composition and analysis of roofing protection systems

BASIC CRITERIA FOR PLANNING ROOFING PROTECTION USING POLYMER BITUMEN MEMBRANES

Composition and analysis of roofing protection systems • The load-bearing structure • The laying surfaces and inclination • Additional features • Vapour barriers • Steam barriers and attachment to support surfaces • Thermal insulation • Hot roofs and cold roofs • Thermal insulation in hot roofs • Thermobase • Laying the insulation material • Attaching thermal insulation to the vapour barrier and/or the support surface • The waterproof covering • Open waterproofing covering • Composition of a waterproof covering • Attachment to the support surface • Details • Attachment of the waterproof covering to the support surface • Protection of the covering

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Construction Products

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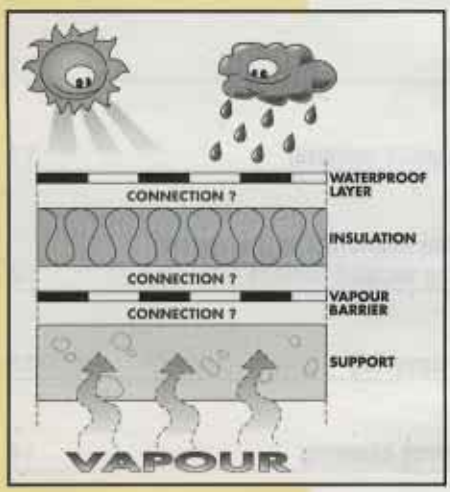
COMPOSITION AND ANALYSIS OF ROOFING PROTECTION SYSTEMS

Typical roofing protection systems comprise the following principal elements:

- **load bearing structure that may be made of:**
  - concrete (site-cast concrete or a mixture of concrete tiles and prefabricated concrete panels). This may be lined with a lightened cementitious cope of variable thickness used to create the minimum incline necessary for the downflow of rainwater on flat roofs;
  - timber, planking or various types of wood compound panels;
  - metal, in ridged sheeting.
- **Vapour barrier or vapour shield** which is generally made of a polymer bitumen membrane in the roofing if there is also thermal insulation. Its function is to protect the insulation from humidity originating internally. INDEX Defend and Defend Alu membranes perform this function. Insulation that has become damp is no longer capable of insulating and deformations may result.
- **Thermal insulation** made from fibrous or cellular material. Generally, thermal insulation is made of panels in glass fibre, rock wool, polystyrene foam, extruded polystyrene foam, expanded polyurethane, cellular glass-fibre, perlite and cellulose fibre compounds etc. INDEX produces THERMOBASE, an insulator in laths combined with a polymer bitumen membrane. Insulation is not always present but is very common. It helps to reduce energy consumption, limit expansion of the load-bearing structure and prevent condensation on cold walls.
- **Waterproof covering** made from overlapping polymer bitumen membranes which protect the roof from inclement weather. It is used for flat roofs but is necessary for inclined roofs lined with tiles or other discrete elements. INDEX is one of the largest producers in the world of polymer bitumen membranes for roof linings and civil works.
- **Roofing protection** is not strictly necessary nor always utilised but if a flat roof is used as a terrace and subject to foot traffic, some kind of pavement must be put down on top of the covering. Likewise if the roof is used for parking. Often, a layer of gravel is used even if this increases the costs of the load-bearing structure and so is becoming less common. Such systems are known as "heavy protection". Often, however, the waterproof covering is itself uncovered (an open covering) and



can be painted or the membrane may incorporate a slate chip protection known as "protected" membranes. INDEX products of this nature are found in the MINERAL range.

- **Other features:** perimeter walls, skylights, rainwater drainholes, guttering, cornices etc. which are fundamental for a roof to do its job properly and which should be carefully designed and constructed.

Different but associated layers in the same roofing system interact as they contract and expand with fluctuations in temperature. It is essential that these movements are restricted by careful design, correct construction of the points of connection and through careful choice of the system components. The different natures of the various layers affect the mechanical resistance of the adjacent layers. For example, a waterproofing covering has a different puncture resistance if laid on concrete rather than on mineral fibre insulation. Another example: the dimensional variations of an insulation panel corresponding to variations in temperature will be smaller than those of a more stable insulator. These examples illustrate that, although a series of suggestions of a general nature is given in the following pages, the numerous problems linked to the different technological solutions require the designer and constructor of roofing protection systems to make a careful study of each possibility, case by case, and under their own exclusive responsibility.

THE LOAD-BEARING STRUCTURE

This is the surface on which the roofing protection system rests. Its function is to resist deformation from the permanent load of its own weight and by temporary loads imposed by the use to which it is put, maintenance and weather conditions such as snow, rain, wind etc.

THE LAYING SURFACES AND INCLINATION

The load-bearing structure also creates the laying surface for the layers above which, except in particular cases, are layers of constant thickness. It is the load-bearing structures' function to ensure there is sufficient incline for the downflow of rainwater.

This is not a problem for sloping roofs or for roofs made from timber or metal but for cementitious flat roofs another solution is required. A lightweight concrete cope is laid over the load-bearing structure in variable thicknasses and is divided into a series of areas no greater than 500 m^2 each and and with variable inclines. Each area has its own water drainage system proportional in section to the area of roof it serves.

