STRONG REFLEX AB

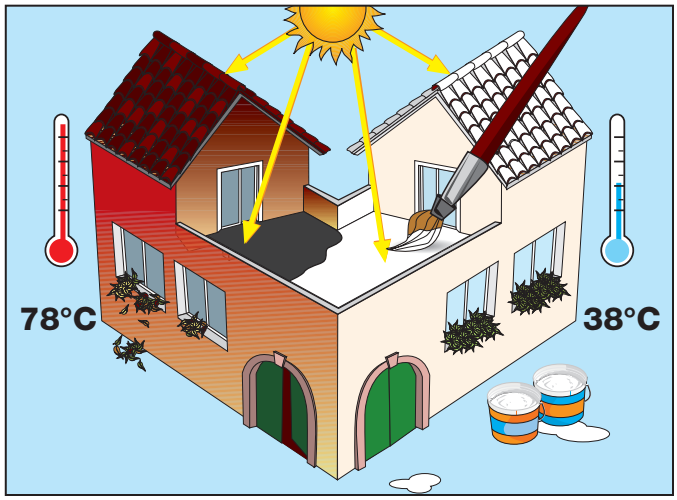
WATER-BASED TWO-COMPONENT WHITE HIGH REFLECTING AND EMITTING WATERPROOFING COATING FOR BITUMEN WATERPROOFING, CONCRETE, SHEET METAL, ROUND TILES AND SHINGLES, IMPROVING THE THERMAL INSULATION OF BUILDINGS

GRANTS *LEED* CREDITS

CHARACTERISTICS			ENVIRONMENTAL	METHOD OF USE				PRECAUTIONS
AB	H_2O							
TWO-COMPONENT	WATER BASED	WATERPROOFING	ECO GREEN	MIX MECHANICALLY	SPRAY APPLICATION	APPLY BY BRUSH	APPLY BY ROLLER	STORAGE: KEEP AWAY FROM FROST

PROBLEM

- INCREASE THE SUMMER TIME THERMAL COMFORT OF INHABITED INTERIORS
- REDUCE AIR CONDITIONING COSTS IN THE SUMMER
- REDUCE THE URBAN HEAT ISLAND EFFECT
- WATERPROOF CONCRETE ROOFS, EVEN WITH COMPLEX GEOMETRIES



More than 90% of roofs are dark in colour and the covering surface reaches temperatures of around 80°C under the heat of the sun, which also negatively affects the life of the waterproof coating.
The table that follows indicates the temperatures recorded in Northern Italy in the month of July 2007 under bituminous surfaces with different methods of protection:

MAXIMUM TEMPERATURE	
Dark membrane	78°C
Grey slate membrane	74°C
White slate membrane	70°C
Painted aluminium membrane	67°C
Self-protected membrane with copper foil	60°C
Self-protected membrane with aluminium foil	55°C
Bituminous membrane with STRONG REFLEX	**38°C**

REFLECTANCE	
Dark membrane	<0.10
Membrane with aluminium paint	0.40-0.46
Bituminous membrane with STRONG REFLEX	**>0.89**

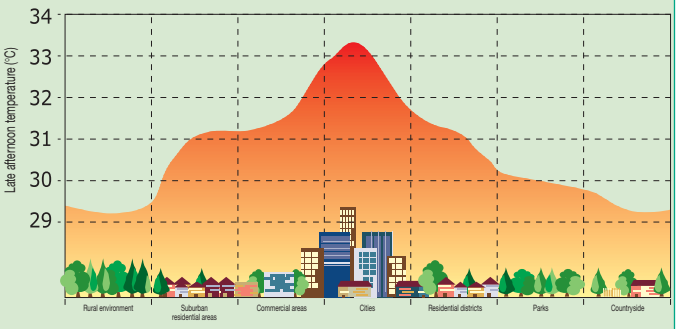
EMISSIVITY	
Dark membrane	>0.80
Membrane with aluminium paint	0.90
Bituminous membrane with STRONG REFLEX	**>0.89**

In summer, the interior under the roof overheats, compromising the thermal comfort of the occupants and increasing air conditioning costs.

Roofs and the heat island effect

The American EPA (Environmental Protection Agency) has for some time being working to combat the Heat Island Effect, the phenomenon of higher temperatures in urban areas than in the countryside, which may have serious consequences in the summer.

These heat islands over cities may have a temperature difference relative to the surrounding areas of 1 to 6°C, which results in peak electrical power consumption and the attendant risk of black out, increased air conditioning costs, increased pollution, illness and death.



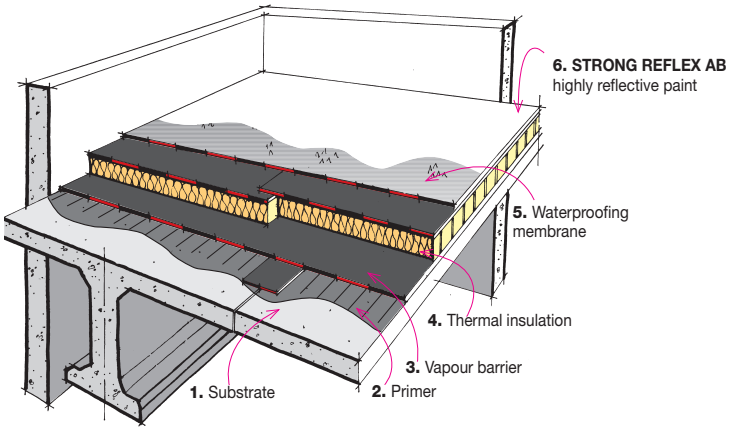
The EPA has drawn up the following strategies to combat the urban heat island effect:
- Increasing green areas, including roofs (Green Roofs)
- Cooling roofs with reflective paint or membranes (Cool Roofs)
- Cooling urban pavement surfaces, including terraces (Cool Pavements)

