TECHNICAL FOCUS

SUSTAINABILITY AND ENERGY EFFICIENCY IN ROOFING

An engine driving development and economic revival

POLYGLASS®

MAPEI GROUP

SUSTAINABILITY AND ENERGY EFFICIENCY IN ROOFING

An engine driving development and economic revival

SUSTAINABLE DEVELOPMENT
REFERENCE STANDARD

REQUISITI MINIMI DEGLI EDIFICI E DELLE COPERTURE

ITALIAN LEGISLATION: MINISTERIAL DECREE (D.M.) 26.06.2015

Ministerial Decree D.M. 26.06.2015 - Application of methods for calculating energy performance and definition of building standards and minimum requirements - is the legislative instrument on building energy efficiency in effect in Italy.
The Decree calls for a number of checks to be carried out, including **checking** the envelope of each building for formation of **mould and interstitial condensation**. In addition, it introduces the fundamental issue of **energy performance requirements**, determined by means of the transmittance (U-value) of the envelope's clear and opaque surfaces, divided into Italy's different climate zones (for both new builds and refurbishments).
The 2015 update also introduced standards for the **energy efficiency** of buildings **under summer conditions**, which has thus become a more prominent issue.

Summer energy consumption rates for industrial or commercial buildings can be as much as ten times higher than winter consumption rates, and a highly reflective roof can reduce annual energy requirements by more than a third.

Appendix 1 to the decree explicitly states:
"in order to limit energy requirements for air-conditioning in summer and keep indoor temperature down, and to limit overheating in urban areas, the use of certain systems in building roofing structures **must be checked for efficiency** in terms of cost-benefit ratio, more specifically:
a) Cool roofing materials, to have a **SOLAR REFLECTANCE rating of at least**:
- 0.65 in the case of flat roofs
- 0.30 in the case of pitched roofs
b) Passive HVAC technologies (including by way of example, but not limited to, ventilation, **green roofs**).
The above-mentioned checks and assessments are to be documented in a technical report as explained in section 2.2 of the Decree (D.M. 26.06.2015).
Essentially, the aim of the lawmakers is to underline the **requirement for designers to assess the cost-benefit ratio** whenever they design a roof or demolish/rebuild/extend an existing one.
For a solution to qualify as a cool roof, it is also required to meet the reflectance values set out in the Decree.

REFERENCE U-VALUES
TABLE FROM APPENDIX A U-value of horizontal or sloping opaque **roofing** structures, denoting heat transfer to outside and non-heated interiors

	U [W/m²k]	
Climate zone	As of 1st October 2015	As of 1st January 2019/2021
A-B	0,38	0,35
C	0,36	0,33
D	0,30	0,26
E	0,25	0,22
F	0,23	0,20

MAXIMUM U-VALUES ON EXISTING BUILDINGS
TABLE FROM APPENDIX B Horizontal or sloping opaque **roofing** structures, to outside in refurbishment projects.

	U [W/m²k]	
Climate zone	As of 1st October 2015	As of 1st January 2019/2021
A-B	0,38	0,35
C	0,36	0,33
D	0,30	0,26
E	0,25	0,22
F	0,23	0,20

THERMAL TRANSMITTANCE *as laid down by Italian legislation (D.M. 26.06.2015) for roofs, in the case of new builds (table 1) and refurbishment work (table 2) for the various climate zones.*
Transmittance is the main parameter used to calculate heat loss through a building's envelope. It is defined as the amount of heat energy exchanged by a body or material per unit of surface area (square metre) and unit of temperature difference (degree Kelvin); accordingly, the unit of measure is W/m²K.

SUSTAINABLE DEVELOPMENT
REFERENCE STANDARD

PUBLIC TENDERS AND VOLUNTARY CERTIFICATION

ENVIRONMENTAL COMPLIANCE - ITALIAN LEGISLATION (CAM - D.M. 11.10.2017)

In Italy, an additional set of requirements has been adopted for the building, renovation and maintenance of public buildings. Known as CAM (which stands for minimum environmental criteria in Italian), the system is in line with environmental protection strategies already widely adopted internationally.
The adoption of these environmental requirements relates to the **Italian decree dated 11 January 2017** (published in the Official Gazette issue no. 23 on 28-1-2017), **as subsequently amended with decree DM 11 October 2017** - which covers minimum environmental criteria that must be met in order to award a contract for design services and work for the new build, renovation or maintenance of public buildings - part of Italy's National Action Plan on Green Public Procurement (PAN GPP).
Art. 18 of Italian law 221/2015 was then introduced to ensure this set of environmental requirements would be effective, followed by the addition of art. 34 "Energy and environmental sustainability criteria" to the **Italian Public Contract Code - D.lgs. 50/2016** (amended by decree D.lgs 56/2017), which **made their application compulsory by all contractor**s bidding for public contracts.

ROOFING AND ENVIRONMENTAL COMPLIANCE

When it comes to roofing, the following environmental criteria can be met:
- Section **2.2.6 Reduction of the impact on the microclimate and atmospheric pollution**
It calls for the use of materials with a high solar reflectance index (SRI): the **preferred option for roofing should be a living** (green) **roof**; in the case of non-green roofs, the materials used must deliver an **SRI rating of at least 29% when dealing with a slope greater than 15%; and at least 76% for roofs with a slope less than or equal to 15%**.

- Section **2.3.6 Building maintenance plan**
The designer is required to present a maintenance plan focusing specifically on monitoring performance levels to ensure lasting environmental compliance, such as going back to check the roof's ongoing performance against the SRI requirements set out in point 2.2.6.

- Section 2.4.1. Criteria common to all building components:

2.4.1.1 Disassemblability
At least 50% of the weight by weight of the building components of prefabricated elements - except for plants - must qualify for **selective demolition so that they can be recycled or reused** at their end of life. Non-structural materials must account for at least 15% of this percentage.
This credit is checked with the list of recyclable or reusable materials and components, giving their weight out of the total weight of materials used in the building.