The laying surface must be smooth and on a cementitious surface. There should be no depressions greater than 1 cm. under a 2 m. straightedge laid on the surface, or greater than 3 mm. using a 20 cm. rule. Variations in level between timber planks should not exceed 2 mm. Edging lines between prefabricated panels are covered with bridging strips to insulate them.

The designer of the roof-covering must take the various layers laid on the load-bearing structure into account and adapt the whole protection system so that it can be lined without improvisation on the building site.

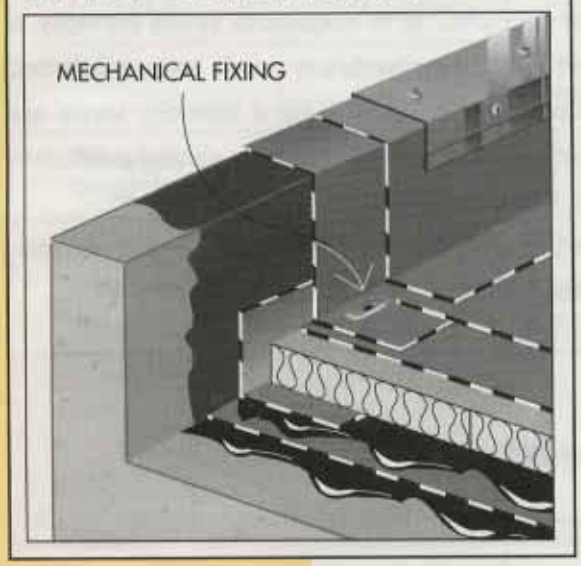
ADDITIONAL FEATURES

Chimneys, perimeter walls, skylights and drain outlets are all additional features that need to be carefully planned before application. Consideration must be given to how the waterproof covering will line these features and be attached.

There must be sufficient space between features to carry the work out and then inspect it.

Some guidelines are given in the INDEX Technical Specifications.

DETAIL OF MECHANICAL FIXING AT THE FOOT OF A PROJECTION

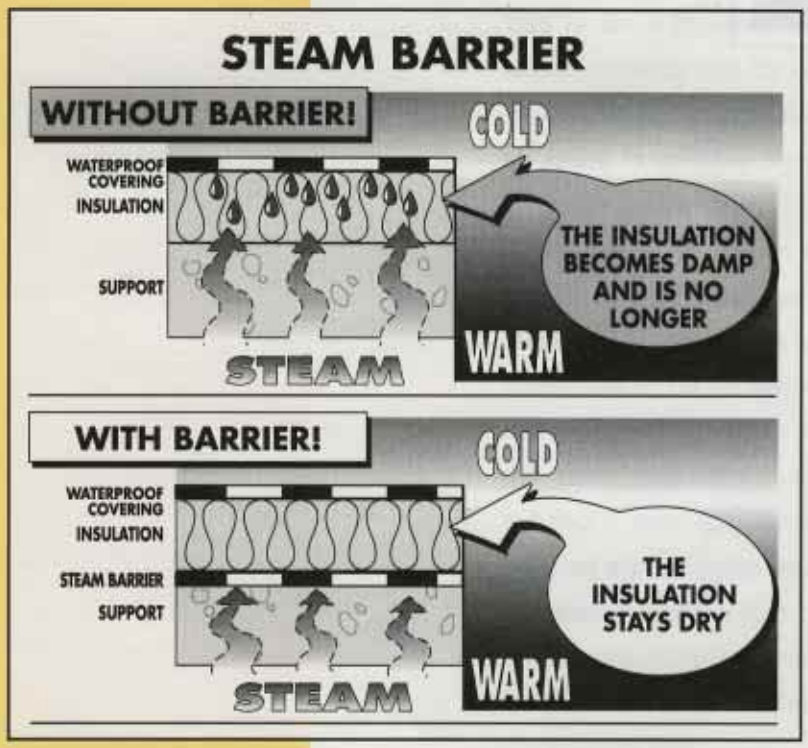


VAPOUR BARRIERS

Vapour barriers protect thermal insulation from vapour arising inside a building and, as a rule, are placed on the "warm" side of the insulation. They are therefore suitable for climates where winter temperatures fall below O°C and indoor heating is used. It is not useful in equatorial climates as the building's interior is cooler than outside and vapour entering the insulation generally comes from the external environment. It is commonly used in other climates and is always placed under the thermal insulation.

In theory, it should be as waterproof as the waterproof covering but practice has shown that if the conditions below are not particularly damp, a 3 mm. polymer bitumen membrane offers sufficient protection (DEFEND 3). In conditions where humidity is greater than 80% at 20°C, the membrane needs to be reinforced with a sheet of aluminium (DEFEND ALU); if humidity levels are constant and in cold climates, it is advisable to spread a diffusion layer (PERFOBASE, ROLLBASE etc.).

Attaching a vapour barrier to the various surfaces in the commonest situations is described in the following section.



STEAM BARRIERS AND ATTACHMENT TO SUPPORT SURFACES

Recommended methods of attachment are given in the table below. These represent the most common situations but the designer of the roof covering is still obliged to make a careful study of each possibility, case by case, and exclusively under his own responsibility.