SOLAR REFLECTANCE INDEX

STRONG REFLEX AB
Solar Reflectance Index
SRI 114

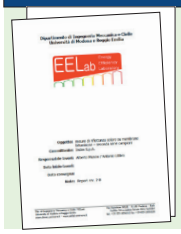
SOLUTION

The cool roof technique, in which roofs are cooled by increasing their reflectance, has proved to be a highly successful approach.
Using white coatings based on titanium dioxide has proved to be more effective than using reflective metal surfaces.
STRONG REFLEX AB is a two-component white coating pigmented with titanium dioxide, consisting in a water-based emulsion of polymers and special additives.
It dries to form an elastic film which is resistant to atmospheric agents and UV.
STRONG REFLEX AB is used to protect polymer-bitumen membranes: its white finish and the special additives not only extend the life of the roof coverings but also reduce the temperature, both outside and inside the building.
The high reflectance of **STRONG REFLEX AB** (0.89) significantly reduces heat absorption in comparison with a dark roof, increases occupant comfort in the summer and satisfies the limits for cool roofs set out in Annex 1 of Italian Inter-ministerial Legislative Decree 26/06/2015 for both flat and pitched roofs; the results are a considerable reduction in temperature and greatly reduced costs for air conditioning both residential buildings and livestock sheds in the summer.
The high level of infrared emissivity (0.89) also promotes the dissipation of heat accumulated overnight.
In urban areas, roofs coated with **STRONG REFLEX AB** do not overheat in the sun and contribute to the reduction of the urban heat island effect. The temperature reduction and the light diffused by the reflective coating increase the efficiency of solar panels installed on the roof.
The performance of the panels does indeed decrease by approximately 5% for every 0.5°C deviation from the temperature of 25°C (temperature at which best performance is obtained).
Painting roofs with **STRONG REFLEX AB** yields an **SRI** (Solar Reflectance Index) **of 114**, which amply satisfies the criteria of established environmental protocols (CAM PANGPP, ITACA, ***LEED***) for *sustainable construction*.



ACCORDING TO EUROPEAN NORMS
EN 1504-2
CONCRETE SURFACES PROTECTION
C
PI-MC-IR
PROTECTIVE COATING

TEST REPORT



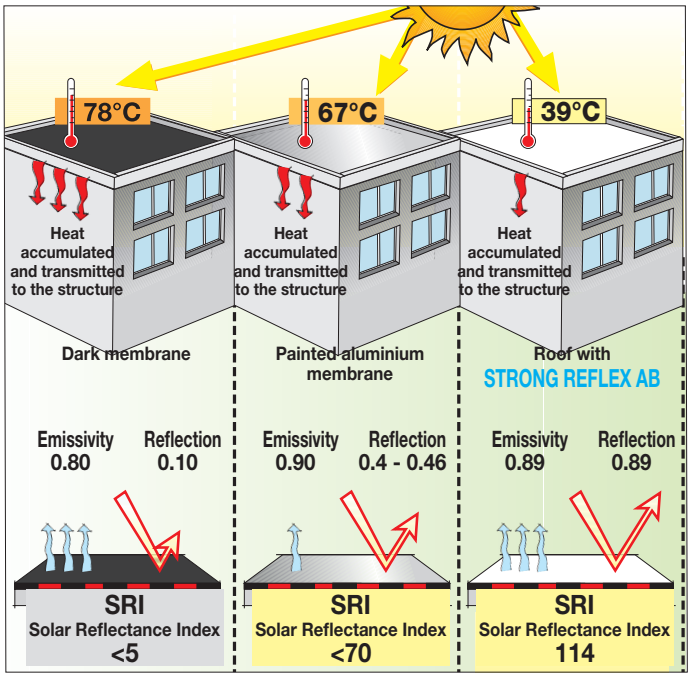
Solar reflectance test report
Department of Mechanical and Civil Engineering
University of Modena and Reggio Emilia

ation Fields

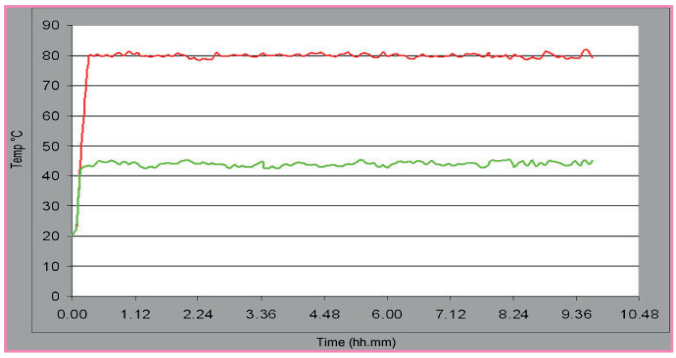
• **RESIDENTIAL AND INDUSTRIAL CONSTRUCTION**
STRONG REFLEX AB coating can be used not just on bituminous coverings but also on plaster, concrete, metal panelling, roof tiles and corrugated bitumen panels. It is used to protect the exposed bituminous coverings of residential and industrial buildings, with the benefits discussed above.

