The Inverted Roof Concept with

ISOFOAM

ISOBOARD®

FOR HOT & COLD CLIMATES

ISOBOARD®

WE CARE ABOUT QUALITY

ISOFOAM
Insulating Materials Plants W.L.L.

ايسوفوم
مصانع المواد العازلة للحرارة والتبريد ش.م.ك.

ISO 9001
BUREAU VERITAS Certification
Cert. No. IND13.4508U/Q

UKAS MANAGEMENT SYSTEM
008

DCL
PRODUCT CONFORMITY
ASTM C 578 - 09
Certificate No. CL05020002

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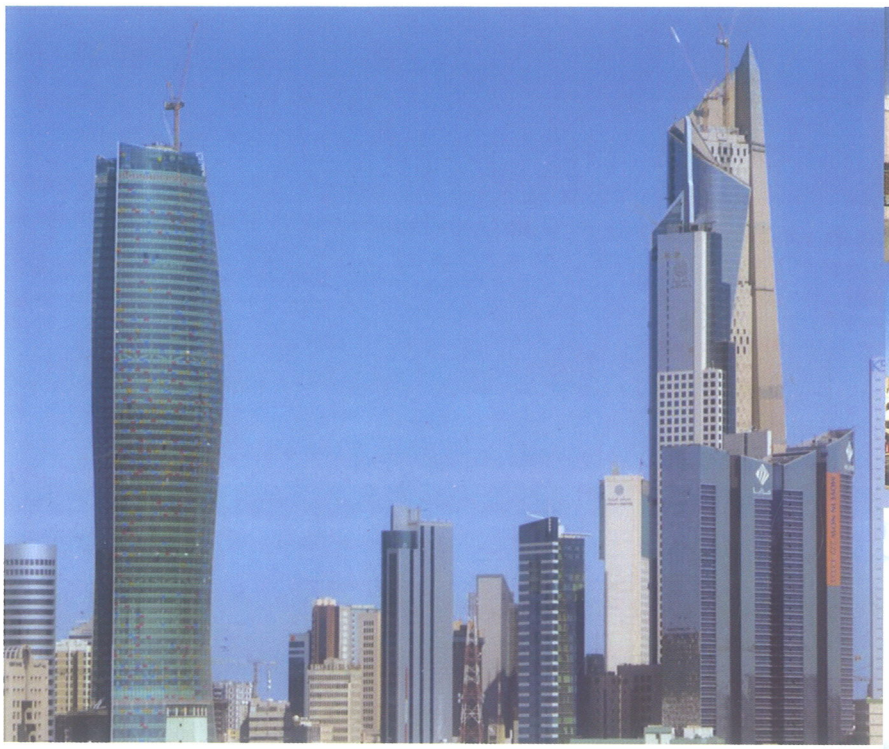
E-mail: insulations@isofoamkw.com

ISOFOAM

ISOBOARD range of products are manufactured to comply to the requirements of ASTM C-578 and BS 3837: Part 2:



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BUREAU VERITAS 1828

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The Need For Thermal Insulation

In extremely hot climates, the high energy demand for air conditioning is constantly increasing;

One of the best ways to conserve energy is to provide high class insulation for buildings.

Product Desription

ISOBOARD ISOFOAM 's extruded polystyrene, panel has sealed cells, linked to one another and is produced by a continuous, fully automated extrusion process in accordance with international specifications and standards. This particular technology makes it possible to guarantee exceptional mechanical properties, resistance to the diffusion of water vapour, resistance to water absorption, uniform density distribution, dimensional stability, very high compressive strength, aging resistance and also immunity against insects, pests, bacteria, rodent attacks, and micro organisms as it does not provide them with nutrients.