SUPPORT SURFACE	HUMIDITY	STEAM BARRIER (under flooring or gravel)	STEAM BARRIER (below open covering)
CONCRETE	NORMAL	INDEVER + DEFEND 3 (total adherence)	INDEVER + DEFEND 3 (total adherence)
	HIGH (>80% at 20°C)	INDEVER + PERFOBASE + DEFEND ALU (flame-bonded)	[1] INDEVER + PERFOBASE + DEFEND ALU
TIMBER [2]	NORMAL	ROLLBASE/V nailed + DEFEND 3 (total adherence)	ROLLBASE/V nailed + DEFEND 3 (total adherence)
RIDGED SHEETING [3]	HIGH (>80% at 20°C)		INDEVER + DEFEND ALU (flame-bonded)

[1] Valid only if the insulation is mechanically fixed or used in non-windy areas

[2] High humidity is not expected under a hot roof on a timber support and requires special study

[3] For normal humidity, full ridged sheeting is sufficient protection

THERMAL INSULATION

This is based on the laws and regulations in force in each country. It must be checked that the thickness of the insulation is enough to keep all layers below the steam barrier at a temperature higher than that of vapour condensation (dew point) in the rooms below the roofing. If it does not, thicker thermal insulation is necessary.

INSULATION

- ENERGY SAVINGS
- SPACE SAVINGS
- LIMITS EXPANSION OF THE STRUCTURE
- PREVENTS CONDENSATION ON COLD WALLS
- GIVES COMFORT

HOT ROOFS AND COLD ROOFS

For situations where continuous waterproofing covering is used, hot roofs are certainly more common, particularly in industrial construction. Cold roofs, also called ventilated roofs, are made almost exclusively for timber coverings and residential buildings.

A hot roof is a compact roof where all layers described so far are adjacent and lie one on top of the other, whereas a cold roof has a ventilation space which separates the layers placed between the insulation and overlay, if the roof is insulated, and below the overlay which supports the waterproofing, if it is not insulated.

In hot roofs the waterproof covering is nearly always laid directly on the thermal insulation (which forms its support) while for cold roofs the waterproof covering is placed on the overlay which is nearly always made from timber.

THERMAL INSULATION IN HOT ROOFS

The stress placed on insulation in hot roofs, and consequently on the covering, is notably higher and of a different nature than that placed on other types of building.

Besides being chosen for their insulating properties, insulation materials must also meet requirements regarding dimensional stability and resistance to compression and humidity. Their cohesion and compatibility with adjacent layers must also be evaluated; compatibility here is meant in its widest sense and includes compatibility with the methods of laying the covering, chemical resistance to glues used for laying etc.

The insulation material should not alter shape under variations in temperature and its dimensions should be such that fatigue movements do not appear along the edging lines between the underlying prefabricated panels.

For open waterproof coverings, cohesion of the panel has to be sufficient to give the covering enough adhesion to resist the force of the wind. For insulated roof car-parks, choice of insulation type will depend more on resistance to crushing; this characteristic is naturally of less importance for open roof coverings.

There are many types of roofing insulation materials but it is not enough just to describe their nature. Every manufacturer has a suitable application for hot roofs in his range of products and he should be consulted during the planning stage.

SURFACE THERMAL EXPANSION COEFFICIENTS

PERLITE (FESCO) - CELLULOSE (adhered) $\alpha = 0,1$ a $0,2\ 10^{-5}$

POLYSYTRENE (adhered/loose) $\alpha = 3$ a $6\ 10^{-5}$

POLYSTYRENE (under covering) $\alpha = 2,5$ a $4,5\ 10^{-5}$

MOVEMENT AT THE JOINT BETWEEN 1 METRE PANELS FOR A VARIATION IN TEMPERATURE OF 70° C

	STUCK	LOOSE
- FESCO	0,14 mm	0,14 mm
- POLYSTYRENE <6 cm	2,1 mm	4,2 mm
- POLYSTYRENE >6 cm	4,2 mm	

THERMOBASE

INDEX has developed a thermal insulation supplied in rolls especially for roofings. The product comprises a membrane and strips of different types of insulating material. It is designed to be adhered to the support surface.

The dimensions of the insulating strips mean their dimensional variations become negligible and do not create any problems of fatigue on the covering above. Supplied in rolls means easy and rapid application and both the insulation and first waterproofing layer are applied in a single operation.

THERMOBASE's special design means it is possible to line concave and convex surfaces easily and uniformly.

LAYING THE INSULATION MATERIAL

All insulation materials are laid on a vapour barrier, where such barriers are required, except for cellular glass-fibre which does not require a protective layer due to its own impermeability.

As previously mentioned, insulation is placed under the waterproof covering with the exception of a particular hot roof configuration ("upside down roof') where the covering is placed under insulation made of dry extruded polystyrene foam. This, in turn, is generally protected by a layer of gravel or something heavy. Extruded polystyrene foam absorbs very little water and so maintains its insulating properties and, in this case, the covering also acts as a vapour barrier.

In other cases, the insulation material is always adhered or anchored to the laying surface.

The following section contains suggestions on attaching thermal insulation to the laying surface according to the insulation material and different types of construction. Dry application is allowed only in a few cases, for surfaces under 200 m^2 and under heavy protection.