Advantages

- **Reduces the surface temperature of roofs exposed to the sun.**
- **Improves thermal insulation reduces the cost of air conditioning in the summer.**
- **Increases the efficiency of photovoltaic panels.**
- **Reduces the urban heat island effect**
- **Extends the life of the bituminous waterproof covering.**
- **Water-based, solvent free, easy to apply.**
- **Satisfies the requirements of Annex 1 of Italian Inter-ministerial Legislative Decree 26/06/2015 the criteria of environmental protocols for sustainable construction (CAM PANGPP, ITACA, LEED).**



GRAPH COMPARING THE TEMPERATURE OF BITUMEN POLYMER MEMBRANES PAINTED WITH WHITE REFLEX AND UNPAINTED MEMBRANES



Black bitumen polymer membrane
Roof protected with WHITE REFLEX

• LIVESTOCK SHEDS

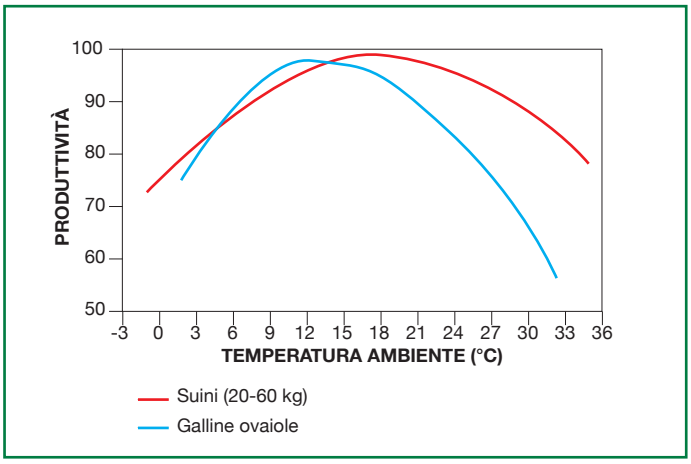
The materials and system offered by Index contribute not only to the wellbeing of human users but also to that of livestock in intensive farming applications, which generally use lightweight shed roofs which transmit heat due to sunshine directly into the interior.

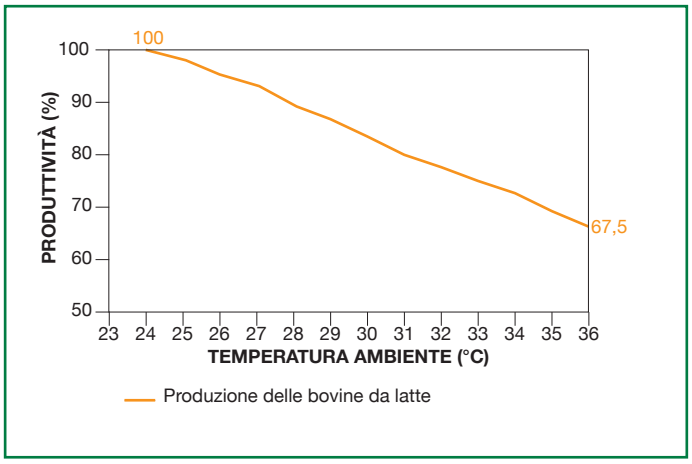
Metal roofs are very common, and corrugated fibre cement roofs are even more so; the latter are often made of asbestos cement which can be remediated with INDEX systems (see “Specification 12 – Rehabilitating asbestos cement roofs"). The roofs often also provide poor quality thermal insulation and combining reflective coatings with insulation increase the roof's performance even in the winter, by reducing its thermal dispersion.

In upgrading livestock shed roofs the benefits of a cool roof are experienced by the livestock itself, which is affected by heat stress in the summer, since it is very difficult to control the micro-climate in the shed due to the metabolic heat generated by the animals themselves.

This is an application of considerable economic importance, since heat stress in the summer can be injurious to the animals, degrading both their health and fertility, the quality and productivity of hens and the milk production of cows, as well as reducing the growth of rabbits, cattle and swine.

for an example, see the following graphs, which show how the productivity of swine (20 - 90 kg), laying hens and milk cows varies with the ambient temperature.

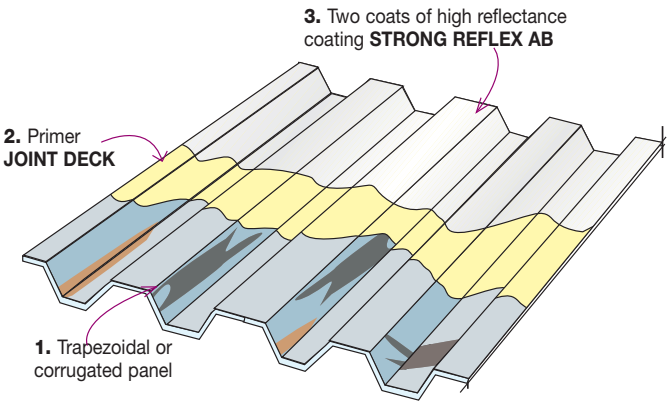




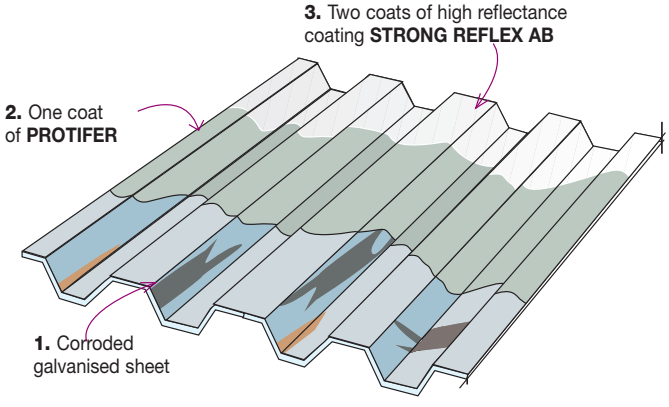
Examples of livestock shed cool roofs

For painting roofs which do not require REMEDIATION (in contrast with asbestos cement roofs): corrugated or trapezoidal metal panels, corrugated fibre cement panels or corrugated bituminous fibre panels, use **STRONG REFLEX AB ultrareflective coatings.**