2.4.1.2. Recovered or recycled materials
The recovered or recycled content of the materials used for the building - which includes taking into account different percentages for each material - must be equal to or greater than **15% by weight** calculated against the total of all materials used. **Non-structural materials** must account for at least **5%** of this percentage. A deviation from this percentage is allowed for synthetic waterproofing membranes, as also confirmed in point **2.4.2.6 Plastic components** in chapter 2.4.2 Specific criteria for building components.

Waterproofing systems still count towards environmental compliance in terms of recycled content and their weight compared to the total weight of the materials used for the building.

The recycled content is checked with the Type III **EPD** Environmental Product Declaration (in compliance with standard UNI EN 15804 and standard ISO 14025), or other product certifications.

2.7.3 Assurances

The manufacturer provides contractors with assurance regarding the material through maintenance and installation procedures that ensure the component will perform as designed.

Polyglass also helps earn credits under criterion 2.1.1. environmental management system, which comes under chapter 2.1. selection of ISO 14001 accredited candidates.

LEED

LEED (Leadership in Energy and Environmental Design) is a **voluntary system for rating the building as a whole**, based on the design, construction and operation of highly energy efficient green buildings. **Referring to the whole structure**, it certifies the building's environmental impact and sustainability.
Developed in the US in the early '90s, it is now applied in over 100 countries across the globe. In Italy, LEED was introduced by the **Green Building Council Italia in 2008** and provides an all-encompassing approach to sustainability, awarding points for desirable performance in key areas of human and environmental health.
LEED standards **give requirements for constructing buildings that are environmentally sustainable** in terms of both energy and the consumption of all environmental resources involved in the construction process.
The certification system is based on a series of **credits awarded for seven different environmental categories**. It involves meeting compulsory requirements and a number of environmental performance standards, that together determine the building's final score:

Sustainable sites (SS)

Historic Value (HV)

Water Efficiency (WE)

Energy and Atmosphere (EA)

Materials and Resources (MR)

Indoor Environmental Quality (IEQ)

Regional Priority (RP)

The designer gathers data for the assessment and determines the type of certification based on the sum of the credits earned in the various categories: certified (40-49 points), silver (50-59 points), gold (60-79 points), platinum (more than 80 points).

The current relevant set of standards is **LEED V4.1**., for which credits can be earned, in the roof department, with cool roofs or green roofs.
For **cool roofs, credits can be earned**: under Category 1 - **Sustainable Sites (SS) - credit 7.2 - Heat Island Effect: Roof**, according to this **acceptance criterion**:

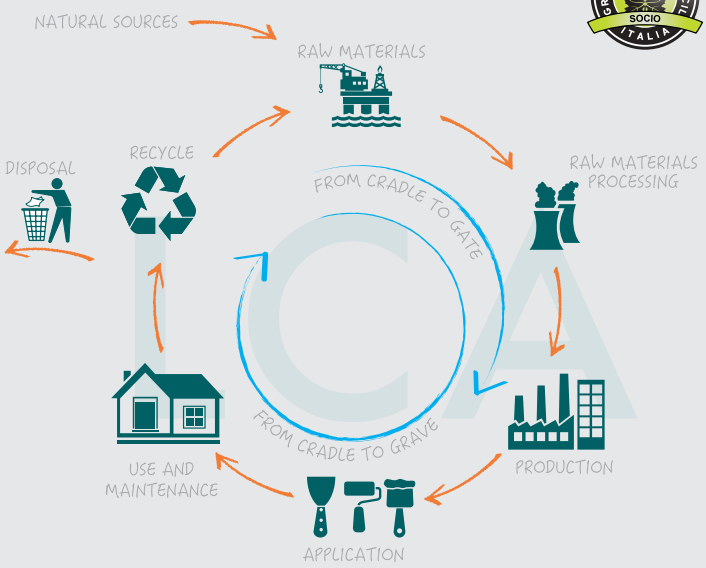
Use roofing materials with a Solar Reflectance Index (SRI):
SRI>82% (for roofs with a slope ≤15%)
SRI>39% (for roofs with a slope >15%)

LEED credits can also be earned with **green roofs**:
under Category 1 - Sustainable Sites (SS) - **credit 5.1 Site Development: Protect or Restore Habitat**, as it helps protect natural green areas and promote biodiversity;
Credit 5.2 Site Development: Maximize Open Space;
Credit 6.1 Stormwater Design: Quantity Control, as it allows the stormwater regime to be optimized, drawing a large amount into the substrate and reusing it for irrigation;
Credit 6.2 Stormwater Design: Quality Control, given the filter effect of the soil and vegetation;
Credit 7.1 Heat Island Effect: Non-Roof, for car parking areas planted with vegetation;
Credit 7.2 Heat Island Effect: Roof, for buildings with green roofs.

In addition, packaging made from materials that are easy to separate and recycle counts towards LEED credits under Materials and Resources, Construction and Demolition Waste Management.
The product's recycled content, while not counting towards additional credits directly, provides designers with an additional significant piece of data to be included on the building's overall LEED certification documentation.

EPD - DAP

The EPD® - **Environmental Product Declaration** - is a **voluntary product certification** scheme developed in conjunction with the application of standard ISO 14025 (Type III environmental labelling), according to the International EPD System programme.



Thus, the EPD is a document that **allows us to share objective, comparable, credible information on the environmental impact associated with the product's life cycle**. The information contained on the EPD is provided merely as a guide to environmental performance and does not set out performance thresholds.
The EPD is drawn up according to the Product Category Rules (PCR), which define the principles and requirements for compiling EPDs for a specific product category or service. The identification and quantification of the product's environmental impact refers to the **Life Cycle Assessment (LCA)**, which takes into consideration every stage, from extraction of the raw materials through to transport, manufacturing and disposal, in accordance with the ISO 14040 standards, which ensure that the data collected are correct and objective.

