rooms on the 2nd and 3rd floors and in 10 rooms on the 1st floor.

04.

4.7 - Nezu Museum

Location - Tokyo - Japan

Designed by - Architect Kuma Kengo

Project - After being closed for several years and now under the authority of Japanese architect Kuma Kengo, the new museum is inspired by the concept of traditional Japanese harmony; an effect gained by selecting materials developed in balance with Nature. Thus, in the museum entrance and central hall, large windows open onto the magnificent outdoor gardens and inundate the space with light.

Use of cork - The addition of cork flooring gave this space its desired distinction while providing acoustic comfort and an idealized look.

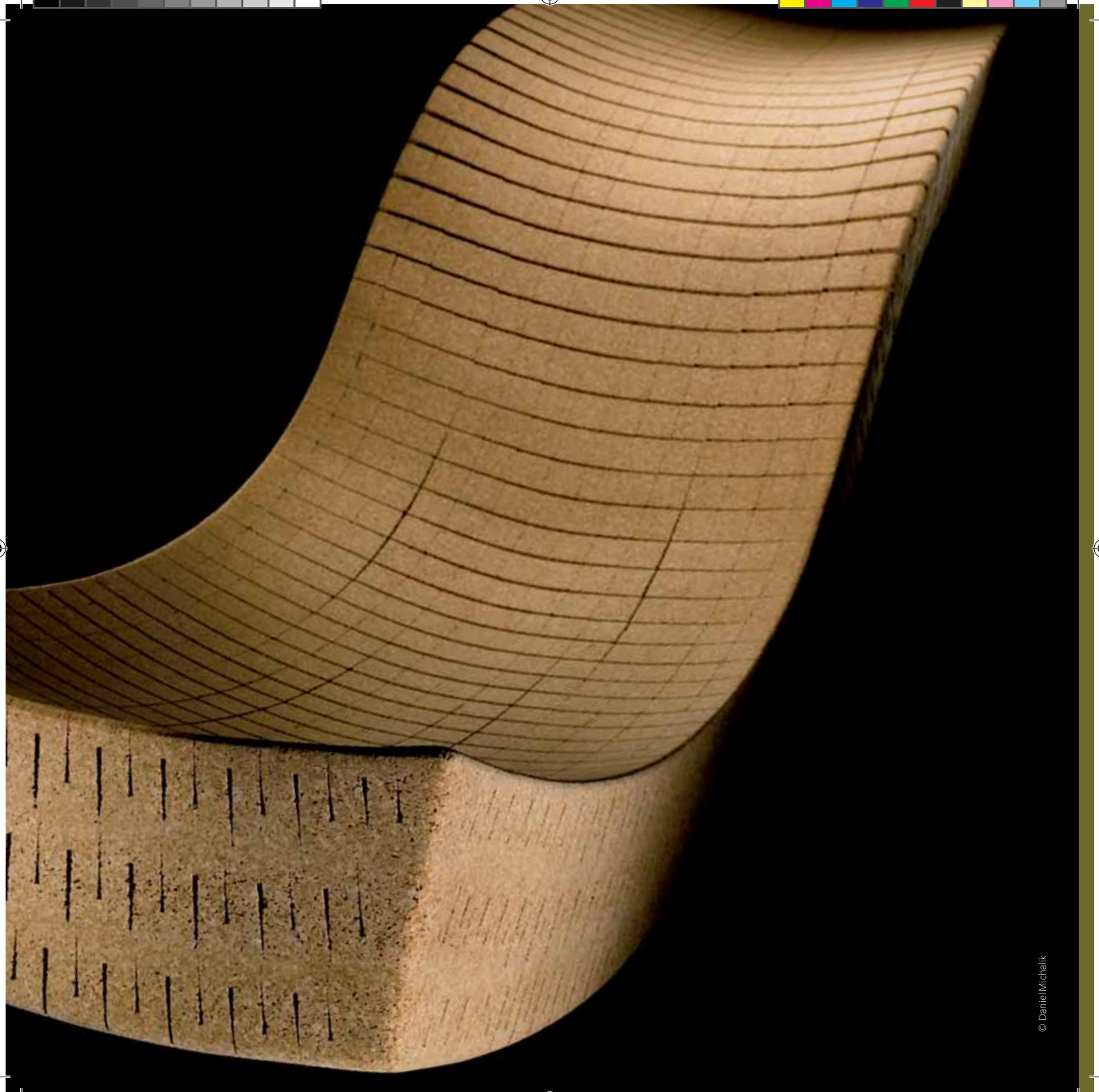
4.8 - Aveda Frederic's Institute

Location - Indianapolis - USA

Designed by - Aveda Frederic's Institute

Project - By taking on the role of a "green and environmentally friendly" building, this renowned institute of cosmetology, arts and sciences education made a point of using recycled or recyclable materials while keeping technical performance in mind.