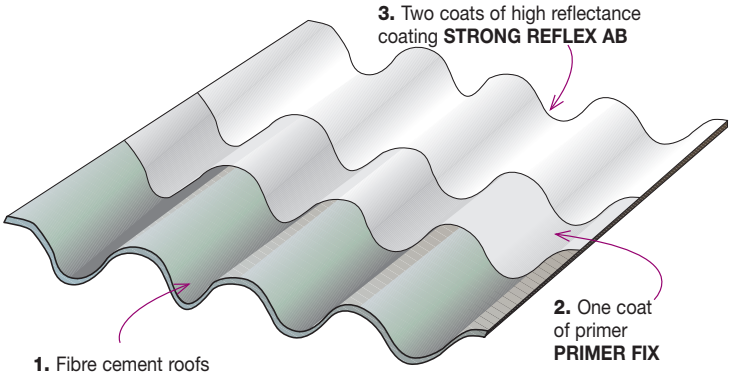
TRAPEZOIDAL OR CORRUGATED PANELS IN GOOD CONDITION



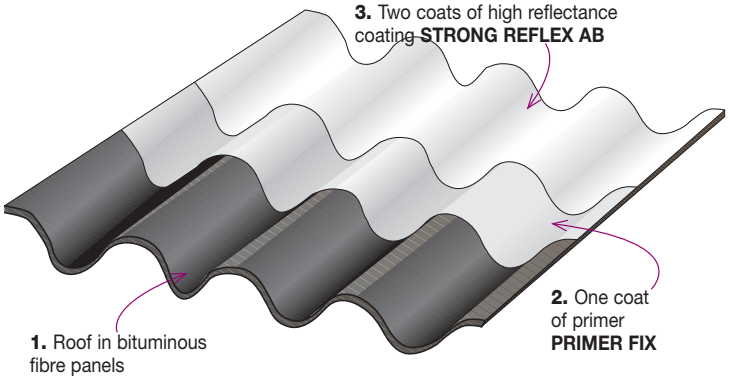
CORRODED GALVANISED SHEET



FIBRE CEMENT PANELS

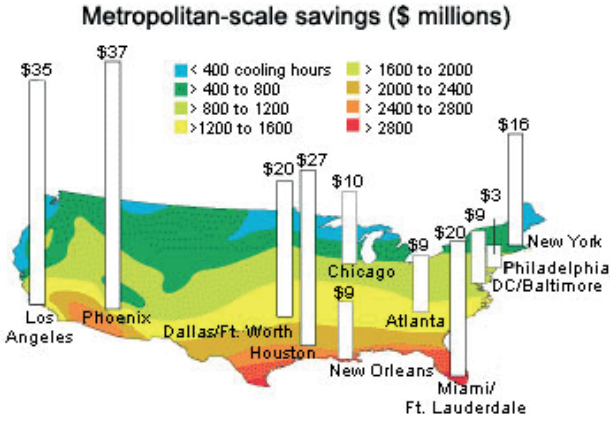


BITUMINOUS FIBRE PANELS



MONITORING ON ENERGY SAVING CARRIED OUT IN THE USA

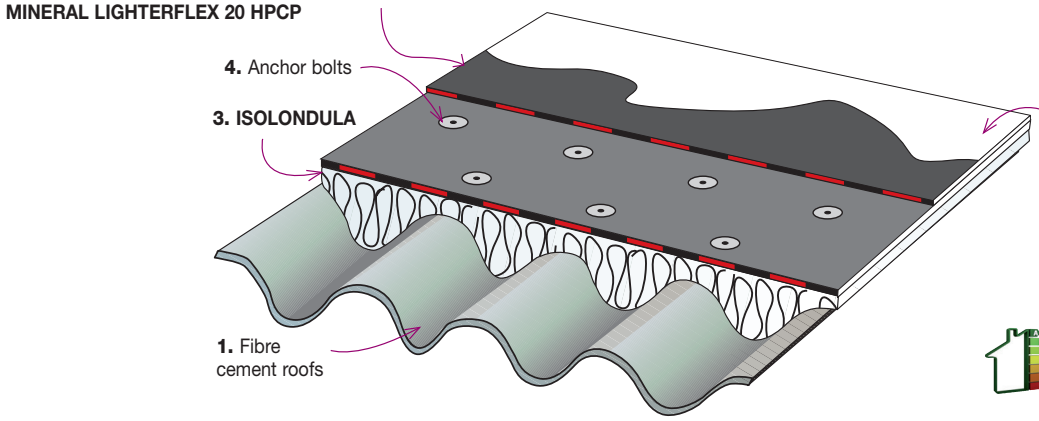
Monitoring carried out on 10 buildings in California and Florida has shown a reduction from 20% to 70% in the energy consumed due to air conditioning. The saving is most noticeable for roofs with little or no thermal insulation and in climatic zones characterized by hot and sunny summers. Even though painting the roofs of non-air-conditioned buildings does not generate energy saving, it does increase the internal comfort in summer. Research has demonstrated that in the majority of climatic zones in the USA, the energy saving on summer air conditioning obtained by painting is significantly larger than the winter energy penalty due to the lower absorption of solar heat in the cold season.
The estimate of the cost of the energy which could potentially be saved by painting the roofs of residential and commercial buildings, calculated for 11 American cities representing various climates (Los Angeles, Phoenix, Dallas, Houston, Chicago, New Orleans, Atlanta, Miami, Baltimore, Philadelphia, New York), amounts to 195 million dollars per year.