SUSTAINABLE DEVELOPMENT
OTHER ASPECTS OF A PRODUCT

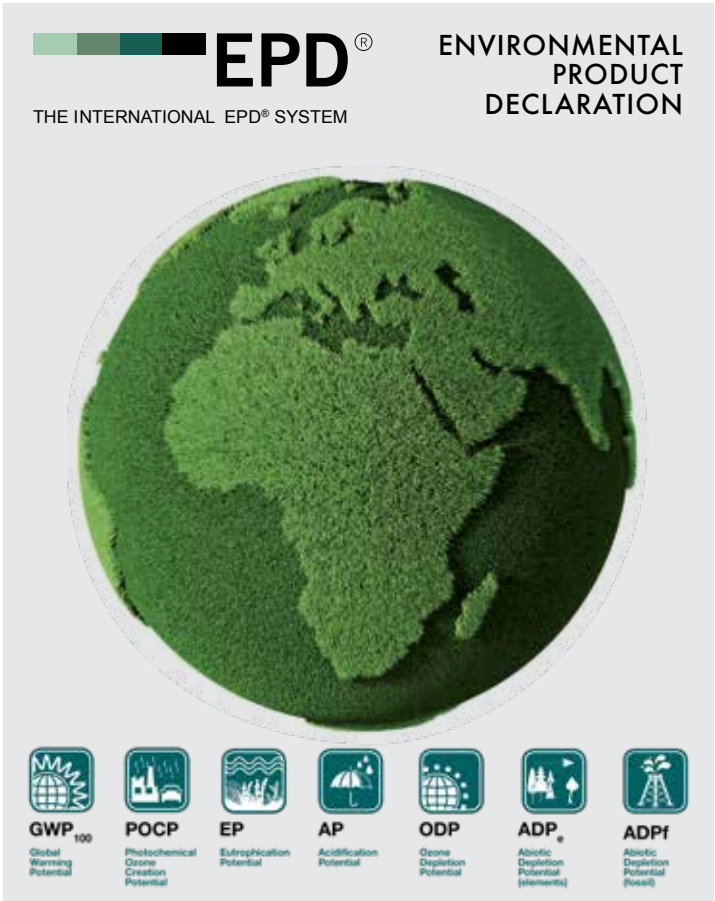
ETHICS AND THE MADE IN ITALY BRAND

Care for the environment and the pursuit of innovative products that improve energy efficiency have always been cornerstone values for Polyglass.
Since 2017, Polyglass, together with other Italian affiliates, has been included in the Sustainability Report, which presents Mapei Group initiatives in environmental, social and economic domains.
UNI EN ISO 9001 certifications: 2008, UNI EN ISO 14001: 2004 and product marking according to standards EN 13707, EN 13969 and EN 13956 are the confirmation and demonstration of Polyglass' commitment to the continuous improvement of performance in terms of pollution prevention and promoting workplace health and safety.
In addition to a focus on sustainability, Polyglass has put in place a Code of Ethics and an HSE service to monitor and promote a culture of **health, safety and environmental awareness**.
Corporate ethics and **100% Italian-made** products constitute an additional assurance of quality and reliability.

POLYGLASS BY THE NUMBERS

HSE (Health, Safety, Environment)
UNI EN ISO 14001
4 million euros on HSE
3,000 hours of safety training

- 30% OF ENERGY PRODUCED WITH COGENERATION
- WATER USED IN PRODUCTION PROCESS 100% RECYCLED
- PRODUCTION SCRAP 100% RECYCLED
- PACKAGING MATERIALS REDUCED BY 70%
- REDUCED CO_2 EMISSIONS



ENERGY EFFICIENCY
COOL ROOF

Cool roofs are roofs that are highly effective in reflecting incident solar radiation, while also emitting thermal energy at infrared wavelengths. In other words, they feature high solar **reflectance and thermal emissivity ratings**. Cool roofs, therefore, are roofs that have a **low surface temperature**, even over the summer months and in direct sunlight.

ADVANTAGES OF COOL ROOFS

Even leaving aside for a moment the advantages on the environmental sustainability front, there is no reason for not producing a cool roof. In fact, it is a successful strategy for extending the service life of the whole roof package.

INCREASED ROOF LIFE EXPECTANCY
Reducing surface temperature limits the ageing of materials as a result of heat.

COMFORT
With the reduction in surface temperature, the rooms below also enjoy cooler temperatures.

FINANCIAL SAVINGS
Lower energy requirements for summer cooling, with a decrease in peak power demand.
Tax relief.

IMPROVED PHOTOVOLTAIC EFFICIENCY
Photovoltaic panels deliver top performance at a constant, lower temperature.

IMPROVED ROOF PERFORMANCE
When it comes to winter heating, too, as thermal insulation panels last longer.

REDUCED HEAT ISLAND PROBLEMS
Makes a real contribution to limiting overheating in urban areas.

PARAMETERS OF A COOL ROOF

SOLAR REFLECTANCE

A measure of the ability of a material or surface to reflect incident solar radiation. It is expressed as a value between 0 and 1 (where 0 is a surface absorbing all solar radiation, and 1 is a surface that is a perfect reflector) or as a percentage.
Reflectance is strictly linked to the **colour of the surface**: the lighter the surface, the higher its level of reflectance. Surface temperature thus stays low even in direct sunlight, hence limiting the flow of heat entering.
It is worth noting that a variation in the reflectance rating from 0.60 to 0.80 results in a building requiring **a third less energy over a year**.

