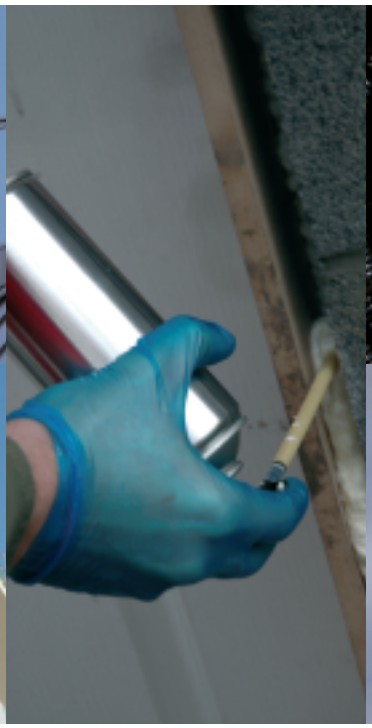
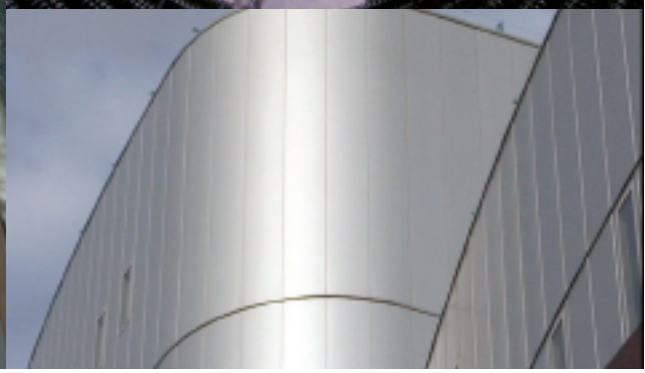
HUNTSMAN

Enriching lives through innovation

Polyurethanes

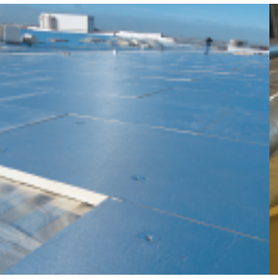
Insulation for construction

Polyurethanes

making a difference in construction



The versatility of polyurethane foam makes it suitable for an extensive range of insulation applications. Up to 1,5 million tonnes of rigid foam is used each year in products for residential housing, retail stores, commercial offices, factories, warehouses, power stations, cold stores, food processing plants, telecom shelters and public institutions such as schools and hospitals.

Polyurethanes are a sustainable material delivering real benefits to society faced by climate change. Their use as energy efficient insulating products in building and construction contributes to easing the problem of global warming.

The most popular applications of polyurethane foam-based insulation are:

- **Composite Panels —** factory engineered exterior panels manufactured with metal skins containing polyurethane foam insulant. Used for roofing and wall cladding.
- **Insulation Board and Block —** two distinct products offering similar benefits. Insulation board is polyurethane foam laminated and can be faced with a wide variety of materials, including paper, aluminium, cork, bitumen, glass fleece, plasterboard and fiberboard. Block is polyurethane foam which can be cut and shaped to the required dimensions. Both are used for a broad range of insulation including cavity walls, flooring and roofing applications.
- **Technical Insulation —** a Huntsman term used to categorise a wide range of insulation applications, including discontinuous panels, water heaters, boilers and refrigeration systems, one component foam and mining.
- **Pipe Insulation —** polyurethane foam used to insulate and protect heating and plumbing services within large diameter pipe systems. Typically used in municipal heating and offshore oil and gas pipelines.

Features and benefits

of polyurethane foam insulation

Rigid polyurethane foam offers the specifier a versatile material with a compelling combination of physical strengths and mechanical properties. These qualities allow it to be used in many multi-functional building products where the need for insulation is combined with load bearing, impact resistance, sealing, weight and space saving, low maintenance and longevity.

Low Thermal Conductivity

Rigid polyurethane foam is widely known for its excellent thermal conductivity rating, which is among the lowest of any insulating material. This ensures efficient heat retention or alternatively, consistent temperature control of refrigerated or frozen environments. About half the energy used in the life of a building is for heating and cooling, so effective insulation is a major priority.