Product	Description	Major application	Board Covering dimensions (mm)
ISOBOARD LD 1/6 1=21 CW (21- 24 kg/M^3) 6=26 CW (26 - 28 kg/M^3)	Extruded polystyrene rigid foam with and without shiplap edges.	Thermal Insulation Boards for - Walls - Perimeters - Sandwich Panels	Width : 600 Length : 1250 Thickness : 40 to 100
ISOBOARD ND 32 - 35 kg/M^3	Extruded polystyrene rigid foam with skin. Available with and without shiplap edges.	Thermal Insulation Boards for - Roofs - Floors - Walls - Perimeter Insulation for underground construction and cellar outer walls.	Width : 600 Length : 1250 Thickness : 50, 60 65, 75 80, 100 : 25, 30 40 available in straight edge only.
ISOBOARD MD 38 - 42 kg/M^3	Extruded polystyrene rigid foam with dense skin. Available with and without shiplap edges.	Thermal Insulation Boards for - Roofs - Coldstore floors and walls. - Frost Protection. - Swimming pools & Ice Skating rinks. - Parking Decks	Width : 600 Length : 1250 Thickness : 25, 40, 50 60, 65 75, 80 100
ISOBOARD HD 45 - 48 kg/M^3	Extruded polystyrene rigid foam with very hard skin. Available with and without shiplap edges.	Thermal Insulation boards where high compressive strength is required. - Parking decks. - Low temperature space floors. - Thermal Insulation beneath storage tanks. - Thermal Insulation of underground storage tanks subject to high surface or earth pressures. - Floatation applications	Width : 600 Length : 1250 Thickness : 50, 75, 100

N.B. Longer Boards can be produced on special request up to 2500 mm or more. Other thicknesses are available upon request.

Specifications

ISOBOARD LD

Extruded polystyrene rigid foam, coloured blue throughout with skin on top and bottom sides, as manufactured by ISOFOAM

Material dimensions and thickness shall be according to the drawings, specifications and applicable codes of practice for the use of insulation and the material shall have the following properties:

1. During the process, the thermal conductivity lies within the range of 0.027-0.032 W/m.K (0.19 - 0.22 BTU in/sq.ft.h°F) in accordance with DIN 52612 or ASTM C-518.
2. Compressive strength of 190 KPA (27 psi) average, when tested according to ASTM D-1621 or DIN 53421.
3. Water Absorption of 1% average when tested in accordance with ASTM C-272.
4. Water vapour permeability of 1.5 perm-inch when tested in accordance with ASTM E-96.

ISOBOARD ND

Extruded polystyrene rigid foam, coloured blue throughout with skin on top and bottom sides, as manufactured by ISOFOAM

Material dimensions and thickness shall be according to the drawings, specifications and applicable codes of practice for the use of insulation and the material shall have the following properties:

1. During the process, the thermal conductivity lies within the range of 0.027 - 0.031 W/m K (0.19 - 0.21 BTU in/sq.ft.h°F) when tested at 24 °C (75°F) in accordance with DIN. 52612 or ASTM C-518.
2. Compressive strength of 280 KPA (40 psi) average, when tested according to DIN. 53421or ASTM D-1621 (Strength according to thickness).
3. Water Absorption of 1% average when tested in accordance with ASTM C-272.
4. Water vapour permeability of 1.1 perm-inch when tested in accordance with ASTM E-96.

ISOBOARD MD

Same as text for ISOBOARD ND, except better compressive strength, 400 KPA (60 psi) average.

ISOBOARD HD

Extruded polystyrene rigid foam, coloured blue throughout with skin on top and bottom sides, as manufactured by ISOFOAM

Material dimensions and thickness shall be according to the drawings, specifications and applicable codes of practice for the use of insulation and the material shall have the following properties:

1. During the process, the thermal conductivity lies within the range of '0.030 - 0.033' W/m K (0.21 - 0.23 BTU in/sq.ft.h°F) when tested at 24 °C (75°F) mean temperature in accordance with Din. 52612 or ASTM C-518.
2. Compressive strength of 570 KPA (80 psi) average, when tested according to DIN. 53421or ASTM D-1621 (Strength according to thickness).
3. Water Absorption of 1% average when tested in accordance with ASTM C-272.
4. Water vapour permeability of 1.1 perm-inch when tested in accordance with ASTM E-96.