ATTACHING THERMAL INSULATION TO THE VAPOUR BARRIER AND/OR THE SUPPORT SURFACE

It is advisable that thermal insulation is laid over at least one vapour sheet; only where it is applied on unperforated ridged sheets to cover rooms with normal humidity and cellular glass-fibre, should the barrier not be used.

The table below illustrates the recommended methods of attachment for different insulation materials depending on the application surface and the type of protection above.

The most common cases are considered but they do not exempt the roofing designer from making a careful study of each possibility, case by case, and exclusively under his own responsibility.

INSULATION MATERIAL	UNDER AN OPEN COVERING (on a concrete surface)	UNDER FLOORING OR GRAVEL (on a concrete surface)	UNDER AN OPEN COVERING (on ridged sheets)	UNDER AN OPEN COVERING (on timber)
THERMOBASE PUR	H.B.B./nailed	H.B.B./nailed	Nailed	Nailed/H.B.B.[3]
PSE	Nailed	Cooled H.B.B./nailed	Nailed	Nailed
PSE/E	—	Cooled H.B.B./nailed	Nailed	Nailed
FR	H.B.B./nailed	—	Nailed	Nailed/H.B.B. [3]
CORK	H.B.B./nailed		—	H.B.B. [3]
CELLULAR GLASS-FIBRE	H.B.B.	H.B.B.	—	H.B.B. [3]
PERLITE CELLULOSE	H.B.B./nailed [1]	H.B.B./nailed	Nailed [1]	[1] Nailed/H.B.B. [3]
EXPANDE POLYURETHANE LINED WITH BITUMINISED GLASS FIBRE	H.B.B./nailed	[2] H.B.B./nailed	Nailed	Nailed/H.B.B. [3]
EXPANDED POLYSTYRENE	—	[2] Cooled H.B.B./nailed	—	—
MINERAL WOOLS WITH BONDABLE UPPER FACE	H.B.B./nailed	—	Nailed	Nailed/H.B.B. [3]
EXTRUDED POLYSTYRENE FOAM	—	Upside down roof	—	—

KEY

H.B.B. = Hot blown bitumen (in open coverings it can be used up to s<40%; if integrated by laying wooden laths of thickness equal to the insulation and inserted every 5 m., it can be used up to s > 100%.

H.B.B./nailed or Nailed/H.B.B. = alternative application systems; the first word indicates the preferred method or the one used more.

s = slope of the roof

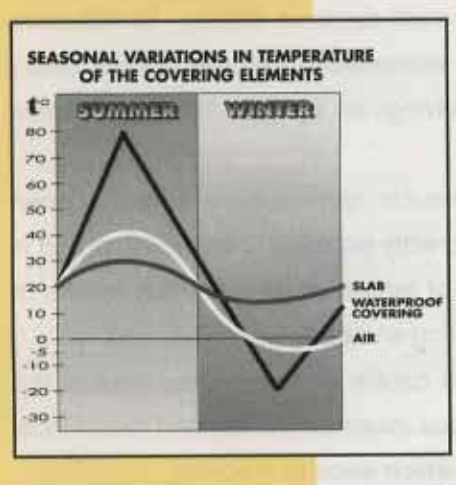
NOTE:

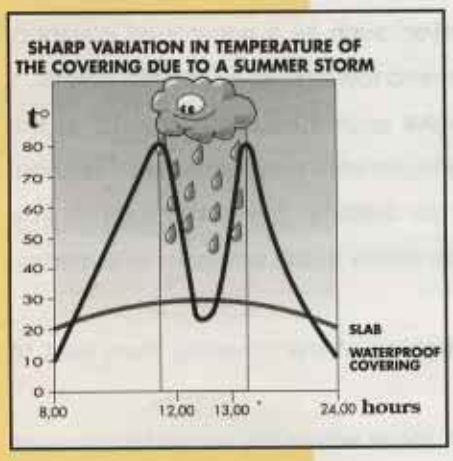
(1) = It is advisable to nail the first layer of the waterproof covering also.

(2) = For roof surfaces of less than 200 m², cold adhesive MASTICOLL can be used.

(3) = Use of the H.B.B. system supposes the presence of a Vapour Barrier; if not, either DEFEND 3 or ROLLBASE should first be nailed to the support.

THE WATERPROOF COVERING





The waterproof covering is a continuous roofing component used to protect the construction from water in the long term.

The covering is exposed to inclement weather and has to resist heat, cold, wind, rain, hail, sunlight and chemical pollution in the air and water etc. The covering is subject to various mechanical actions too. Depending on its use, it may have to stand up to vehicle traffic, foot traffic, plant roots etc. Also to be considered is that the waterproof covering is one part of a system that comprises several layers on top of one another.

These layers are made from different materials and so have different thermal expansion coefficients. Depending on their position, the layers are at different temperatures, including within their own thickness (e.g. thermal insulation), and continuous layers alternate with discontinuous layers, for example, panel insulation under waterproof covering.

The layers are also subject to shrinkage, such as a sloping roof cope made from aerated concrete or an insufficiently cured insulation panel. It is also possible that the various layers will expand with damp or heat as do certain thermal insulation materials.

OPEN WATERPROOFING COVERING

Open coverings are the most common solution for industrial buildings and also the most economical because, without heavy protection on top, it allows savings on the load-bearing structure as well as on maintenance.