If all buildings were effectively insulated, global energy consumption could be cut by 20 per cent. In European Union countries alone this could save around 450 million tonnes of carbon dioxide emissions each year. Sound energy management contributes to conservation of non-renewable fossil fuels and a reduction in the speed of global warming.

Strength

High levels of both shear and compression strength are achieved with rigid polyurethane. These values can be further enhanced by bonding to facing materials such as metal or plasterboard.

Processability

Rigid polyurethane foam is the only insulant that can be processed under continuous block or batch factory production or by on-site mixing for spray and injection application.

Adhesion

During the curing stage, rigid polyurethane foam is highly adhesive, allowing it to bond with many building facing materials. Bond strength is often higher than the tensile or shear strength of the foam.

Compatibility

The majority of popular building facings including paper, glass fibre, aluminium, plywood, plasterboard, bitumen and foil are all compatible with rigid polyurethane foam. The many combinations available add to the inherent strength of the foam, allowing use in semi-structural panels and cladding. Cosmetic finishes such as paint and plaster can also be applied, equipping the product to operate effectively as a moisture barrier in high humidity environments.

In-situ stability

Extreme temperature ranges of —200 degrees C to +100 degrees C can be tolerated by rigid polyurethane based foam products.

Water vapor transmission

Rigid polyurethane foam has low water vapor permeability. Polyurethane foam products with a facing such as aluminium foil or polyethylene film, will have the water vapour permeability of these facings.

Fire performance

Like all organic building materials (wood, paper, plastics, paints etc.), rigid polyurethane foam is combustible, although its ignitability and rate of burning can be modified to suit a variety of building applications. The overall fire performance of a composite panel can be significantly enhanced by the facing material e.g. steel.
The best fire properties can be obtained by using a polyisocyanurate (PIR) foam. Rigid polyurethane foams are usually used at lower thicknesses than other insulants, so that their heat or fuel contribution to a fire is low compared to other, thicker insulating materials.

Lightness

At low densities of say 30 kg/m^3, rigid polyurethane foam is made up of 97% gas trapped in cells and just 3% polyurethane polymer. The lightness of the material is a bonus in reduced transportation costs and easy on-site handling and installation.

Chemical resistance

Rigid polyurethane foam provides excellent resistance to many common chemicals, solvents and oils.

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Economy and environment

The choice of rigid polyurethane foam as a building solution supports important economic and environmental considerations

Economically rigid polyurethane foam is:

- extremely light compared to alternative materials, reducing transportation costs and on-site handling and installation time
- easy to erect and install; saving time, reducing labour costs and making Health & Safety regulations easier to meet
- consistent factory quality; meaning fewer technical defects than site produced or assembled systems
- low maintenance; for reduced running and repair costs for building owners.

From an environmental perspective, rigid polyurethane foam offers:

- outstanding thermal insulation; reducing heating and cooling costs for the lifetime of a building
- long-life applications; maximising natural resources used in its manufacture
- a significant contribution to reduced emission of greenhouse gases; in production, transportation and installation
- reclaimable and recyclable materials, with inherent energy value.

Composite panels

Composite panels are factory engineered exterior panels used for a wide range of non-residential buildings. Applications include cladding, partitioning, load bearing walls and roofing elements.

Panels are manufactured on a continuous lamination basis with metal facings — usually steel or aluminium — encapsulating a foamed polyurethane core. The thickness of the polyurethane foam can range from 30mm to 200mm depending upon application and required insulation characteristics.

These versatile products are also known as sandwich panels due to the physical interaction of the two materials. This composition offers a high degree of stability, rigidity and excellent load bearing capacity.

Working with Composite Panels

The growth in use of composite panels has been driven by the construction industry s need for a lightweight panel with good thermal insulation qualities and simple on-site installation.

This requirement has been assisted by the technical development of rigid polyurethane foams offering very high insulation values, especially compared to site-assembled systems.

The ease of mounting composite panels to the building substructure is another major factor in the popularity of this product. Building times are significantly reduced compared to traditional methods, with spin off savings in labour costs.

Composite panels offer architects and specifiers an exciting dimension in the planning, costing and design of new and re-furbished buildings.