The Inverted Roof Concept

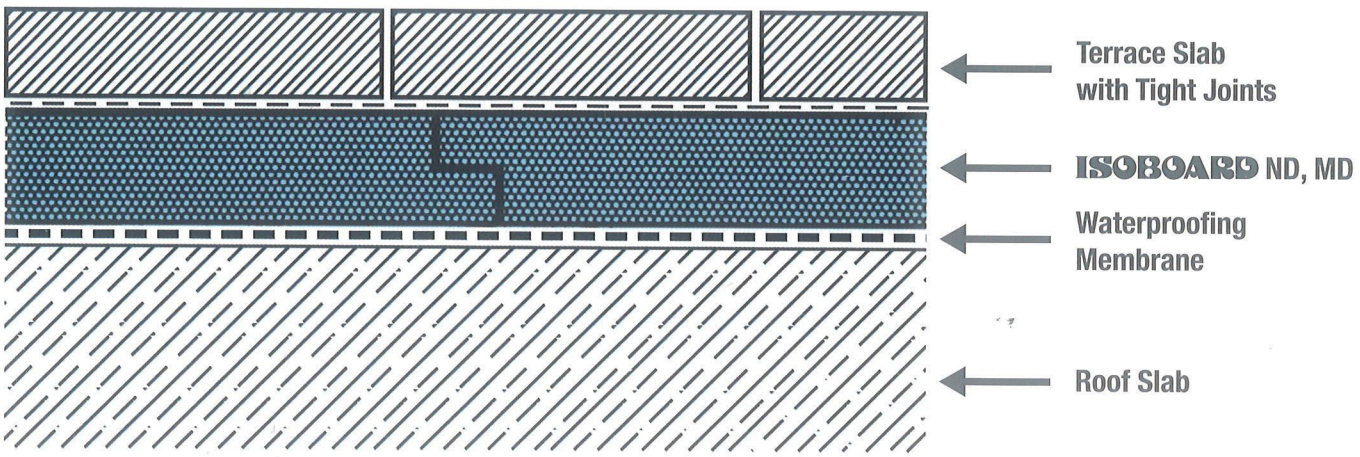
The Inverted Roof Concept, which is also known as protected membrane or upside down roofing, succeeds in insulating both the weather-proofing membrane and the R.C. slab from extreme thermal stresses. This is achieved by inverting the arrangement of the thermal insulation and the water proofing membrane and by placing ISOBOARD extruded polystyrene thermal insulation board above, instead of below, the water-proofing membrane.

This concept is very simple to apply with minimum labour requirements and is very effective in protecting the waterproofing membrane.

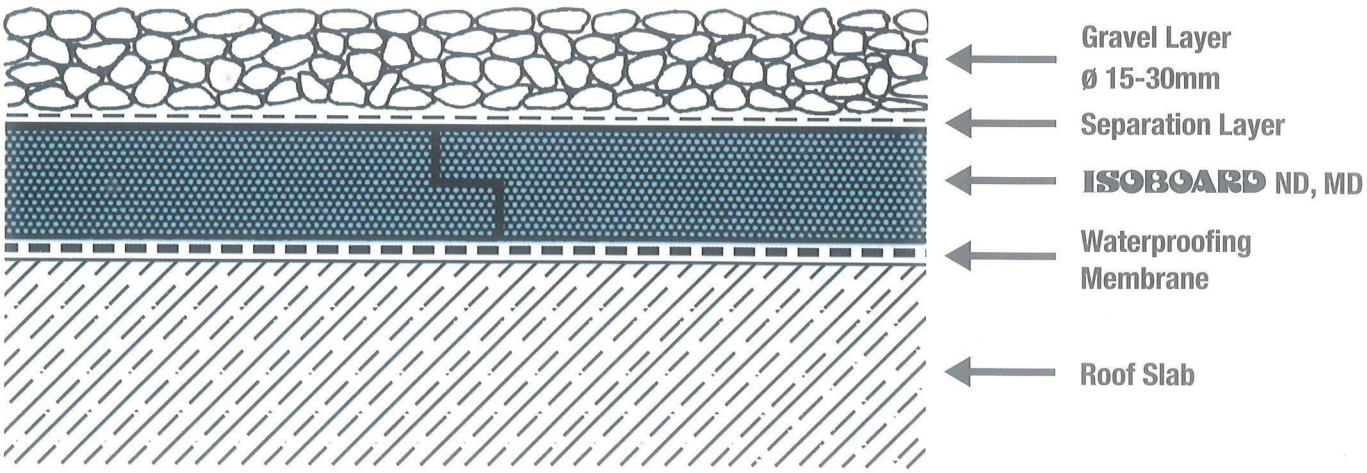
ISOBOARD incorporates the following properties to withstand extreme temperature, thermal cycling, mechanical stresses due to live loads and site traffic, and high relative humidity.

- Closed-cell with homogenous structure and uniform density distribution
- Very low moisture absorption.
- Long term high insulation efficiency.
- Good compressive strength.
- Resistance to aging.
- Resistance to rotting.
- Good dimensional stability.
- High resistance to thermal cycling.