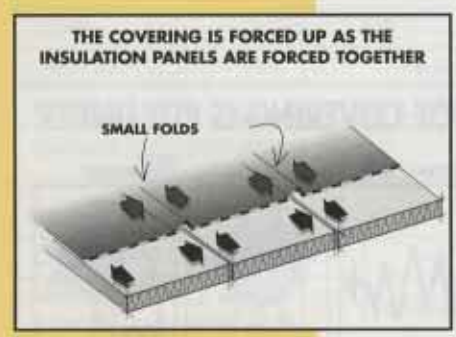
Insulation-waterproofing products receive more stress in open coverings because they are directly exposed to the weather and in particular to sharp changes of temperature. The main results of temperature change are cracking and buckling.

In the first case, movements centre on the edging lines in the layers made from discontinuous insulation panels and cause local fatigue in the covering above which leads to cracking.

Movement of a continuous layer, such as a waterproof covering, affects the whole surface from and towards its geometric centre.

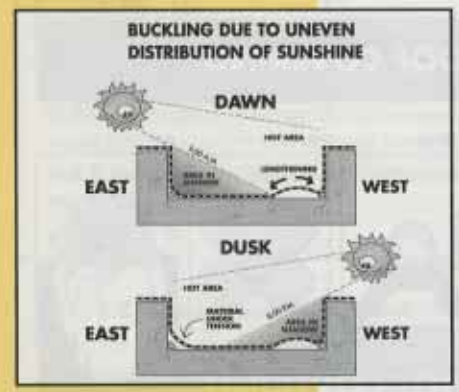
Such movement could provoke asymmetric movements in the waterproof covering due to differentiated temperatures throughout the day in different areas of the material; this might happen in a surface bounded by high walls which throw shadows over certain areas from dawn until dusk.

The result will be gradual creeping of the covering from east to west.



These phenomena are seen in zones where the winter temperature falls below O°C and on roofs with open coverings where the presence of thermal insulation aggravates and accelerates the problem.

In low temperatures, the covering shrinks and, as it becomes rigid, it becomes strong enough to drag the layers below that are not sufficiently fixed. Alternatively, it can become unstuck itself and form folds around the fixed points on the roof such as perimeter corners, chimneys and skylights.



When the sun and heat return, the covering expands but, being thermoplastic, it becomes soft and no longer has the strength to return to its position, to flatten the folds in the material nor to pull back the layer below that it dragged towards the centre. The covering moves towards the centre progressively.

Folds form at the corners of the roof, at the edges of the skylights and chimneys and along perimeter walls; the material stretches and the insulation below is pulled towards the centre of the covering.

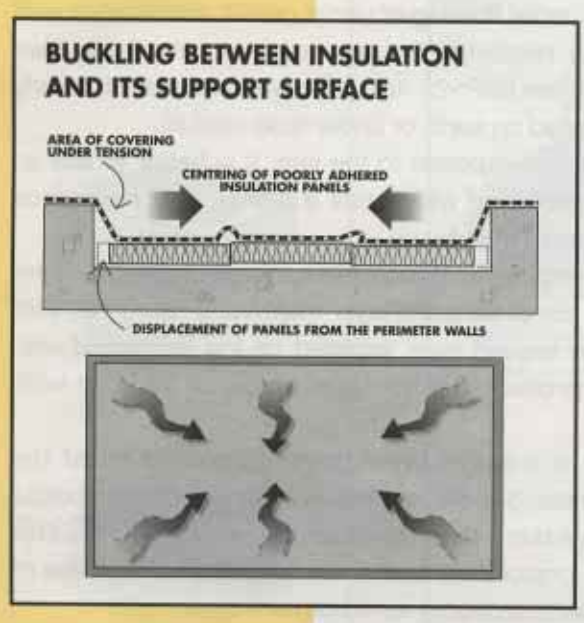
Movements of and between layers which cause progressive

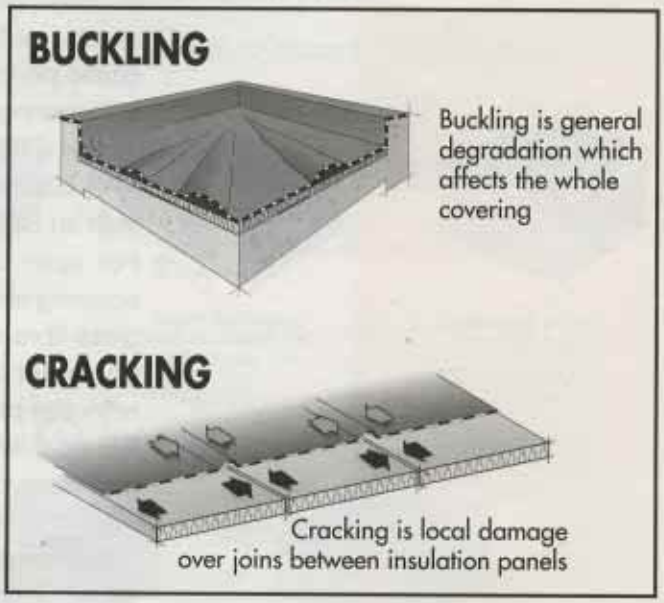
displacement of the covering and/or adjacent layers in a rippling movement are called buckling.