THERMAL EMISSIVITY

A measure of the ability of a material or surface to disperse heat. It is expressed as a value between 0 and 1 (where 0 is a surface absorbing all radiated heat; and 1 is a surface transferring all heat to the environment in contact with it) or as a percentage.

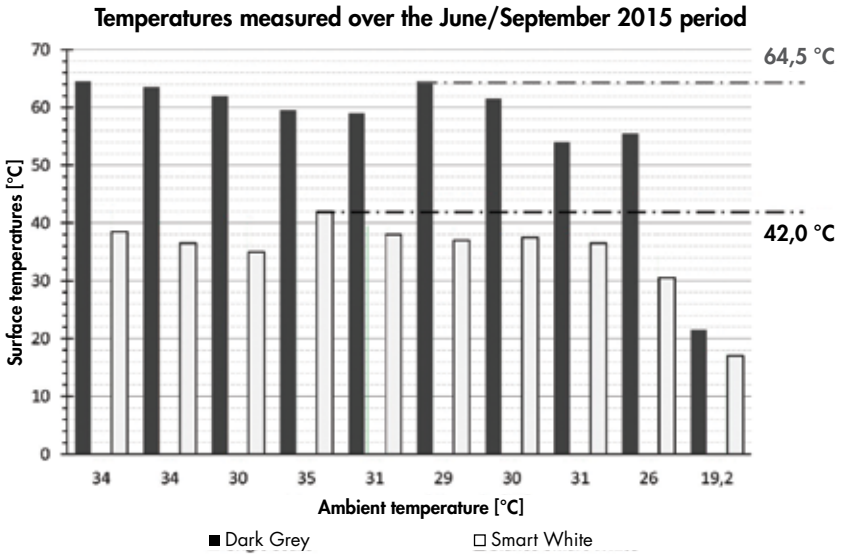
SRI (SOLAR REFLECTANCE INDEX)

The value of the combined impact of solar reflectance and thermal emissivity of a material or surface, calculated according to standard practice ASTM E1980 at three different wind conditions (low, medium, high).
It is expressed as a percentage but, being based on a calculation method with reference surfaces and values, can have values greater than 100%.

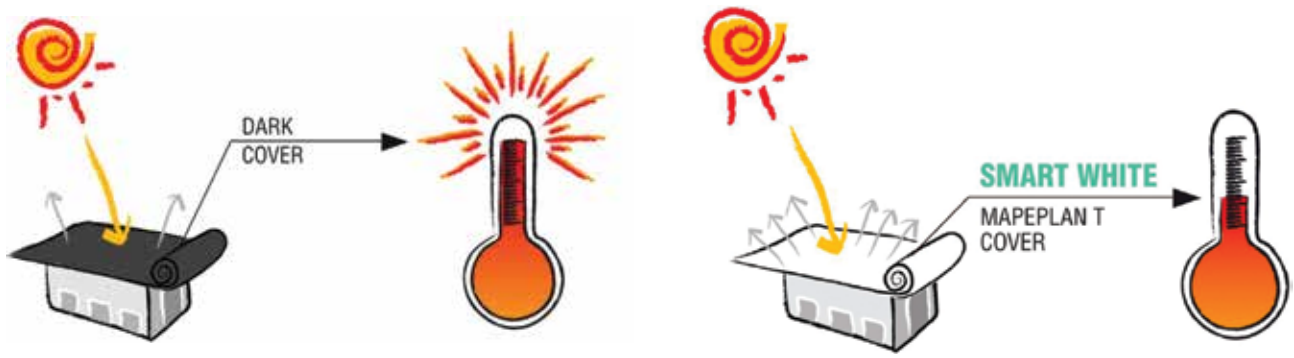
FIELD TESTS

Polyglass has developed a test to check the actual behaviour of roofs over the summer months.
Over the summer of 2015 (one of Italy's hottest summers in recent decades), Polyglass measured the surface temperature of two waterproofing membranes with **different coloured top layers**: dark grey and Smart White. Measurements were taken every day for three months (from June to September) at the hottest time of day (2 pm) and revealed that on the **Smart White coloured** surface, **the temperature was approx. 20-25 °C lower than the dark grey colour**, confirming the interdependence between colour, solar reflectance and surface temperature. The difference in temperature between the Smart White membrane and its grey counterpart is consistent whether the system used involves synthetic membranes - with temperatures varying from 65 °C for the grey compared to approx. 40 °C for the white - or bitumen membranes, with temperatures varying from 80 °C to approx. 50 °C.
The test thus demonstrates that a cool roof contributes significantly to improved energy efficiency, by reducing the heat transmitted inside by as much as 80%, and hence has a significant impact **on the building's energy bills**.

A variation in solar reflectance from 0.6 to 0.8 results in a building requiring a third less energy over a year.



Graph comparing surface temperatures measured between June and September 2015 on membranes with different coloured surfaces: dark grey and white.



ENERGY EFFICIENCY
ROOF GARDENS

Roof gardens are gaining increasing attention in the environmental sustainability sphere due to the benefits that they have on the actual building, on the urban ecosystem and on people's lives.
Their use is **promoted through tax relief and, sometimes, is a statutory requirement**: for example, in Italy, some areas have restrictions imposed by landscape and cultural heritage conservation law (D.lgs. 42/2004). Shopping centres, supermarkets, office districts and hospitals are featuring more and more in green roof projects.

ADVANTAGES OF ROOF GARDENS

INCREASED ROOF LIFE EXPECTANCY
Protects from UV rays, the elements, and mechanical wear and tear.
Reduces surface temperature.

COMFORT
Thanks to the additional mass on the roof, which improves thermal insulation and soundproofing.

FINANCIAL SAVINGS
Lower energy requirements for summer cooling, with savings as high as 25%.
Tax relief.