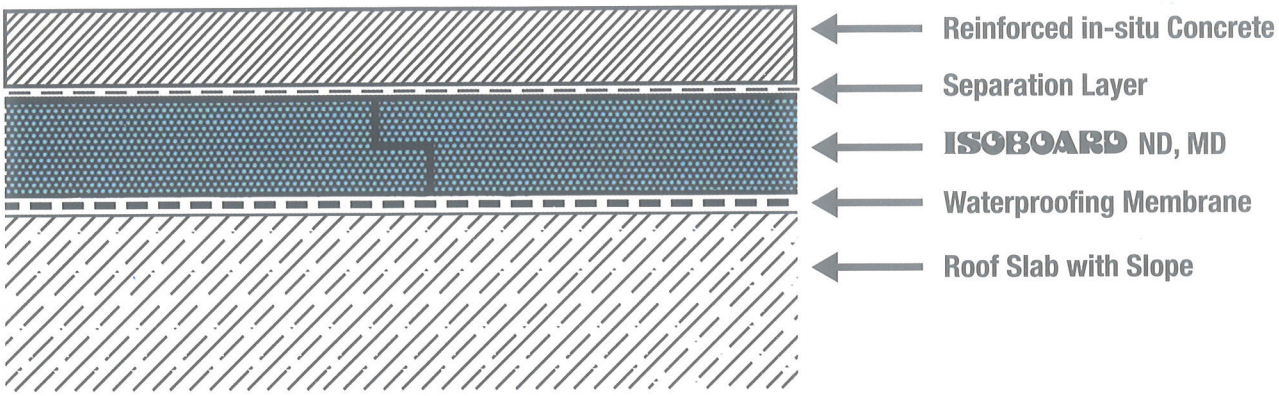
Upside Down Roof Terrace



Upside Down Roof



In-Situ Concrete Layer

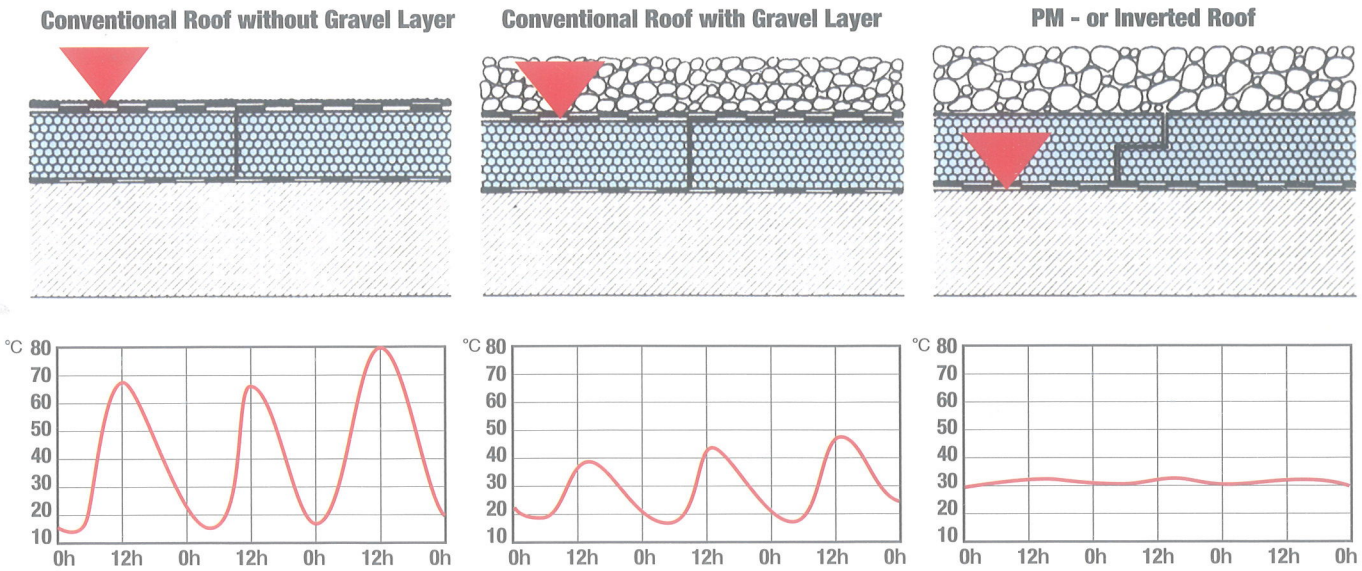


Advantages Of The Inverted Roof Concept

The simplicity of the application of this concept and its efficiency has been proven in Kuwait, G.C.C., the Middle East, USA and Europe. The waterproofing covering does not suffer thermal shocks, and maintains an optimum and constant temperature.