To avoid problems of buckling, it is important for open coverings that:

- the materials that comprise the insulation and membrane are stable with variations in temperature;
- the layers are solid and adhere to the surface;
- small details in the job are executed with particular care, especially those dealing with the fixed points of the covering (walls, drainage pipes, chimneys etc.).

Open coverings are also exposed to the effects of the wind. Similar movements to buckling may affect coverings or insulation-membrane products that have not been bonded well to the surface. The effects of the wind are such that open coverings must be completelv solid with the support surface.





COMPOSITION OF A WATERPROOF COVERING

INDEX polymer bitumen membranes can be applied in single layers or in two or more layers. Choice of the type and number of layers and how they are attached is made taking account of the covering's support surface, the local climate, the thermal insulation, the use that the covering will be put to, the material of the adjacent layers, the internal microclimate etc.

Some rough guidelines are given below but they do not exempt the designer of the roof protection system from making a careful study of each possibility, case by case, and exclusively under his own responsibility. In its "Technical Specifications", INDEX publishes a series of technical brochures that give more detailed information on each type of covering.

- Only the following coverings should be used in a single layer: membranes reinforced with non-woven polyester or doubly reinforced glass-fibre/polyester or composite glass-fibre/polyester with a minimum thickness of 3 mm. if applied loose, 4 mm. if adhered or semi-adhered, and 5 mm. if the laying surface is rough.
- APP bitumen membranes are suitable in hot or temperate climates, SBS bitumen membranes in cold climates.
- For two or more layers, at least one of the APP bitumen membranes should be reinforced with non-woven polyester. It is always preferable to lay a single layer reinforced with non-woven polyester rather than two or more APP bitumen membranes reinforced with a thin layer of glass-fibre. Only SBS bitumen membranes reinforced with a thin layer of glass-fibre can sometimes be applied in a double layer.
- In coverings laid under flooring or under gravel, membranes with greater polyester reinforcement against perforation are used (static perforation on ESP>25 kg.- a heavier material). Similarly for coverings applied on earth or under road asphalt.
- To line a vertical wall exposed to the sun, it is better to use an APP bitumen membrane which has a higher heat resistance than an SBS bitumen membrane.
- For open coverings with thermal insulation, a double layer covering should comprise a first layer membrane reinforced with glass-fibre and a second layer adhered on top reinforced with polyester and protected with slate chips or painted with reflective paint.
- Reinforcement of a single layer covering should be of the glassfibre/polyester double reinforcement type or composite glassfibre/polyester. If a double layer with polyester reinforcement is prescribed, one of the two layers should be of the polyesterglassfibre double reinforcement type.

Resistance to static perforation on ESP>15 kg. is enough for open coverings except for areas subject to maintenance foot traffic where a second polyester reinforced membrane with a slate chip surface should be laid.

ATTACHMENT TO THE SUPPORT SURFACE

There are three types of surface coverings:

- independent
- adhered
- semi-independent

INDEPENDENT

Independent applications are simply laid on top of the support surface; indeed, an "independent layer" is often laid dry on the laying surface first so that the covering will not adhere itself under the heat of the sun. A 100 g/m² glass-fibre "veil" performs this task well as does ROLLBASE sheeting with open non-woven polyester on the lower side.

Independent applications cannot be executed on roofs where the slope exceeds 5% and the covering must be ballasted with gravel protection or flooring which prevents the wind from getting underneath. Independent applications are common on concrete or concrete tile surfaces where heavy weights can be supported. The covering is independent of the movements of the support surface below but leaks are difficult to trace.