IMPROVED PHOTOVOLTAIC EFFICIENCY
With surface temperatures being lower and more constant.

INCREASED SALE VALUE
of the building.

OPTIMIZED STORMWATER REGIME
Reduced and slower runoff into the sewer system due to rainwater being absorbed and slowly released by the soil and vegetation.

REDUCED PARTICULATE AND SMOG
Due to the absorption and retention effect provided by the vegetation

DECREASED HEAT ISLAND EFFECT, CO_2 EMISSIONS
and global warming.

BIODIVERSITY CONSERVATION

Roof gardens fall into two categories depending on the substrate thickness required. The latter results in different roof loads, which vary depending on the desired vegetation, which naturally involves different levels of care.

EXTENSIVE GREEN ROOF

Featuring thicknesses in the 7-15cm range, which is the minimum required for the growth of sedum, a special plant species. It has all the benefits of a roof garden, while minimizing the impact of the garden on the building structure and subsequent maintenance. Light weight, 60-250 kg/m^2.

INTENSIVE GREEN ROOF

With a substrate between 30 and 80 cm thick, which is the depth required to grow a lawn, shrubs and trees.
It turns roofs into great amenity spaces, though it also requires continuous, costly care. It has to be planned in greater detail to avoid significant issues later on during its service life.
It places significant loading on the building structure, 300-2,000 kg/m^2.

The reference standard for roof gardens in Italy is UNI 11235:2015 - Instructions for the design, execution, control and maintenance of green roofs - which sets out the essential layers of a green roof:

- **Load-bearing component**
  This must be sized to allow for permanent loads and accidental overloading (irrigation water, people and equipment required for its maintenance, etc.).
- **Waterproof component**
  Waterproofing layer protecting the building structure from water ingress. It usually also serves to protect against penetration by roots, and hence must be certified root resistant to EN 13948.
- **Mechanical protection component**
  The purpose of this layer is to protect the waterproofing from mechanical damage during the garden's construction and service.
- **Drainage layer**
  The purpose of this layer is to allow excess rainwater or irrigation water to drain away. Often incorporated into the reservoir layer so as to have a constant reserve of water that is available for absorption by the vegetation.
- **Filter component**
  Filter layer that stops the growing medium being washed into the layers underneath.
- **Growing medium layer**
  Blend of lapilli fragments, mineral sands, peat and organic soil serving as the growing substrate.
- **Vegetation layer**

FUN FACT: BIODIVERSITY

Today, biodiversity not only plays a significant ecological role, it is also of primary importance to ensure sustainability in the farming sector.
The fact that 71 out of the 100 crops accounting for 90% of foodstuffs worldwide are pollinated by bees says a lot, while most crops in the European Union also depend on insect pollination. Aside from the fundamental value of pollination for biodiversity conservation, its global annual monetary value is estimated to be in the hundreds of billions of euros.
Hence the European Union is now promoting and funding bee repopulation and beekeeping support schemes. In some countries, like the Netherlands, roof gardens are promoted as an important tool for bee and bumblebee repopulation.

ENERGY EFFICIENCY
MAPEPLAN® T M 18

FLEXIBLE POLYOLEFIN SYNTHETIC MEMBRANE FOR COOL ROOFS

MAPEPLAN® T M 18 is a 1.8 mm thick FPO/TPO flexible polyolefin synthetic membrane with a Smart White top layer, made with a mechanically very strong polyester mesh carrier, for building **loose-laid and mechanically fastened exposed roofs.**

MAPEPLAN® TM 18 does not contain substances that are detrimental or harmful to people or the environment and, being free from plasticizers and volatile substances, is a **highly eco-friendly** product. This latter trait means the membrane **retains its original properties in the long term**, with a **life expectancy that can stretch to several decades**.

Once the membrane reaches the end of its life cycle, it can be removed and recycled to produce new raw material (section 2.4.1.1 Disassemblability for environmental compliance purposes).

It can be used to produce **cool roofs given its high reflectance and SRI** rating, as required by current standards:

MAPEPLAN® membranes come with an EPD.

EN 12311-2	TENSILE STRENGTH ULTIMATE ELONGATION	N/50 mm %	≥ 1100 ≥ 15
EN 12691-A	RESISTANCE TO IMPACT	mm	≥ 600
EN 12691-B	RESISTANCE TO IMPACT	mm	≥ 1100
EN 12730-A	RESISTANCE TO STATIC LOADING	kg	≥ 25
EN 12730-B	RESISTANCE TO STATIC LOADING	kg	≥ 30
EN 12310-2	RESISTANCE TO TEAR	N	≥ 350
EN 1107-2	DIMENSIONAL STABILITY	%	≤ 0,3
EN 495-5	FLEXIBILITY AT LOW TEMPERATURE	°C	≤-40
ASTM E 1980	SRI (Solar Reflectance Index)	%	99
ENV 1187	EXTERNAL FIRE PERFORMANCE	B_{roof} (t1)	available on request

Solar Reflectance 0,81 > 0,65 required by Italian law (D.M. 26.06.2015)
Solar Reflectance Index (SRI): 102% > 82%; counts towards LEED credits and environmental compliance
Thermal emissivity: 0,91
MAPEPLAN® TM 18 comes in a version enhanced with special additives for the construction of B_{ROOF} (t2) fire-rated roofs accommodating photovoltaic systems:
Solar reflectance 0,79 > 0,65 required by Italian law (D.M. 26.06.2015)
SRI 99% > 82%; counts towards LEED credits and environmental compliance
Thermal emissivity: 0,92