There is a wide and attractive choice of surface finishes available, both in terms of colour and metallic coatings. Hidden joints, combination options with other materials and foamed mouldings for roofs and walls enable buildings of striking architectural value and appearance to be created.

Features and benefits of composite panels

Feature	Construction benefit
● **single manufactured unit**	● fast on-site erection = labor cost savings ● allows fast project completion ● minimises on-site impact on product quality
● **high insulation value at low panel thickness**	● reduced energy costs for life of building ● dimensional space savings ● greater saleable/leasable building area
● **structural value** ● **combined air/water barrier**	● long span, high load construction performance ● material cost savings ● ease of construction
● **removable panels**	● design/refurbishment flexibility
● **low maintenance**	● low whole-life costs for building owner/tenant
● **surface treatments: texture and profiling**	● design/appearance flexibility

Versatile Applications

The versatility of Composite Panels means they are increasingly widely used across many construction and renovation projects. The following list of popular applications includes specifications for Composite Panels as load bearing roof panels, wall cladding and partitioning:

- **administration centres**
- **logistics centres**
- **retail stores**
- **hospitals**
- **deep-freeze stores**
- **airports**
- **residential care homes**
- **cold stores**
- **waste incineration plants**
- **hotels**
- **recycling facilities**
- **power plants**
- **workshops**
- **schools**
- **climate-controlled rooms**
- **exhibition centres**
- **warehouses**
- **sports centres**
- **telecom shelters**

Insulation board and block

Versatile Applications

The versatility of Insulation Board and Block means it is used in many roofing, flooring and cavity wall applications. Typical examples include:

Flat roofs
An industry standard for use beneath partially bonded built-up felt on flat roofs

Pitched roofs
Highly effective insulation beneath tiled or slated pitch roofs, creating an average 15% more usable roof space

Cavity walls
Widely specified insulation for partial fill cavity walls, providing high insulation performance

Internal walls — dry lining
Combination insulation with plasterboard, providing an insulation barrier and ready-to-decorate surface in one

Flooring insulation
Excellent insulant against heat loss from a ground floor, whether of solid concrete or suspended timber construction

Insulation performance of polyurethane foam

Thickness (mm)	60	80	100	120	140
Lambda value (W/mK)	0.023	0.023	0.023	0.023	0.023
R-value (m^2K/W)	2.61	3.48	4.35	5.22	6.09
U-value (W/m^2K)	0.38	0.29	0.23	0.19	0.16

Huntsman is a leading producer of polyurethane systems for manufacture of rigid foam Insulation Board and Block for use in residential and commercial construction. Boards are insulating products which are laminated on both surfaces with a variety of facing materials.

Block, as the term suggests, is polyurethane foam manufactured in blocks which is cut and shaped to required dimensions. Board and Block are highly versatile insulants suitable for use in many construction tasks, including flat and pitched roofs, cavity walls, floors, internal linings, composite decks, pipes and tanks.

Over 600,000 tonnes of polyurethane board and block is used by the construction industry each year — a figure which is forecast to grow steadily due to new legislation governing energy consumption and greater awareness of the valuable role played by effective insulation. Most producers operate on a continuous production basis.

Working with Insulation board and block
Insulation Board and Block is the most widely used rigid polyurethane foam product in the construction sector. Its popularity reflects a range of qualities which make it a simple and highly effective product to work with.

The prime attribute of rigid polyurethane foam is outstanding insulation qualities, but this is also supported by a range of other practical benefits. Board and Block are extremely versatile in providing insulation for an infinite number and variety of building applications. As Board it fits neatly and unobtrusively into wall and roof cavities. It can be used in conjunction with many facing materials to add specific properties and finishes.

In Block form it is cut and shaped to fit large surfaces such as floors, or smaller areas where an insulant is required. Rigid polyurethane foam is light and simple to transport to and around building sites. It is a clean, non-hazardous material that requires no special handling, storage or specialist trade skills to work with. Equally, it is not temperature or moisture sensitive and can be fitted under most weather and climatic conditions.