ISOBOARD protects the water proofing membrane from the ultraviolet degradation and from weathering (rain, wind etc.) thus delaying the aging effect.When the waterproofing is of the bituminous type, it is recommended to insert a protective layer of polythene film between the ISOBOARD and the waterproof covering. This protection will give a longer life to the waterproofing membrane which will function as a vapour barrier and prevent interstitial condensation. The cost of the vapour barrier required in conventional roofing systems is therefore saved.

ISOBOARD when laid loose on the waterproofing membrane and loaded with paving slabs or gravel, will not only protect the membrane during construction and during maintenance of plant and equipment situated at roof level, but also the boards can be re-used when extending the building at a latter stage.



Installation

A. Water Proofing Membrane

Ensure the concrete slab is clean and fairly smooth, then membrane can be laid directly on the slab. If the concrete surface cannot be made smooth, it is required to lay protection sheet below the membrane.

B. Protection Layer

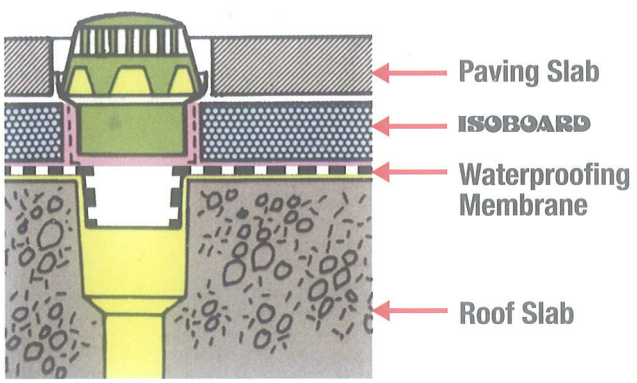
Protection layer against the wind uplift, buoyancy and the ultraviolet degradation can either be of gravel or paving slabs. When using pebble gravel it is necessary to use the round, washed type having a 15 - 30 mm size distribution, laid dry on a synthetic, non fabric, rot proof felt filtering layer (Geotextile Membrane). To determine the quantity of pebble gravel paving slabs to be laid, it is advisable to adopt the values indicated in the following table.

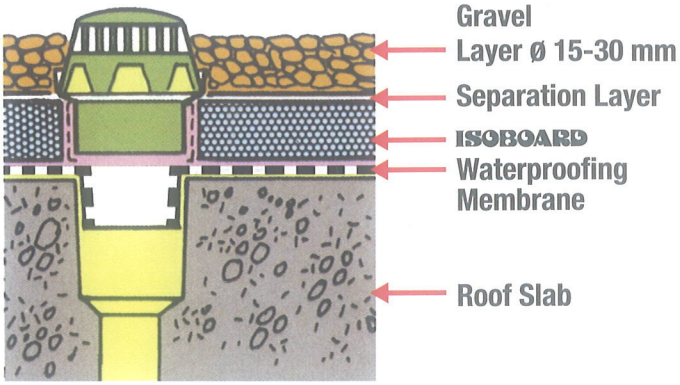
ISOBOARD Thickness mm.	up to 50	65	75	80	100
Required Gravel Layer Depth	50	65	65	70	80
Required Paving Slab Thickness	40 min.	50	50	55	60

Drainage

The roof slab should be sloped towards the drainage outlet. Waterproofing membrane should be properly installed around the drain opening so that water drains off from the waterproofing membrane to the roof outlet.