Use of cork - Highly resistant to scratches, stains, and other problems resulting from intensive use as well as an environmentally friendly, aesthetically attractive, durable, and practical solution in application and maintenance, cork flooring fit in perfectly with the spirit of Aveda Frederic's Institute.


© Daniel Michalik

Although 90 percent of cork is used in the cork stopper and construction materials industries, the use of this raw material does not stop there. It is increasingly common to find it used in decorative and design items that beautify spaces, in garments and goods that are shown on the runways, and in the aerospace, automobile and pharmaceutical industry. Cork continues to be a subject of great discoveries and new uses.

There is a world to discover that fascinates investigators, scientists, architects, and designers.

05. TRENDS AND OTHER USES FOR CORK.

5.1 - Other Uses

5.1.1.ACOUSTIC AND VIBRATION INSULATION FOR MACHINERY

Regarding cork agglomerate for machinery, there are two general methods of application that are both ideal solutions for issues of minor vibration in machinery.

In the first, the foundation's volume is covered in concrete; next, sheets of cork with sufficient density and thickness are placed and applied using hot pitch. Waterproof paper is also applied on top of the cork using hot pitch.

In the second method, sheets of cork are applied directly between the machine bench and the floor or foundation to which it is connected.

There are countless machines that require insulation against vibration, including: compressors, elevators with motors, hydraulic presses, looms, turbines, vises, generators, and engines.

5.1.2 - AUTOMOTIVE INDUSTRY

Although cork is already used in the automobile industry in joints (cylinder head, gearbox, etc.) and on floors in public transport vehicles, cork products have been studied for use inside automobiles, for stickers, on hand brake handles and gear shifts, for covering the steering wheel and dashboard and so on. One example of its innovative use in the automotive industry is in the F700 model from Mercedes Benz.

5.1.3 - CORK POWDER

Cork powder is the residue produced in the cork industry, which comes from grinding and milling cork. The powder is mostly used as a co-generator of the energy that feeds the factories. Cork powder can also be used in many applications, such as a cleaning product for parts, statues, and façades exposed to environmental pollution.

5.1.4 - AEROSPACE INDUSTRY

A type of granule used in NASA rockets is made of cork. This material is used in the boosters and acts as an insulating agent against high temperatures.

5.1.5 - CONDUITS

Cork can also be used to cover conduits. Its use neutralizes the two main enemies of refrigerator installations, heat and humidity, and prevents them from penetrating and allows for complete waterproofing of the installation.

5.1.6 - SOLVENTS

One waste product from manufacturing pure expanded agglomerate is steam condensation from boiling cork. This can be used in its raw form to prepare solutions as well as in solvents that are applied to wood, granting it greater dimensional stability, greater resistance to fungal growth, and providing interesting colorants for certain uses (i.e. furniture). It can also be used in applications to protect tree stumps and trees.

5.1.7 - PHARMACEUTICAL INDUSTRY

Cork residue can also be used as a very important raw material in obtaining fine chemical and pharmaceutical industry products. After it is purified and chemically separated, compounds are obtained with various uses, among which is as a vaccine adjuvant. There are even studies on anti-cancer treatments and as an insect repellent.

5.1.8 - DESIGN

By embracing ecological and natural materials more often, architects, designers and decorators have been rediscovering cork, enabling them to come up with a variety of decorative products with different textures, tones, and colors, opening up a range of options for creating new environments.

Design, style, trendiness and image are key attributes in creating added value for a material with a centuries-old tradition.

The challenge is to creatively add value to cork in areas as diverse as furnishings, decoration, kitchen utensils, textiles, shoes, Hi-Tech accessories, toys, and many other things.

06. TECHNICAL PRODUCT SHEETS

SHEET FOR PRODUCT 1 Insulation for inclined roofs

Density **100/ 120Kg/m³**	Heat transfer coefficient **0,037/0,040 W/mK**	**Dimensional stability**	**Good resistance to compression (flexible)**
Does not absorb water through capillarity	**Use in inclined roofs**	Thickness* **30 mm or superior** (as specified in the project)	Size (mm) **1000 x 500 mm** Considering the standard size

APPLICATION As a primary layer, placement of locking teeth and application of bricks to lock in the shingles. Second stage: waterproofing – application of plastic to protect the roof. Next stage, insulation with application of sheets of expanded cork agglomerate and, as a finalizer, finish with application of shingles/tiles.