Features and benefits of insulation board and block

Feature	Construction benefit
● low thermal conductivity	● excellent insulant for domestic and commercial buildings
● versatility	● suitable for use in many varied applications and with different facing materials
● good fire performance	● proven by large scale testing, particularly compared to alternative insulants
● ease of use/installation	● light, clean, simple to install as board or cut in block applications
● longevity	● majority of installations will retain thermal qualities for at least 50 years

Technical insulation

Technical Insulation is a Huntsman term used to define a diverse range of rigid polyurethane foam applications covering many low volume, discontinuous products. Although fragmented it is a major market for polyurethane foam.

Typical applications for Technical Insulation products include discontinuous panels, water heaters, cool boxes, reefers, refrigerated transport, commercial display units, pipe insulation, one component foam and mining.

Energy performance is the critical factor for specifiers and this is usually measured on the final product by energy usage or heat leakage analysis. Achievement of these targets can be attained by the use of different blowing agent technologies, which produce specific performance characteristics in rigid polyurethane foam.

Huntsman is a significant supplier to this market, both in terms of direct supply and through its close association with nominated Systems Houses. By taking a focussed view of the Technical Insulation market Huntsman is able to offer high technology, leading edge solutions to its customers.

The cold chain: from harvesting the crops in the field to serving the meal at the table, polyurethane foam insulation plays a critical role in ensuring that the food we eat is stored, transported and prepared at the correct temperatures

Hot Insulation

One of the most important insulation tasks is in the production and storage of hot water, which requires less energy when stored in appropriately insulated boilers. This can be achieved by injecting rigid foam into the double metal mantle or spraying directly onto the exterior of the boiler. Hot water used for municipal heating systems or industrial use can be protected against energy loss by using polyurethane foam pipe insulation.

Cold Insulation

Insulation to assist chilling and refrigeration of foodstuffs throughout the supply chain is a primary function of rigid polyurethane foam in the Technical Insulation sector. In food transport and delivery vehicles discontinuous panels allow the correct temperature controlled environment to be achieved. Similar products, but on a larger scale, are used in the construction of cold store factories, processing plants and warehouses. At retail point of sale chilled and refrigerated display units featuring polyurethane foam are present in virtually every food store in the developed world.

One Component Foam (OCF)

OCF is a self-expanding, self-adhesive moisture-curing gap filler with the main advantages being its portability and ease of application. OCF is supplied to the building and DIY industries in pressurised cans.

Mining

A niche application for rigid polyurethane and foam used to assist rock consolidation in mining works.

Features and benefits of technical insulation

Feature	Construction benefit
● low thermal conductivity	● energy savings, suitable for hot and cold
● versatility	● multi-application products in panel, injection or spray forms
● Huntsman technology	● bespoke foams with special characteristics
● longevity	● low maintenance with long term energy savings

Pipe insulation

Rigid polyurethane foam has been used for the insulation and protection of pipes for more than 30 years.

For district heating systems, one of the largest areas of use, it is preferred in around 95 per cent of all applications. Other popular construction and engineering uses include offshore oil and gas pipelines and heating and plumbing services for power stations, chemical plants and refineries.

The main benefit of using polyurethane is as an insulant which prevents heat loss or alternatively maintains a temperature which prevents freezing or cracking. In addition it provides high mechanical strength, flexibility and good flowability properties, important when filling long pipe sections.

There are several methods and techniques by which foam can be applied. These can broadly be split between factory applied and in-situ application. In most cases, factory applied is preferred as it can be produced by continuous or discontinuous methods and is not dependant on favourable weather conditions.

Another distinction is between foam which is introduced into the cavity between the service pipe and the outer casing, and spray or pour applications which cover the exterior of the pipe with a layer of insulating foam.

Polyurethane foam is suitable for applications ranging from 10mm diameter plumbing pipes, up to the largest district heating pipes with 2,000mm diameters and 250mm of insulation thickness.