Roof Drainage

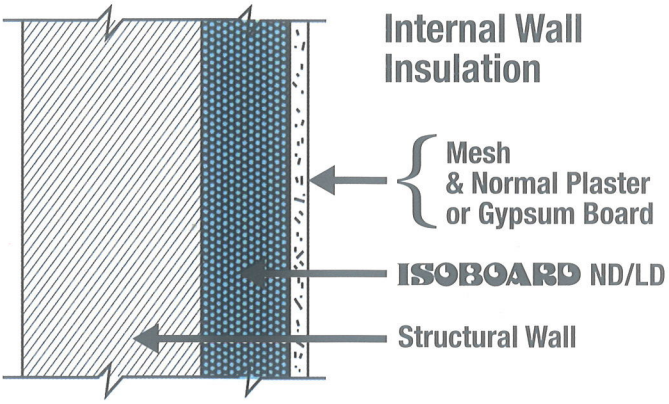


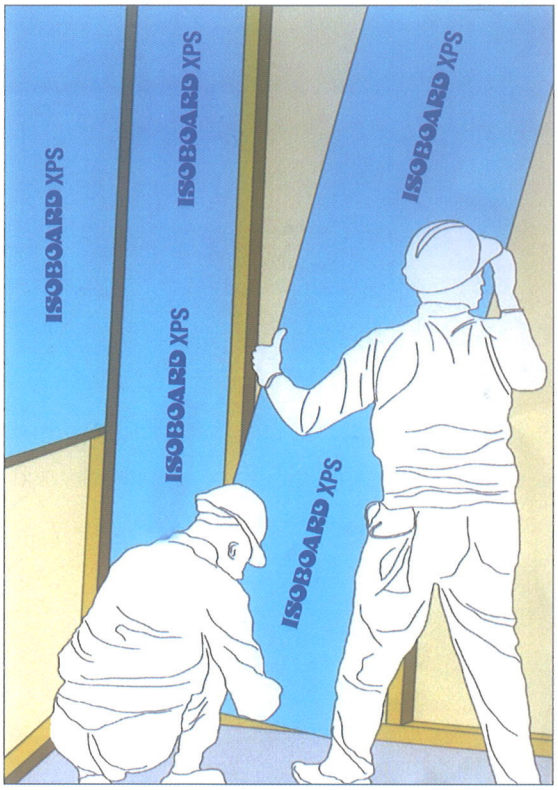


Internal Wall Insulation

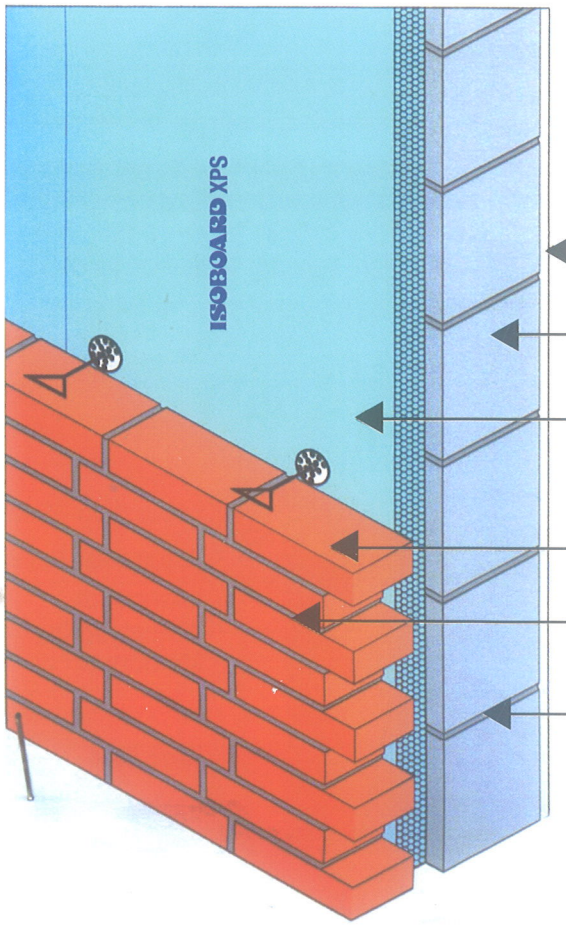
Internal thermal insulation is of great advantage where existing buildings are to be insulated and also building with special exterior finishes.

For the internal lining ISOBOARD ND can be used either with the help of adhesives by mechanical fasteners. Internal lining can be covered either by gypsum plaster board or by wire mesh fixed with fastener and normal plaster.





Cavity Wall Insulation



Cavity wall insulation is of prime advantage where an external brick of any type and finish is required, and also for any type of air conditioned buildings.

(a) Internal Plaster

(b) Concrete block or (Structural wall).