The graph shows the potential urban energy saving in some large US cities if the roofs of the residential and commercial buildings were painted with paints such as WHITE REFLEX

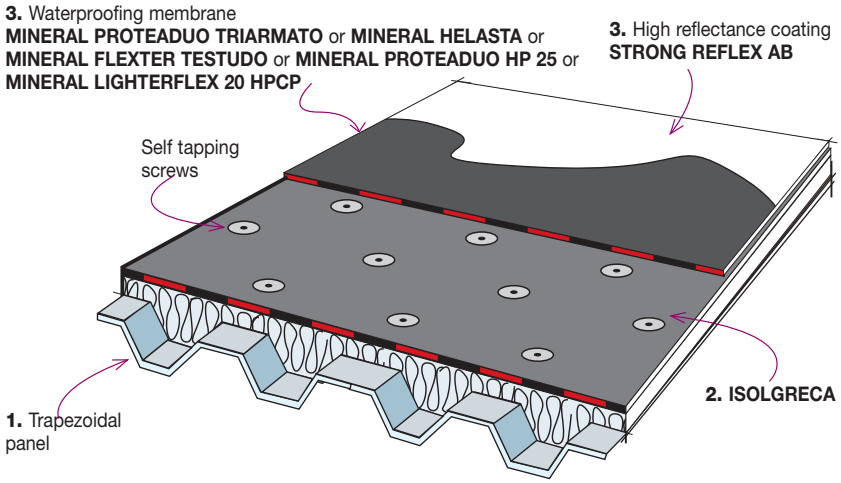
Energy requalification of livestock shed roofs

The "Stability Law" 2016 (law n. 208, 28 December 2015) extended the tax deduction of 65% for energy requalification of buildings to 31 December 2016. From 1 January 2017, the incentive will be replaced by the tax deduction of 36% for restoration projects. For thermally insulating corrugated fibre cement roofs, use ISOLONDULA thermal insulation panels, themselves protected by a slated waterproofing layer to which **STRONG REFLEX AB ultrareflective coating can be applied.**



Energy requalification

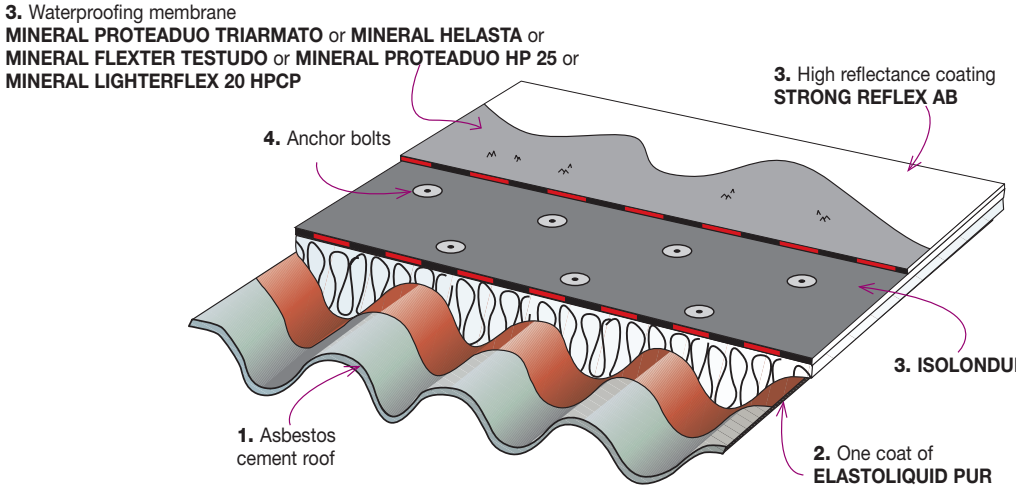
For thermally insulating trapezoidal or corrugated panel roofs, use ISOLGRECA or ISOLONDULA, themselves protected by a slated waterproofing layer to which **STRONG REFLEX AB ultrareflective coating can be applied.**



Energy requalification

Remediation of asbestos cement and energy requalification with cool roofs

For REMEDIATING corrugated asbestos cement roofs (pursuant to UNI 10686, March 1998, Annex 2, enacted by Decree on 20 August 1999, extension of the Law of 27 March 1992, n. 257.): Following encapsulation of the asbestos cement fibres with ELASTOLIQUID PUR, ISOLONDULA may be used for the OVERCOATING – TYPE C, itself protected by a slated waterproofing layer to which **STRONG REFLEX AB** ultrareflective coating may be applied.



Energy requalification

CERTIFICATION OF SUSTAINABLE CONSTRUCTION PROJECTS

The attestation of the environmental quality of a building in relation to a specific protocol is a tool for assessing the environmental impact of the building in a holistic manner. ***LEED*** certification, which was devised in the USA, is a voluntary initiative which has become widespread all over the world. It is promoted in our country by the GBC Italia, whose main aim is to encourage sustainable building on the Italian market through the ***LEED*** system, developed over more than 10 years' experience by USGBC. In this sense GBC Italia is aiming to make use of the result of the work carried out by USGBC in the USA and adapt the various aspects tackled by it to the Italian situation. The American experience has led to the development of environmental protocols for sustainable public buildings in Italy as well, for instance:

• The **ITACA protocol** (iiSBE Italia, SB Tool, Associazione delle Regioni Italiane) approved 15 January 2004 by the Conferenza delle Regioni e delle Province Autonome (Conference of Regions and Autonomous Provinces), now enacted as UNI/PdR 13.1:2015
• The **CAM** (minimum environmental criteria) of PAN-GPP (National Action Plan for Green Public Procurement), Legislative Decree 12-4-2006 n. 163 Public contract code for works, services and supplies, enacting European Directives 2004/17/EC and 2004/18/EC, Law n. 221/15 enacted 02.02.2016 provides for mandatory Green Public Procurement – Ministerial Decree 24 December 2015 containing the CAM for public construction activities.