SHEET FOR PRODUCT 2 Insulation of flat and metallic roofs

Density **100/ 120Kg/m³**	Heat transfer coefficient **0,037/0,040 W/mK**	**Dimensional stability**	**Good resistance to compression (flexible)**
Does not absorb water through capillarity	**Use on flat Roofs**	Thickness* **30 mm or superior** (as specified in the project)	Size (mm) **1000 x 500 mm** Considering the standard size

APPLICATION The expanded cork agglomerate is applied, considering the steam barrier space, under the metallic covering followed by a waterproofing product.

* - The thicknesses (mm) will depend on the heat transfer coefficient that the environment needs.

SHEET FOR PRODUCT 3 Façade Insulation – ETICS System

K value for different thicknesses

30 mm thickness **1.0989** | 40 mm thickness **0.8620** | 50 mm thickness **0.7090**

K WITH INSULATION AGGLOMERATE THICKNESS

WALL CHARACTERISTIC			S= 3 CM	S= 4 CM	S= 5 CM
Ordinary Concrete	Thickness: 25cm	Dens. 2,2 t/mc λ = 1.28 W/m °C	0.85	0.69	0.59
Type "S" bricks	Thickness: 25cm	λ = 0.410 W/m °C	0.63	0.34	0.47
Full bricks	Thickness: 25cm	λ = 0.93 W/m °C	0.80	0.66	0.56
Duble wood (Air space)	Thickness: 25cm	C = 4.25W/m °C	0.62	0.53	0.47
Industrial sheet	Thickness: 25cm	C = 0.73 W/m °C	0.65	0.56	0.49

λ = thermal conductivity coefficient | K = heat transfer coefficient | C = (I/C= K) conduction

Application on façade insulation – ETICS System

Thickness

(20 a 50 mm) ± 1mm* **(55 a 160 mm) ± 2mm***

*Tolerance of the measures

Size (mm)

1000±5mm* **500±3mm***

Considering the standard size

*Tolerance of the measures

06.

APPLICATION Start by assembling foundation and side profiles, and then apply glue followed by insulation, which in this case is pure expanded agglomerate. This is followed by application of reinforced base (fiberglass -150/220 kg), the primary layer and, finally, application of the final covering.

USE External building walls.

SHEET FOR PRODUCT 4 Double wall (air cavity) insulation

Density **100/ 120Kg/m³**	Heat transfer coefficient **0,037/0,040 W/mK**	**Dimensional stability**	**Good resistance to compression (flexible)**
Does not absorb water through capillarity	Thickness* **30 mm or superior** (as specified in the project) *Thicknesses (mm) will depend on the thermal resistance and the heat transfer coefficient required by the environment.		Size (mm) **1000 x 500 mm**

APPLICATION The double wall is made up of: masonry (or concrete) wall, cork agglomerate, mechanical attachment, adhesive putty, and final plaster. The cork agglomerate is attached by using glues (cement glue or liquid nails or special mortars) or through mechanical attachment using so-called thermal bushings.

USE Dividers or internal walls made of concrete, brick or other materials.

06.

SHEET FOR PRODUCT 5 Use as a decoration for indoor walls

Thickness **3mm**

Sizes (mm) **300x300 / 600x300**

The dimensions vary according to the manufacturer.

FINISHES Wax, oil, varnish, or in a natural state (for on-site finishing)

USE As a decorative material for indoor walls in homes, restaurants, bars, hotels, etc.

SHEET FOR PRODUCT 6 Floating floor

Thickness **10 to 12 mm**

Sizes (mm) **900x300**

The dimensions vary according to the manufacturer.

FINISHES Oil, varnish, wax, vinyl, or in a natural state (for on-site finishing) | **APPLICATION** According to manufacturer instructions

SHEET FOR PRODUCT 7 Attached floor

Thickness **3,2 to 6 mm**

Standard Dimensions (mm) (for finishing work) **600x300 / 600x450 / 300x300**

The dimensions vary according to the manufacturer.