(c) ISOBOARD XPS fixed to wall either by suitable adhesive or mechanical fastener

(d) Facial brick

(e) Mortar joint

Properties of ISOBOARD Products

Property (Average)	Standard	Unit	ISOBOARD LD 1/6		ISOBOARD ND	ISOBOARD MD	ISOBOARD HD
			1 = 21 CW	6 = 26 CW			
Density, min.	DIN 53420 ASTM D1622	kg/m³ lb/ft³	21 - 24/24 1.3 - 1.5/1.5	26 - 28/28 1.6 - 1.75/1.75	32 - 35/36 2 -2.2/2.2	38 - 42/42 2.4 - 2.6/2.6	45 - 48/48 2.8 - 3.0/3.0
Thermal Conductivity at 4.4°C (40°F) Mean Temperature	ASTM C-518	W/m K Btu in/sq. ft hr °F	0.016 0.11	0.016 0.11	0.016 0.11	0.016 0.11	0.016 0.11
Thermal Conductivity At 23.9 °C (75 °F) mean temperature	ASTM C-518	W/m K Btu in/sq. ft hr °F	0.032 0.22	0.031 0.21	0.029 0.20	0.027 0.19	0.026 0.18
Compressive strength at 10% deflection (Average)	ASTM D-1621	KPA	100 - 150	175 - 210	300 - 414	414 - 500	540 - 690
			(A C C O R D I N G T O T H I C K N E S S				
Flexural Strength	ASTM C-203	KPA	180 - 240	250 - 300	450 - 517	550 - 600	640 - 690
Water vapour diffusion resistance factor	DIN 52615	μ Perm	60 - 130	80 - 150	100 - 200	150 - 225	170 - 240
			(A C C O R D I N G T O T H I C K N E S S				
Water vapour permeability	ASTM E-96		1.5	1.5	1.1	1.1	1.1
Water absorption by submersion	ASTM C-272	% by vol	0.3	0.3	0.3	0.3	0.3
Capilarity	-	-	Nil	Nil	Nil	Nil	Nil
Linear coefficient of thermal expansion and contraction (Heat soaking conditions)		°C⁻¹ °F⁻¹	70.10^{-6} 39.10^{-6}	70.10^{-6} 39.10^{-6}	70.10^{-6} 39.10^{-6}	70.10^{-6} 39.10^{-6}	70.10^{-6} 39.10^{-6}
Flammability (DIFFICULT TO IGNITE)	DIN 4102	Building material class	B1	B1	B1	B1	B1
Dimensional Stability	ASTM D-2126	%	2.0	2.0	2.0	2.0	2.0
Oxygen Index	ASTM D-2863		24	24	24	24	24

*N.B.: Spread flame: Spread flame is zero as per UL (Underwriters Laboratories) certificate: **BRYX.R19032 FOAMED PLASTIC** according to ASTM E-84*

N.B.: Special product can be produced by minimum density of upper range values upon request.

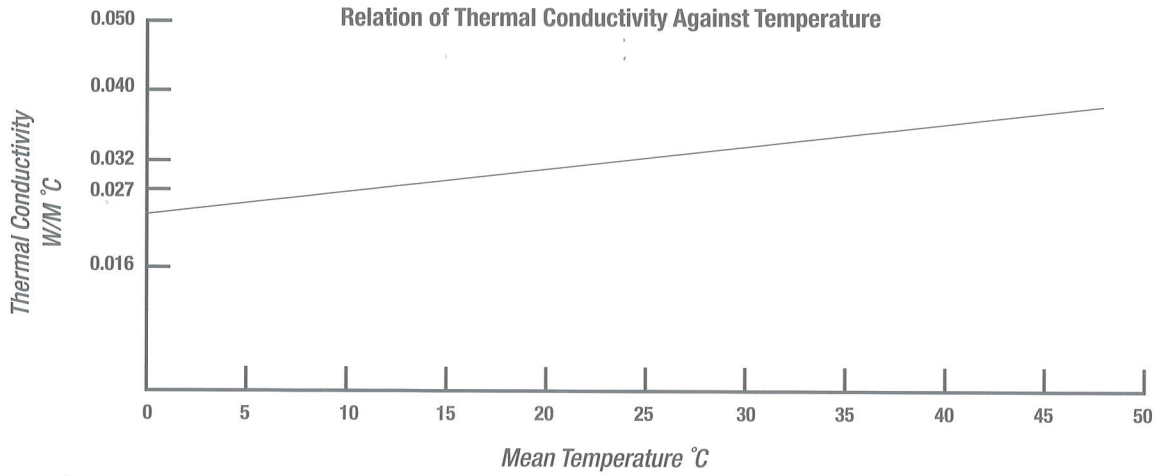
Technical Data

1. Properties

The properties of **ISOBOARD**, on page 9 are average figures obtained by ASTM and DIN test procedures.