Limit environmental protocol values for COOL ROOFS

STRONG REFLEX AB satisfies:
• Reflectance on bituminous surfaces of 0.89 for **STRONG REFLEX AB**, certified by the EELab of the University of Modena and Reggio Emilia, creates a cool roof which satisfies the solar reflectance criteria for both flat and pitched roofs as demanded by Annex 1 of Italian Inter-ministerial Legislative Decree 26/06/2015 enacted on 01/10/2015, solar reflectance no less than:
- 0.65 for flat roofs
- 0.30 for pitched roofs.

• The Solar Reflectance Index (SRI) for bituminous surfaces of 114 for **STRONG REFLEX AB** certified by the EELab of the University of Modena and Reggio Emilia, creates a cool roof which satisfies the limits:
- of the **CAM** of the National Action Plan for Green Public Procurement (PAN-GPP) of Ministerial Decree 24 December 2015 enacted on 2 February 2016, point 2.2.3 Reduction of impact on the micro-climate and of atmospheric pollution - Waterproof surfaces: of which requires that high Solar Reflectance Index materials must be used, as follows:
Roofs must have an SRI of at least 29, for slopes of more than 15%, and at least 75 for slopes of no more than 15%.
- The requisites of **the ITACA protocol - UNI/PdR** 13.1:2015, point C. 6.8, Heat Island Effect, of which demands an SRI of at least:
- 78 for flat surfaces or surfaces sloping by no more than 8.5°;
- 29 for sloping surfaces with slope greater than 8.5°.

• the requisites of the ***LEED*** protocol - GBC ITALY "To design, build and renovate institutional and commercial buildings" of 2009 updated on 9 February 2016 under the item SS CREDIT 7.2 - Heat island effect: roofs

TYPE OF ROOF	SLOPE	SRI
Shallow pitched roof	≤15%	78
Steeply pitched roof	>15%	29

• The requisites of the ***LEED*** protocol – GBC ITALY, HOME RESIDENTIAL BUILDINGS short 2015 under item SS CREDIT 5 – HEAT ISLAND EFFECT, GREEN ROOFS OR HIGH REFLECTANCE ROOFS. Create an extensive green roof covering or use roofing materials with a Solar Reflectance Index (SRI), measured 3 years after installation, equal to or greater than the values indicated in the table below over a minimum of 75% of the roof surface. If information about the SRI 3 years after installation is not available, materials with an initial SRI may be used.

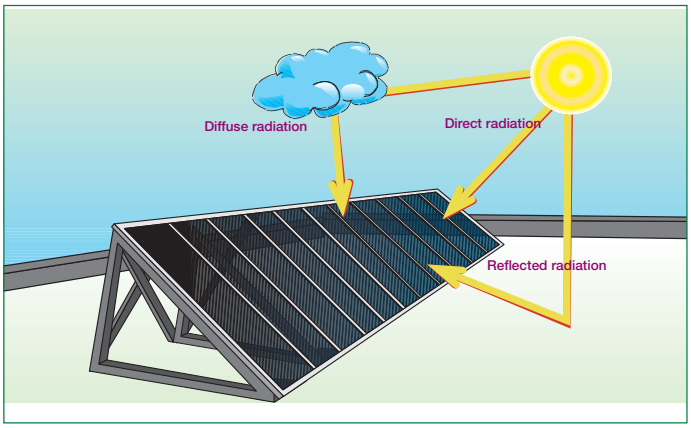
TYPE OF ROOF	SLOPE	SRI	SRI 3 years after installation
Shallow pitched roof	≤15%	82	82
Steeply pitched roof	>15%	39	39

FLAT ROOFS AND RENEWABLE ENERGY

The trend of architecture for sustainable building is not limited to the design of a "conservative" envelope from an energy point of view, but current design research intends to make the building envelope perform an "active" energy role.
Flat roofs allow substantial freedom in the orientation of the installations for solar collection both for solar thermal power and photovoltaic solar power.
STRONG REFLEX AB coating, with a double effect, also provides a significant increase in the energy performance of the photovoltaic solar panels to be installed on the flat roof, both because they reduce the temperature of the covering and therefore increase the performance of the panels which are more efficient if they work at a lower heat regime, and because they increase the diffused and reflected light which is added to that collected by direct radiation.

Sunlight

The total sunlight incident on the photovoltaic module has three components: direct, diffuse and reflected.
The **direct sunlight** is that part of the light that strikes the module directly, for instance during cloudless days.
The **diffused sunlight** is that portion of the direct radiation which is diffused as it passes through clouds and airborne particles, so that the module generates energy even on cloudy days, although to a lesser extent.
The **reflected sunlight** is that portion of the sunlight which is reflected towards the module by its surroundings, for instance when the roof is covered with snow.
The reflected radiation thus depends on the material surrounding the module, so that the output of the panel can be increased by taking suitable action.



Using a **STRONG REFLEX AB** coating, which keeps the waterproof covering at around 40°C, reduces the temperature of the rigid crystalline silica module by 10 - 20°C, thus increasing its output by 3 - 8%. The output of photovoltaic panels increases with the brightness of the environment.
STRONG REFLEX AB reflective coating increases the albedo and thus improves the output of photovoltaic panels.
The combination of the two effects results in an estimated increase in the output of conventional photovoltaic panels (made of crystalline or polycrystalline cells) of 4 - 10%. To demonstrate and validate the above assertion.