INDEPENDENT SYSTEM

ADVANTAGES

QUICKER TO APPLY

LESS SENSITIVE TO CRACKING IN THE LAYING SURFACE

VAPOR IS DIFFUSED WITHOUT CREATING LOCAL AREAS OF PRESSURE

INDEPENDENT SYSTEM

DISADVANTAGES

LESS RESISTANT TO FOOT TRAFFIC AND SHOCKS

ONLY SUITABLE FOR INCLINES OF LESS THAN 5%

REQUIRES HEAVY PROTECTION

DIFFICULTY IN LOCATING LEAKS

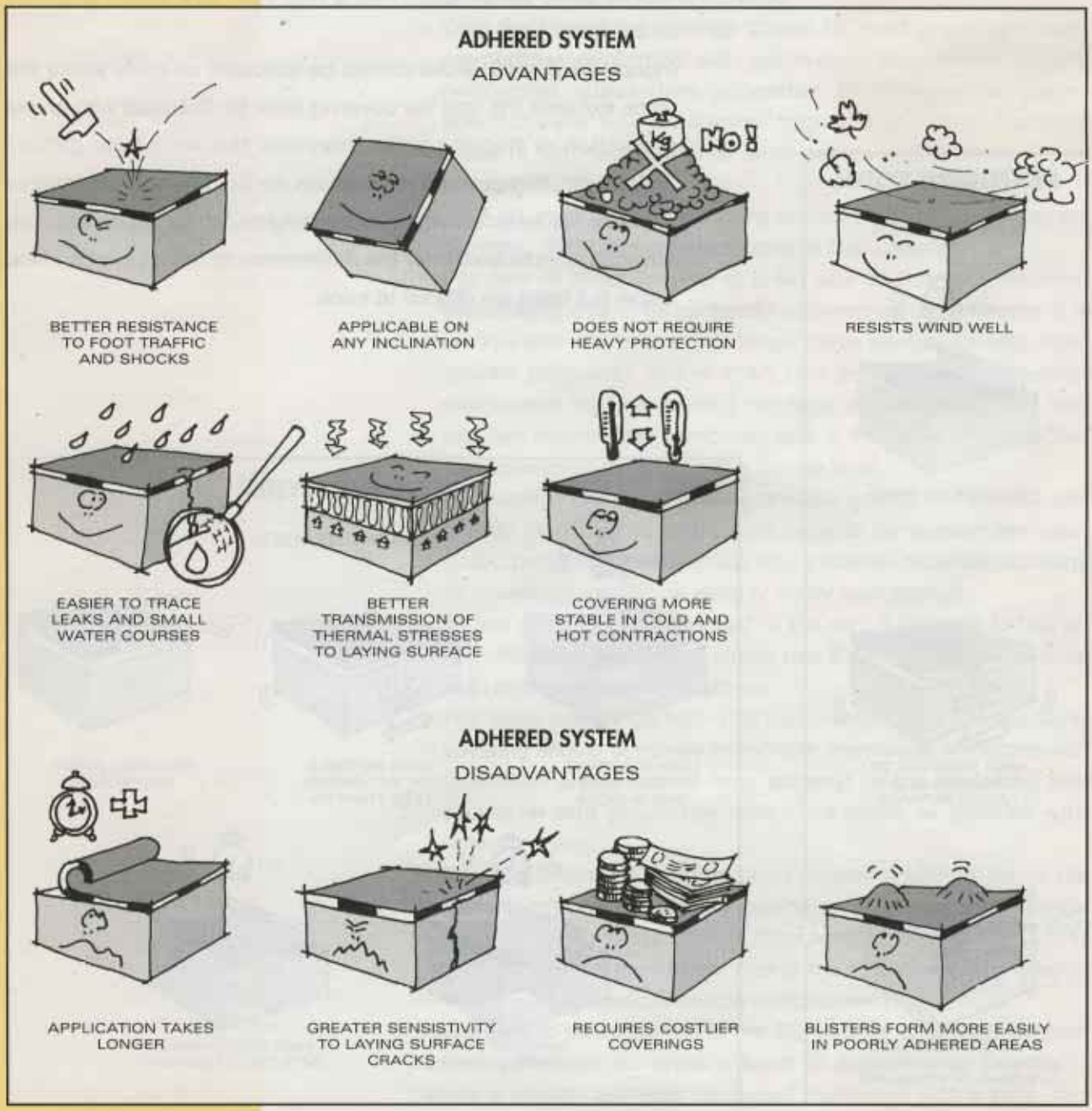
FREE TO CONTRACT WITH COLD AND HEAT

ADHERED

The covering is completely adhered to the laying surface. The surface needs to be stable while the covering must be both resistant and elastic to cope with any surface movements.

The adhered system is usually used on open coverings on sloping roofs or where heavy protection cannot be used.

Leaks in the covering are more easily traced and the quantity of water that enters will be modest.



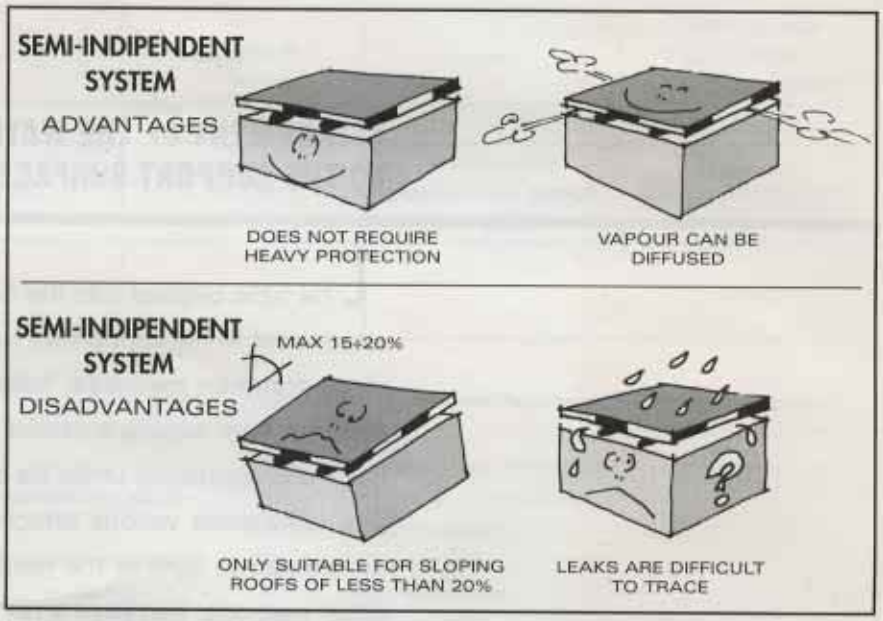
PONTAGE

"Pontage" bridging strips of approximately 20 cm. width are laid over edging lines between prefabricated panels and adhered to one side of the join before the covering itself is applied. Bridging strips help to counter the effects of differential movements of the panels by distributing the force of the movement of the join over an area as large as the strip itself and not directly onto the covering. Bridging strips may be made from TESTUDO SPUNBOND Polyester 20/4.