Features and benefits of Polyurethane pipe insulation

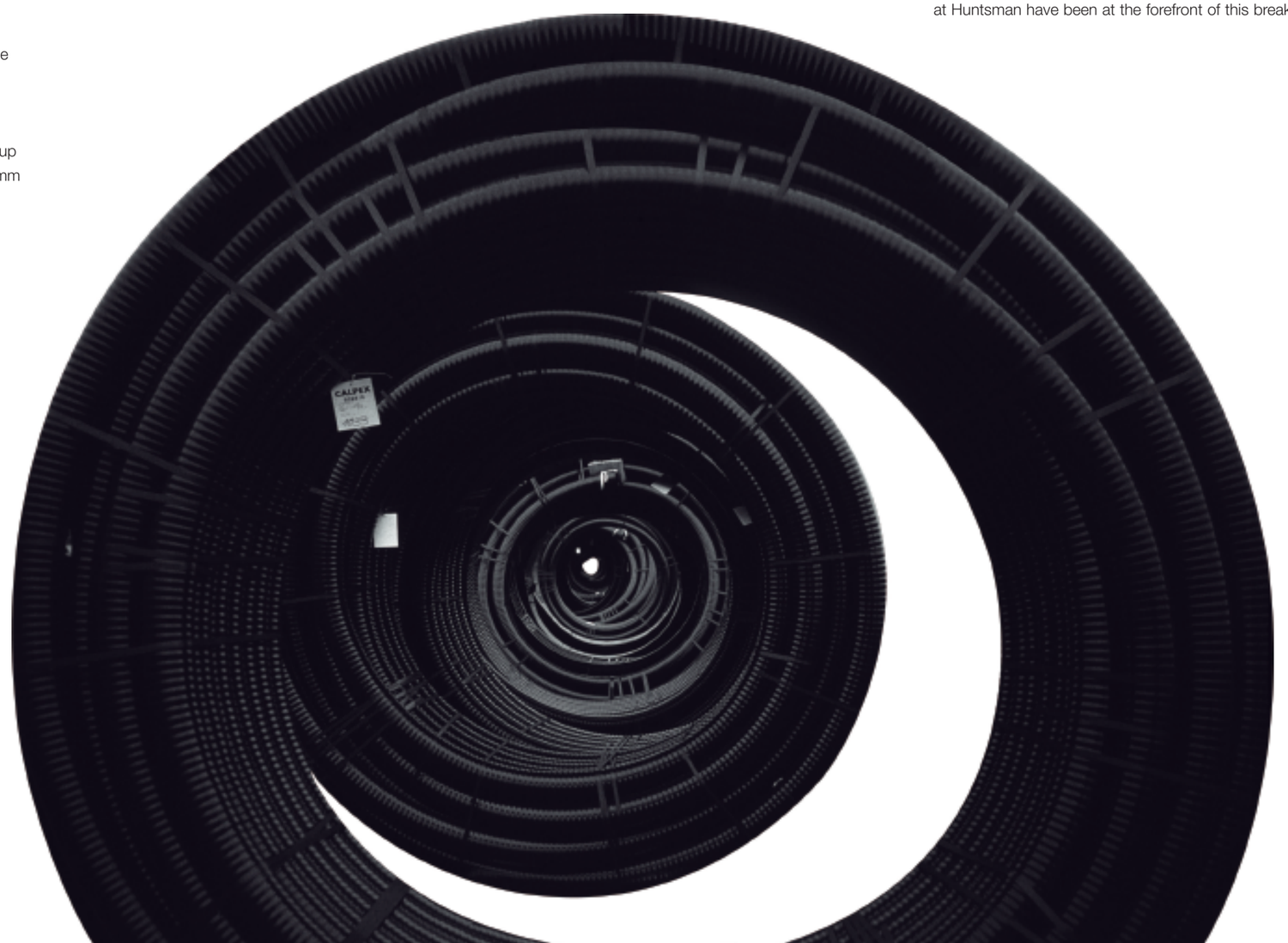
Feature	Construction benefit
● **low thermal conductivity**	● prevents heat loss/insulates against freezing
● **suited to wide temperature range**	● -180˚C to +150˚C
● **high flexibility**	● ease of handling/installation
● **factory manufactured or in-situ**	● production versatility to suit application
● **compatibility with pipe materials**	● works with steel, PE, PP, PVC or HDPE
● **exclusive Huntsman systems**	● combine flexibility with thermal resistance
● **longevity**	● low maintenance/long replacement cycle