Modalità d'impiego

• SURFACE PREPARATION
Surfaces must be clean, dry and free from impurities or old paint. They must also be washed with water to remove the water-soluble reddish dust and any loose talc residues (**1**).
For new, talced and sanded membranes, it is essential to prime the surface with PREPAINT - Index, as indicated in its technical data sheet. PREPAINT is a fixer and insulator which allows unseasoned bitumen polymer membranes to be coated.

• PREPARATION
Thoroughly mix the 2 components **slowly adding Component A to Component B** to obtain a uniform paste.

• APPLICATION
Apply the first coat after diluting it with water (around 5%); apply the second coat to the completely dry surface (at least 8 hours). The amount of dilution depends on the type of surface and the environmental conditions.
Always apply two coats, preferably in a crosswise pattern. The product can be applied with a brush, roller, large brush or spray gun.
The surfaces must be pitched sufficiently to drain rainwater. Over time, stagnant water leads to the accumulation of dirt and hence a reduction in the reflectance and performance of the photovoltaic panels.
To keep the reflectance and therefore the efficiency high, periodic maintenance of the surfaces is recommended, with a visual inspection and removal of the dirt by washing with a water jet cleaner.
For application on metal sheet roofs, apply a coat of JOINT DECK gripping primer first, according to the methods indicated in the relative technical data sheet.
When applying on concrete, any holes, cavities or cracks must be evened up using RESISTO UNIFIX mortar.
Apply a first coat insulating sealant, diluting the product with 30% of water. If the surfaces are particularly porous and powdery, apply PRIMER FIX or BETON PRIMER S acrylic primer, as detailed in the respective technical data sheets.
The application on curved or other roof tiles will follow the same procedures as for concrete, and in this case a spray application is recommended (**2**).

• CONSUMPTION
The consumption depends on the type and porosity of the support.
The consumption per coat, on aged smooth membranes is about 350 g/m², whereas on slated membranes, it is about 500 g/m².
As a waterproof coating, consumption is 1.5 kg/m² per 1 mm of thickness. If reinforced, the consumption increases to 2 kg/m².

• PRECAUTIONS

- It can be applied on surfaces subject to the occasional presence of stagnating water. The waterproofing must however be arranged appropriately to drain rainwater efficiently.
- Do not apply on wet or damp surfaces.
- Do not use for tanks, cellars or drains subject to high water counterthrust or to water under pressure.
- Do not use the product for surfaces or containers in contact with liquids for human consumption, drinking water or which may come into contact with solvents or mineral oils.
- Mix the product well before applying.
- Keep the containers sealed before use.
- Apply at temperatures between +5°C and +35°C. Extreme conditions of heat and cold must be avoided during application. Do not apply if the temperature is likely to drop below +5°C while the paint film is drying. Do not apply on very hot substrates because the paint filming process would be unduly accelerated with negative consequences on the cohesion and adhesion of the product to the substrate.
- Do not apply in very humid conditions or if it threatens to rain while the film is still drying.
- Apply the second coat only when the first coat is perfectly dry.
- The product cannot be walked on except for routine maintenance.
- New, freshly applied bituminous surfaces usually have superficial 'outcrops' of hydrocarbons, which prevent the coating from adhering perfectly. You are recommended to apply the product to the surface no earlier than 6 months after they have been laid, which should be long enough to eliminate such "outcrops". Sometimes 6 months waiting is not always sufficient and we therefore advise you to assess the surface before applying the product by carrying out experimental tests using sticky tape in order to evaluate the amount of dirt present and feasibly the level of adhesion (the tests are described in the booklet entitled "Waterproofing Guide"). If the surface is dirty, clean by brushing and washing with water. For new, talced and sanded membranes, if you cannot wait for the membrane to season or if there is talc residue or surface outcrops, it is essential to prime the surface with PREPAINT, as indicated in its technical data sheet. Slated or fabric finished membranes (texflamina) may be coated immediately after installation even without using the fixer, once the surface has been thoroughly cleaned.
- The product applied onto polymer-bitumen membranes placed on insulation packs, may over time form surface micro-cracking. This, however, will not affect the waterproofing in any way.
- After use, clean tools with water and, if the product has already dried, we advise you to use white spirit or hot water to remove it.
- The product is subject to freezing; store at temperatures >+5°C.

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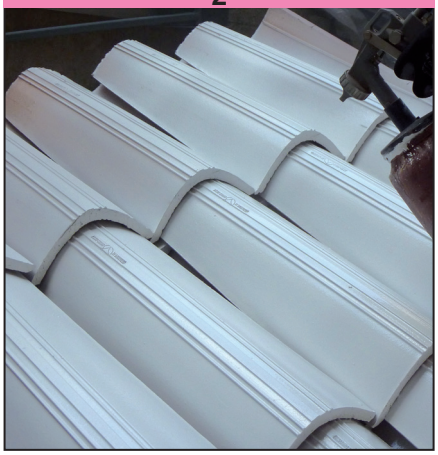

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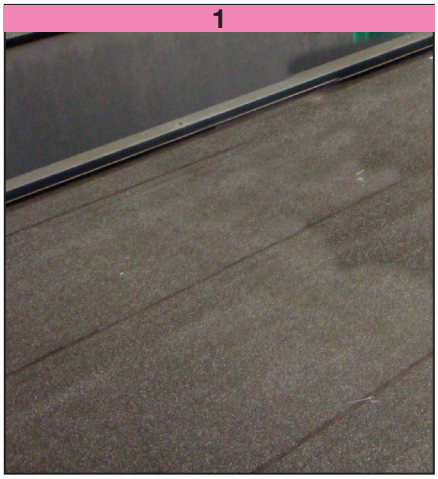