SEMI-INDEPENDENT

When the laying surface is not sufficiently stable or may be damp and therefore create vapour blisters under the adhered covering, the semi-independent system should be used. This is a compromise between the two previous systems and adheres the covering at particular points in a variety of ways:

- adhesion through perforated sheets like PERFOBASE;
- strips or areas created by partial flame-bonding of the lower side of the covering;
- mechanical fixing on timber; a bitumen sheet is nailed onto timber and then the covering is applied on top.



Leaks in the covering are difficult to trace. The semi-independent system is generally used on open coverings on unstable or damp laying surfaces. The mechanical fixing method merits separate consideration which is unbeatable for its practicality and effectiveness on certain surfaces.

DETAILS

Successful waterproofing often depends on the care and attention paid during the planning stage and execution of small details in the covering. The reader is therefore referred to the relevant INDEX "Technical Specifications".

ATTACHMENT OF THE WATERPROOF COVERING TO THE SUPPORT SURFACE

The table overleaf lists the different recommended methods of attachment to the support surface. The cases listed represent the most common methods, however this does not exempt the designer from making a careful study of each possibility, case by case, and exclusively under his own responsibility.

The table gives various attachment solutions which should be considered in light of the requirements of the actual situation. Other methods, that have a high possibility of failure or for which there are more negative than positive aspects or that necessitate too costly a solution, have been omitted.

SUPPORT	TERRACE	GRAVEL COVERED ROOF	ROOF CARPARK	ROOF WITH OPEN COVERING (1)
CONCRETE	S / SP / I	S / SP / I	A + Asphalt (HT) SP + Asphalt (TL) IV + CLS	SP p<15% - S p<40% A p>40% (APP)
TIMBER	—	SCR / IGM	—	SCR
THERMOBASE PUR	F	F	—	F
PSE	F	F	—	F
PSE/E	F	F	—	F
FR	—	F	—	F
CORK	F / I	F / I	—	F
CELLULAR GLASS-FIBRE	HBB+F+HBB+I	HBB+F+HBB+I	HBB+F+HBB+I	HBB + sanded 2 kg/m² bit GF + F
CELLULAR GLASS-FIBRE WITH BONDABLE FACE	F	F	F	F s <20%
PERLITE/CELLULOSE	F / I	F / I	F / I	F on bondable panel HBB + sanded bit. GF on normal panel + F (N1 in windy area)
POLYURETHANE FOAM LINED WITH				
BITUMEN PAPER	IG	IG	—	—
POLYTHENE GLASS-FIBRE	IG	IG	—	—
BITUMEN GLASS-FIBRE	IG	IG	—	F
POLYSTYRENE FOAM	IGM	IGM	—	—
MINERAL WOOLS WITH BONDABLE UPPER FACE	—	I / F	—	F
MINERAL WOOLS WITH-OUT LINING	—	I / HBB + F	—	HBB + sanded 2 kg/m² bit GF + F (N1 in windy area)
UPSIDE DOWN ROOF	I	I	—	—
NEW COVERING ON TOP OF OLD ONE	IG / IR	IG / IR	F + SP on old asphalt + new asphalt IG + CON	SP s<15% - S s<40%
OLD COVERING ON RIDGED SHEETING AND ON TIMBER	—	—	—	SCR

KEY:

F: Flame bonded

GF: Glass-fibre

I: Independent, laid dry

IG: Independent, laid dry on 100 g/m² glass-fibre layer laid dry

IR: Independent, on Rollbase laid dry

IGM: Independent, laid dry on 100 g/m² glass-fibre veil laid dry +2 kg glass-fibre reinforced membrane laid dry with non-adhered overlays

S: Semi-independent, flame-bonded spots

SP: Semi-independent, flame bonded on Perfobase perforated sheeting

SCR: Semi-independent, flame bonded on nailed Rollbase

N1: Membrane of 1st layer of covering nailed

H.B.B.: Hot blown bitumen

LT: Light vehicle traffic

HT: Heavy vehicle traffic

s: Percentage slope

CON: Concrete cope

(1): Sheets on the last layer of open coverings where s > 40% are mechanically fixed at the head and must not exceed 7m length if s >100%.
With APP bitumen membranes on a concrete surface, application without fixings is possible for s > 40%.
On HBB-covered insulation, the sheets must be mechanically fixed at the head starting from s > 20%.

PROTECTION OF THE COVERING

As previously mentioned, heavy protection protects the covering not only from mechanical stresses imposed by foot and vehicular traffic but also from hail and solar radiation which ages the waterproofing cover.

A recent Swiss survey of 280 flat roofs showed that the average life of a welldesigned and correctly applied open covering is about 25 years. With the addition of heavy protection, this figure is increased to 30 years but using a particular type of protection called "DUO", may reach 45 years. DUO is the addition of extruded polystyrene foam insulation placed under gravel on a hot roof with heavy protection. This is in effect an "upside down roof' on a traditional roofing composition.

But even protection can cause damage to the covering if not applied correctly; consequently, the reader is referred to the INDEX Technical Specifications.

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