PRODUCT FOCUS
POLYFLEX ULTRA P G F SUPER WHITE

POLYMER BITUMEN MEMBRANE FOR COOL ROOFS

POLYFLEX ULTRA P G F Super White is a 4mm-thick white mineral-surfaced plastomeric membrane with a heavyweight spunbond polyester nonwoven carrier, reinforced and stabilized with glass strands parallel to the machine direction.
The compound features flexibility at low temperature down to -20 °C, excellent **elasticity and good substrate adhesion**. The carrier gives **impressive tensile strength** and resistance to static loading, making POLYFLEX ULTRA P G F Smart White 4mm suitable for the most **demanding applications** and for single-layer use even on exposed roofs.
The technical properties of the carrier - especially its tensile strength determined according to EN 12311 - and the compound - with flexibility at low temperature down to -20 °C initially and -10 °C following ageing according to EN 1109 and EN 1296 - earn POLYFLEX ULTRA P G F SUPER WHITE an **S rating**, which denotes «superior» performance in polymer distilled bitumen membranes according to the guidelines given in the relevant **Code of Practice (issued by Italy's IGLAE institute)**, which is required for the membrane to be used in compliant build-ups.

In the Super White mineral-surfaced version, it can be used to produce cool roofs to improve energy efficiency and comply with the main standards:
Solar Reflectance 0,69 > 0,65 required by Italian law (D.M. 26.06.2015)
Solar Reflectance Index (SRI): 85% > 82%, counts towards LEED credits and environmental compliance
Emissivity: 0,94

POLYFLEX ULTRA polymer bitumen membranes come with an **EPD**.

EN 12311-1	MECHANICAL PROPERTIES TENSILE STRENGTH Longitudinal Transversal TENSILE ELONGATION Longitudinal Transversal	 N/50 mm N/50 mm % %	 950 (±20%) 700 (±20%) 55 (±15) 55 (±15)
EN 12691-A	RESISTANCE TO IMPACT	mm	≥ 1000
EN 12691-B	RESISTANCE TO IMPACT	mm	≥ 1200
EN 12730-A	RESISTANCE TO STATIC LOADING	kg	≥ 15
EN 12310-1	RESISTANCE TO TEAR Longitudinal Transversal	 N N	 200 (±30%) 250 (±30%
EN 1107-1	DIMENSIONAL STABILITY	%	≤ 0,3
EN 1109	FLEXIBILITY AT LOW TEMPERATURE	°C	≤ -20
EN 1109 EN 1296	FLEXIBILITY AT LOW TEMPERATURE AFTER ARTIFICIAL AGEING BY LONG-TERM EXPOSURE TO ELEVATED TEMPERATURE AFTER 180 DAYS AT 70 °C	°C	≤ -10

PRODUCT FOCUS
POLYSINT SUN REFLECT

PROTECTIVE LIQUID MEMBRANE FOR COOL ROOFS

POLYSINT SUN REFLECT is a water-based fibre-reinforced liquid membrane in white offering **high solar reflectivity**. It has **high thermal emissivity** and a **high solar reflectance index (SRI)**. It can be used on bituminous waterproofing and concrete structures. POLYSINT SUN REFLECT can be used to produce a cool roof with excellent energy efficiency performance, **halving surface temperature compared to grey/dark-coloured membranes**.
It also helps protect bitumen membranes, **avoiding deterioration as a result of UV radiation, dirt and smog build-up, and biological growths such as fungi, bacteria, etc.** In addition, it helps increase the longevity of the whole waterproofing system by lowering the build-up's surface temperature.
Where the roof is home to a photovoltaic system, it can be applied on **Futura RS 4 AF** mineral-surfaced bitumen membranes to get a **B_{ROOF} (t2) fire-rated cool roof**.

Solar Reflectance 0.83 > 0.65 required by Italian law (D.M. 26.06.2015)
Solar Reflectance Index (SRI): 105% > 82% counts towards LEED credits and environmental compliance
Thermal emissivity: 0.91

EN 12691-A	SOLIDS CONTENT	%	61,4
EN 13501-1	REACTION TO FIRE	Euroclass	B-s1-d0
ASTM E1980	SRI (Solar Reflectance Index)	%	105
ASTM E903	SOLAR REFLECTANCE	%	83
ASTM C1371	THERMAL EMISSIVITY	%	91

PRODUCT FOCUS
ROOF GARDENS

WATERPROOFING SYSTEMS

For the roof garden to be built correctly, a waterproofing system must be designed in compliance with current relevant regulations. The main requirements are:

- **Watertightness** and the ability to withstand the pressure of the water.
- **Resistance to root penetration** on both the continuous surface and at any point along the main overlaps or secondary seams, according to the standard **UNI EN 13948** test method to determine resistance to root penetration.
- **High dimensional stability and low coefficient of thermal expansion**, to avoid mechanical damage resulting from excessive movement of the waterproof component during application as well as during its service life.
- **High mechanical strength**, provided by the internal carrier.
- **Good flexibility at low temperature**, as an indicator of the waterproof component's good quality and longevity.

Test FLL and TEST UNI EN 13948

The **FLL** test is an internationally recognized test method for determining the resistance of materials applied on green roofs to penetration by roots and rhizomes. **The test method is the same as European standard UNI EN 13948**, but involves checking **the highly aggressive effect of rhizomes** - in addition to the action of just roots - by seeding and growing couch grass.
The test lasts 2 years and is carried out on 8 boxes lined entirely with the waterproof component, filled with a growing medium in which the vegetation is left to grow inside a greenhouse. The inclusion of the anti-root waterproofing membrane is in line with specific diagrams that include different kinds of seams and intersections, so that the various types of overlap typically found around more fragile design details are also tested. The bottom of the boxes is made from clear Plexiglas, thus allowing for visual inspection every six months. The material passes the test when, once the two years are up, with the vegetation thriving and having grown correctly, the membrane does not have any damage anywhere across the surface or along the flat and secondary seams.