2. Thermal Conductivity

ISOBOARD with its homogenous closed cell structure, skin faces and its high resistance to water and vapour diffusion prevents the gaseous mixture trapping in cell walls from any convective motion taking place into individual cells. The change in the cell gas composition is retarded by above construction, thus aging phenomenon is slowed down tremendously. This leads to a stable, long term, low thermal conductivity of 0.032 w/mk at 40°C mean temperature a nearly negligible variation with time.



3. Resistance to Water and Vapour penetration

ISOBOARD absorbs negligible amounts of water because its structure consists of small size closed cells with no interstitial space among them, with an outer foam skin of denser material on both sides. This complete lack of voids, capillaries and the dense skin makes it almost impossible for water and water vapour to penetrate the foam and allow moisture condensation. Therefore, **ISOBOARD** will remain dry in the high relative humidity and high ambient temperatures in the Middle East.

4. Compressive Strength

The Compressive Strength of thermal insulation materials is determined by short term standard test methods. The data given in the table refer to a deflection of 10% or yield value within 10% deflection. For structural applications involving continuous high compressive load, non-uniform loads or high temperature, while designing an adequate safety factor in design stress levels should be provided, to minimise deformations in time. These values are reduced at higher temperatures but the mechanical properties are not affected adversely at lower temperatures, down to -40°C.

5. Fire Behaviour

ISOBOARD ISOFOAM's extruded polystyrene contains a flame retardant additive and is a self extinguishing plastic foam. When tested in accordance with the German DIN. 4102, **ISOBOARD** is classified as B1 building material.

6. Dimensional Stability

The high degree of dimensional stability of **ISOBOARD** is ensured by the particular characteristic of the dense compact skin and by the homogeneity and regularity of its cellular structure due to the extrusion process.

7. Chemical Resistance

ISOBOARD is stable and has good resistance to acids, bases, usual building materials, cold bitumen, silicon oils but is unstable to tars, organic solvents, hydrocarbon gasoline and oil-based paints.

8. Cutting/Fixing

ISOBOARD can be easily cut with wood working tools such as hand saws, band and circular saws. etc. It can also be cut by hot wire but the fumes which will arise from the cutting process must be extracted. ISOBOARD can be bonded with suitable hot bitumen adhesives and with special adhesives suitable for polystyrene foam. Tar-free and solvent-free wood preservatives should be used on timber which is in direct contact with ISOBOARD.

9. Biological Effect

The cutting and handling of ISOBOARD has no bad effect on health. The material is immune to insects, pests, plants and micro organisms.

10. Storage in Warehouse

ISOBOARD should be stored on a flat surface. Naked lights shall not be used and flammable materials such as packing paper, waste and flammable liquids should not be stored beside or near ISOBOARD storage.

11. Storage at Site

ISOBOARD boards can be stored in the open for several days without weather protection if they are secured against wind uplift damage. When longer outdoor storage is forced, boards must be protected from ultraviolet light by covering with brightly coloured plastic sheets properly anchored down against wind effect.

Quality Control

ISOFOAM products are produced in accordance with international specification and standards.
To maintain quality, continuous tests are made in our laboratory for density, thermal conductivity, water absorption, compressive strength controls etc.

Delivery

To assure quick deliveries required by customers all over Middle East, ISOFOAM has its own transportation fleet.

Storage Handling and Application

1) Unused materials should be stored in covered areas away from direct sunlight and ultra violet rays.
2) It is strongly advised that dark coloured or black plastic sheets should not be used as protection over the stored quantities. During summer, this can give rise to temperature build up underneath, around 90°C, which will damage the above layer of the insulation.
3) It is advised not to use polyethene sheets or transparent sheets as a prolonged protection to exposed Extruded Polystyrene boards, in order to avoid enhanced ultra violet degradation and damage to the boards (as explained in point 2) in summer months.
4) Weights of temporary nature should be added on top of the insulation boards, when exposed (weights centrally on the insulation boards) so as to prevent wind uplift.
5) Insulation boards once placed on the roof should not be left exposed, to avoid damage. It is recommended that insulation should be covered immediately with the follow-up system. e.g. paving slabs, screed etc.
6) Suitable provision should be made for expansion gaps between all edges i.e. Board to parapets, a few millimeters provision between board to board in case of larger roofs say at an interval of 50 to 60 meters square.

ISOFOAM is purely a material manufacturer and supplier and do not have any control on the end use or the installation of the product, and it's free from any legal responsibility.