FINISHES Oil, varnish, wax, vinyl, or in a natural state (for on-site finishing)

07.
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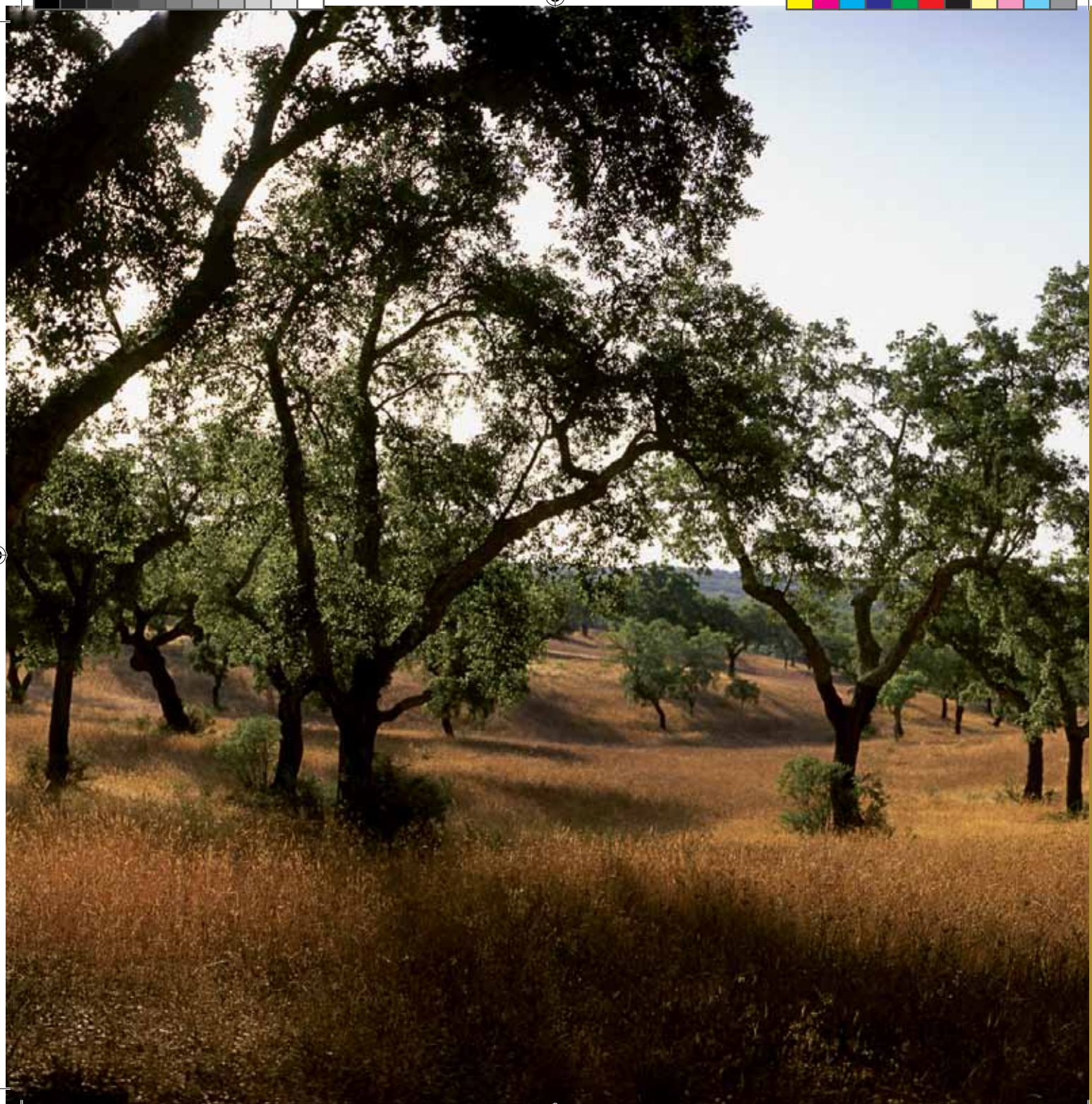

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The mission of the Portuguese Cork Association is to represent and promote the Portuguese Cork Industry and products made using cork. It has 250 member companies that are responsible for around 80% of the nation's total production and 85% of Portuguese cork exports.

APCOR works to ensure that its members adopt the best internationally recognized production practices to produce high quality cork stoppers for the wine industry and its consumers.

APCOR is responsible for developing promotional and value-adding activities for cork by carrying out initiatives that are domestic and international in character, moreover providing an information center as well as technical services to its members.

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