PRODUCT FOCUS
ANTIRADICE EL C

POLYMER BITUMEN MEMBRANE FOR ROOF GARDENS

4 mm-thick plastomeric membrane with cold flexibility down to -20 °C, made with a composite spunbond polyester nonwoven carrier stabilized with glass mesh in both directions.
The carrier gives **very good mechanical properties** in terms of tensile strength, elongation, and resistance to impact and to static loading.
In addition, the addition of the glass mesh results in **optimal dimensional stability** <0.2%.
ANTIRADICE EL C 4 mm constitutes a chemical barrier against membrane puncture by plant roots as it is enhanced with a **special root inhibitor added throughout the membrane**, ensuring lasting perfect watertightness to standard EN 13948. This also allows it to withstand heat and moisture and means it is not water soluble.
The technical properties of the carrier and compound earn ANTIRADICE EL C an **S rating, which denotes «superior» performance** in polymer distilled bitumen membranes according to the guidelines given in the relevant Code of Practice (issued by Italy's IGLAE institute), which establishes that it can be used in all applications.

EN 12311-1	MECHANICAL PROPERTIES TENSILE STRENGTH Longitudinal Transversal TENSILE ELONGATION Longitudinal Transversal	 N/50 mm N/50 mm % %	 950 (±20%) 700 (±20%) 55 (±15) 60 (±15)
EN 12691-A	RESISTANCE TO IMPACT	mm	≥ 1000
EN 12730-A	RESISTANCE TO STATIC LOADING	kg	≥ 20
EN 13948	RESISTANCE TO ROOT PENETRATION	-	Pass
EN 1107-1	DIMENSIONAL STABILITY	%	≤ 0,2
EN 1109	FLEXIBILITY AT LOW TEMPERATURE	°C	≤ -20

PRODUCT FOCUS
MAPEPLAN® T B 18

FLEXIBLE POLYOLEFIN SYNTHETIC MEMBRANE FOR ROOF GARDENS

1,8 mm-thick FPO/TPO flexible polyolefin synthetic membrane with a Smart White top layer and fibre glass mat carrier.
The compound features excellent flexibility at low temperature, while the carrier gives very good resistance to impact, tensile strength and elongation, and excellent dimensional stability (≤0,2%).
The inherent nature of the polyolefins used to produce MAPEPLAN® T B means it is **impervious to roots and chemicals and passes the FLL test without the need for further additives**.

EN 12311-2	TENSILE STRENGTH ULTIMATE ELONGATION	N/50 mm %	≥ 9 > 550
EN 12691-A	RESISTANCE TO IMPACT	mm	> 800
EN 12691-B	RESISTANCE TO IMPACT	mm	> 1500
EN 12730-A	RESISTANCE TO STATIC LOADING	kg	> 15
EN 12730-B	RESISTANCE TO STATIC LOADING	kg	> 25
EN 12310-2	RESISTANCE TO TEAR	N	> 150
EN 1107-2	DIMENSIONAL STABILITY	%	< 0,2
EN 495-5	FLEXIBILITY AT LOW TEMPERATURE	°C	< -40
ASTM E 1980	SRI (Solar Reflectance Index)	%	102
EN 13948	RESISTANCE TO ROOT PENETRATION	FLL test	Pass

PRODUCT FOCUS
COMPLETA™

PRE-VEGETATED EXTENSIVE GREEN ROOF SYSTEM

COMPLETA™ is a modular pre-vegetated system for producing **low-maintenance extensive** green roofs. The module is made with an extremely **lightweight** drainage tray, which comes complete with vegetation, ready to be **simply laid on the roof, like a tile**, and is just as easy to **remove** should the roof require inspection. That way, the whole roof can be produced by a single specialist applicator, who can then handle subsequent maintenance.

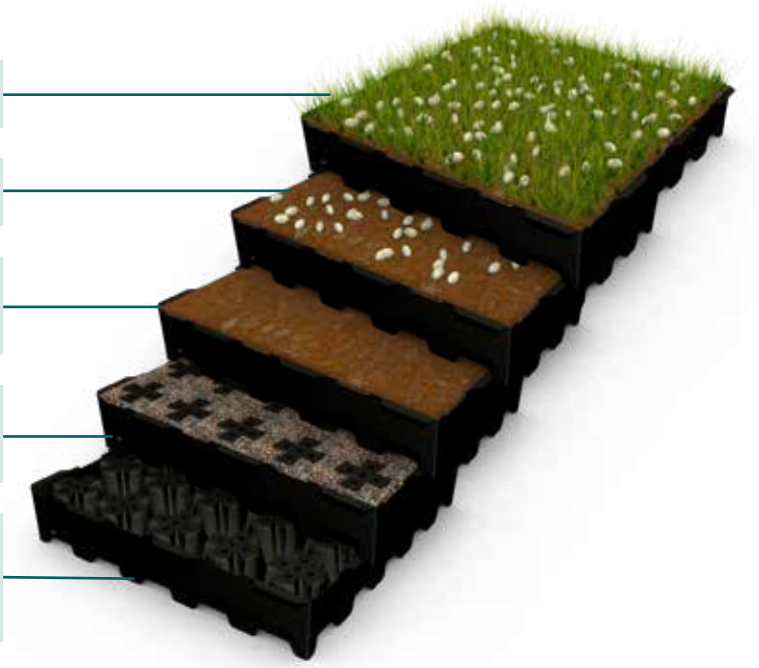
VEGETATION
Blend of sedum in various colours.

GRAVEL
Acts as a ballast and microclimate regulator.

GROWING SUBSTRATE
Volcanic pumice and lapilli fragments mixed with an organic medium.

DRAINAGE FILL
Produced with pumice, which serves as a drainage and moisture-retention layer.

RESERVOIR AND DRAINAGE LAYER
100% reclaimed polypropylene.
Made with supports that create a ventilated separating layer to drain any pooling water.