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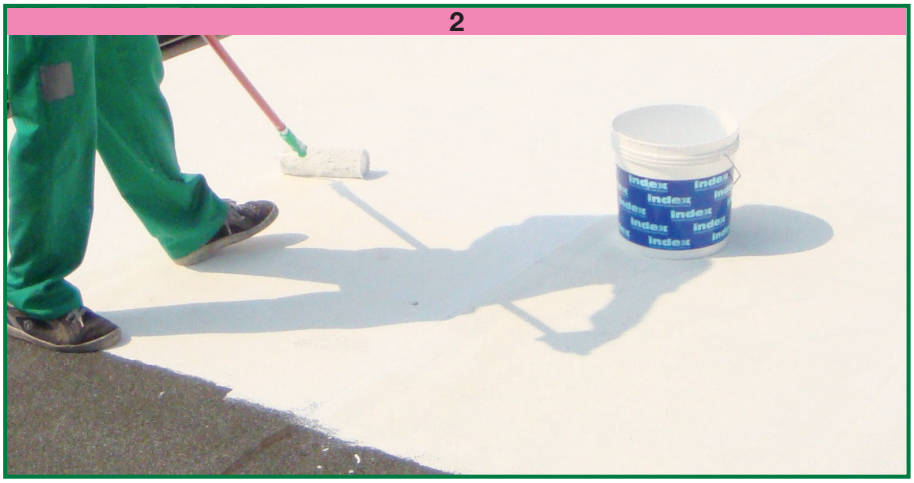

TECHNICAL CHARACTERISTICS

	Standard	STRONG REFLEX AB	
		COMPONENT A	COMPONENT B
Appearance		Liquid	Pasty liquid
Mix ratio		14	1
Density	EN 2811-1	~1.35 kg/L	~1.08 kg/L
Dry residue - at 130°C	UNI EN ISO 3251	71%	68%
Colour		White	
Storage in original packaging in a dry place, away from frost		6 months	
Workability characteristics			
Density		~1.37 kg/L	
Application thickness		0.2 - 0.4 mm (in two coats)	
Waiting time - till tack-free drying (*)		approx 2 ÷ 4 hours	
Waiting time - for applying each coat over the previous one (*)		8 hours	
Waiting time - for total dry (*)		approx 24 ÷ 48 hours	
Application temperature		+10°C to +30°C	
Application		manual or spray	
Performance characteristics	**Standard**	**Product performance**	
Class and type	**EN 1504-2**	**C PI-MC-IR**	
Permeability to water vapour	**EN 7783**	Sd <5 m - class I	
Permeability to CO_2	**EN 1062-6**	Sd >50 m	
Water absorption through capillarity	**EN 1062-3**	w ~ 0.01 kg/m²·$h^{0.5}$	
Adhesion test	**EN 1542**	≥1.5 MPa (flexible system with traffic)	
Fire reaction class	**EN 13501-1**	E	
Fire reaction class in system with POLYFOIL TRIATEX		B_{roof}(t2)	
Hazardous substances		see SDS - Accordint Note 1 - ZA.1	
Cold flexibility	**UNI 1109**	–25°C	
Solar reflectance	**ASTM E-903-12**	0.89 (**)	
Emissivity in the infrared	**ASTM C-1371-15**	0.89 (**)	
SRI (Solar Reflectance Index)	**ASTM E-1980-11**	114 (**)	
Reduction in temperature - over black membrane (75° to 80°C)	**Met. interno**	40 ÷ 45°C	
Exposure to artificial weathering - QUV Test	**EOTA TR 010**	No change evident	
Tear resistance	**ISO 37**	~ 35%	
Ultimate tensile strength	**ISO 37**	~ 4 MPa	
Thermal resistance - Working temperature		–25°C ÷ +80°C	

Test conditions: temperature 23±2°C, 50±5% R.H. and air velocity in test area <0.2 m/s. **These parameters may vary based on the specific conditions of the worksite: temperature, humidity, ventilation, porosity of the substrate.**
(*) The stated times may be longer or shorter as the temperature decreases or increases.
(**) Test report Department of Mechanical and Civil Engineering - University of Modena and Reggio Emilia
Compliant with the general principles defined in **EN 1504-2** - Principles for evaluation of the use of products and systems.

Duration over time

Solar reflectance tends to diminish over time due to the deposition of dust and dirt onto the white surface. Measurements taken at laboratories of research institutes indicate a fall in the solar reflectance of **STRONG REFLEX AB** of about 10% after two years of exposure to the open air. These results are in line with studies conducted at authoritative research institutes:

- The Florida State Energy Center has estimated a maximum reduction of 11% after two years without any cleaning or maintenance.
- Studies conducted by LBNL (Lawrence Berkeley National Laboratory) indicate that there is a larger percentage reduction in the first year and it slows considerably in subsequent years.

We therefore recommend periodic cleaning of the roof to keep solar reflectance high. The studies mentioned above advise repainting roofs roughly every ten years.

Packaging

- Component A: 14.00-kg-Pail
- Component B: 1.00-kg-Can

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A SIKA COMPANY
INDEX Construction Systems and Products S.p.A.
Via G. Rossini, 22 - 37060 Castel D'Azzano (VR) - T. +39 045 8546201 - Fax +39 045 518390

www.indexspa.it
Informazioni Tecniche Commerciali: tecom@indexspa.it
Amministrazione e Segreteria: index@indexspa.it
Index Export Dept.: index.export@indexspa.it

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