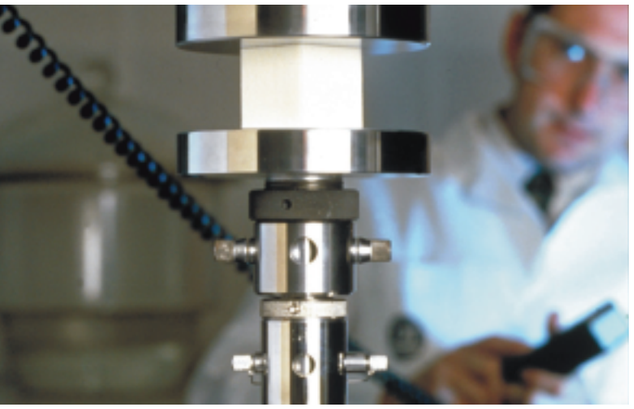
Working with Pipe insulation

Huntsman is an innovator in the development of flexible pipe technology, a product popular with contractors because of its ease of handling. Installation is simpler than with rigid products, as obstacles can be bypassed by bending the pipe.

After production, pipe is usually coiled and then laid in continuous lengths of several hundred metres, reducing the labour and cost of numerous joints and fixings. A further practical benefit is that the trench profile for flexible pipes is often narrower, resulting in lower plant and excavation costs.

Achieving this combination of high flexibility and excellent thermal resistance has required materials engineers to overcome the problem of combining the inherently different chemical structures needed to produce each property. Experts at Huntsman have been at the forefront of this breakthrough.





Commitment to the polyurethane insulation industry

Huntsman has been a long term supplier and partner to the international polyurethane insulation industry for more than 45 years. The company s researchers and foam technologists work constantly to develop and refine foam systems to meet the needs of specifiers and engineers working with polyurethane based products.

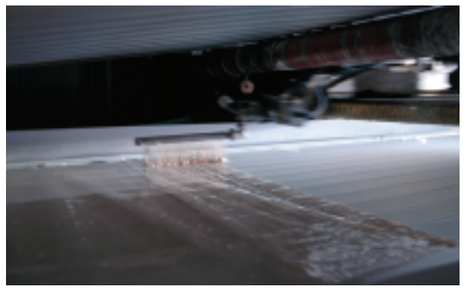
Innovation and technical support

Typifying this commitment are three dedicated Huntsman centres of excellence for foam technology. The Technical Center in Ternate, near Milan serves customers in Europe, Africa, Middle East and Indian sub-continent. Woodlands in the USA supplies the Americas, while Singapore covers the needs of customers in the Asia/Pacific region.

Regional Technical Centers are supported by an international network of Technical Service Centres which offer comprehensive support to customers.

Technical Service teams are available to help with selection of the most appropriate chemical systems, processes and product performance. Centres can also offer demonstrations and testing resources.

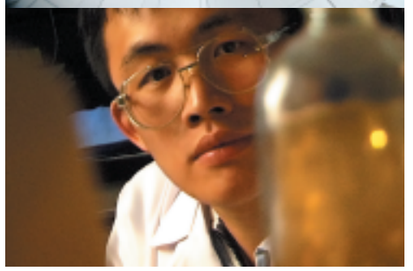
This structure of Regional and Technical centres provides customers in the construction industry direct access to the extensive resources of the Huntsman group of companies. This encourages close, long term working relationships to be established, with the shared goal of innovative new product development and worldwide service support.



Market extension and industry participation

Our market knowledge and expertise in sustainable construction, life cycle analysis, fire safety in buildings, makes Huntsman a recognized leader in driving market extension.

Huntsman takes an active role in polyurethane-related industry groups, reflecting our commitment to the industry.



Product Stewardship

The product stewardship process in place at Huntsman adds value to our products by minimizing the risk of harm to mankind and the environment. We assess our products at every stage in their life cycle, from the sourcing of raw materials, through manufacture and use, to eventual disposal. This involves us working very closely with our customers, suppliers and others in the supply chain to ensure that everybody understands the EHS issues related to our chemicals and to the polyurethanes products that are made.

BING

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GALILEO™ Kreatives Bauen mit Sandwich

EPIC ENGINEERED PANELS IN CONSTRUCTION

EuroACE The European Alliance of Companies for Energy Efficiency in Buildings

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