The COMPLETA™ system can be applied on cold roofs or warm roofs (with thermal insulation), up to a maximum slope of 30%, with root-resistant waterproofing systems, using **synthetic membranes** like MAPEPLAN® B and MAPEPLAN® T B, (figure A page 19) and on **polymer bitumen membranes** like ANTIRADICE EL C P (figure B page 19). A heavyweight nonwoven must be placed on top of the waterproof component to serve as mechanical protection and a reservoir layer.

COMPLETA™ SYSTEM SATURATED LOADING	kg/m²	65-70
DRAINAGE SURFACE AREA	cm²/m²	≥ 800
COMPRESSIVE STRENGTH	kg/m²	6000
WATER RESERVE TO BRIM	L/m²	20
MODULE DIMENSIONS	cm	54 x 54 x 9

IN SHORT, COMPLETA™:

Comes **complete with vegetation**.

Quick and easy installation, like a tile.

Modular system can be adapted to suit any situation.

Designed for easy removal for roof inspection.

Lightweight, 70 kg when saturated (half the weight of extensive gardens installed) means the building's load-bearing structure can be scaled back.

Shallow, 9 cm in total.

One-stop installer to produce the whole roof package.

Minimal **maintenance**.

Impressive green credentials with fully reclaimed module.

COOL ROOF
COMPLIANT BUILD-UPS

APPLICATION DETAILS

The roof system's design must always be assessed for compliance with relevant standards (in Italy**, standard UNI 8178-2** and relevant Code of Practice):
- product characteristics and specific application
- build-up complete with details and its correct installation

The design must come with a maintenance plan in compliance with the relevant standard (in Italy, **standard 11540:2014**).
Hence cool roofs require all the measures typically associated with exposed membranes. In the case of warm roofs (with thermal insulation), the thermal insulation component must be placed on top of a vapour barrier in order to **avoid the issues of interstitial condensation**. In addition, when dealing with roofs over interiors with high moisture levels, such as kitchens, swimming pools, etc. or in refurbishment projects, extra care must go into the build-up's design.
When laying the bitumen vapour barrier, the building structure's surface must be primed first to help the polymer bitumen membrane **adhere correctly**.

Different kinds of material can be used for the thermal insulation component:
- **PIR rigid expanded polyiso foam**: featuring **excellent thermal performance** (thermal conductivity lambda approx. 0,026 W/mK) and dimensional stability.
  For polymer bitumen membrane systems, the panel must be torch-compatible, with a bitumen-coated glass tissue facing and saturated glass fleece underside
- **EPS expanded polystyrene**: when dealing with synthetic membrane waterproofing, it must have a compressive strength of at least 150 kPa; while for polymer bitumen membrane waterproofing, it can be laminated with a bitumen membrane on top to enable torching. For improved thermal performance, you can also opt for EPS with graphite added.
- **Rock wool**: a n**on-combustible** material, it is sometimes chosen to produce $\mathbf{B_{ROOF}}$ certified roofs accommodating photovoltaic systems. Correct installation of synthetic membranes requires a compressive strength of at least **70 kPa** and point load strength of **650 N** to allow for welding machines to be used without issue. For roofs produced with polymer bitumen membranes, the panel must be laminated with a membrane on top for torching.

For correct roof system design, check the simplified table for the use of thermal insulation panels based on their compressive strength and intended use of the roof, Chapter 5 section 3.2.4 of the relevant code of practice (issued by Italy's IGLAE institute).
According to the Italian standard UNI 8178-2, the designer is also required to check the thermal insulation panel's deformation when compressed.

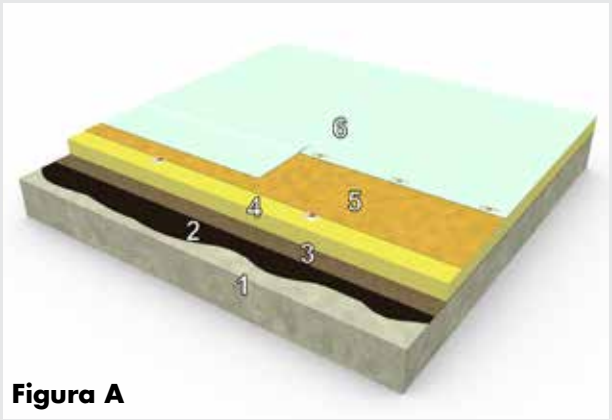


Figura A

1. Deck
2. IDROPRIMER or POLYPRIMER HP 45 Professional adhesion-promoting primer
3. POLYVAP RADONSHIELD P-AL or POLYVAP FIX P-AL vapour control layer
4. Mechanically fastened insulation layer
5. Fibre glass mat separating layer 120 g/m^2 - only required for certain B_{ROOF} fire-rated build-ups
6. MAPEPLAN® T M 18 waterproofing membrane (in B_{ROOF} version for fire-rated build-ups)

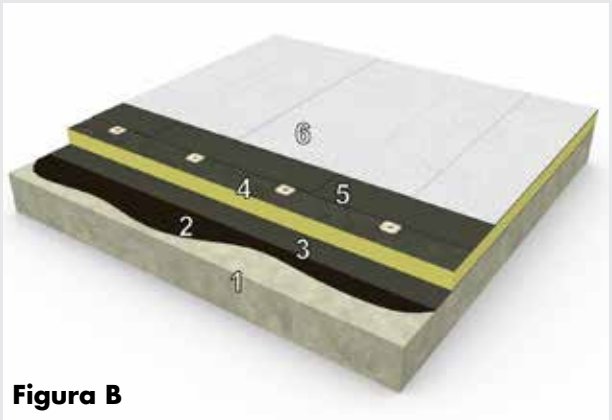
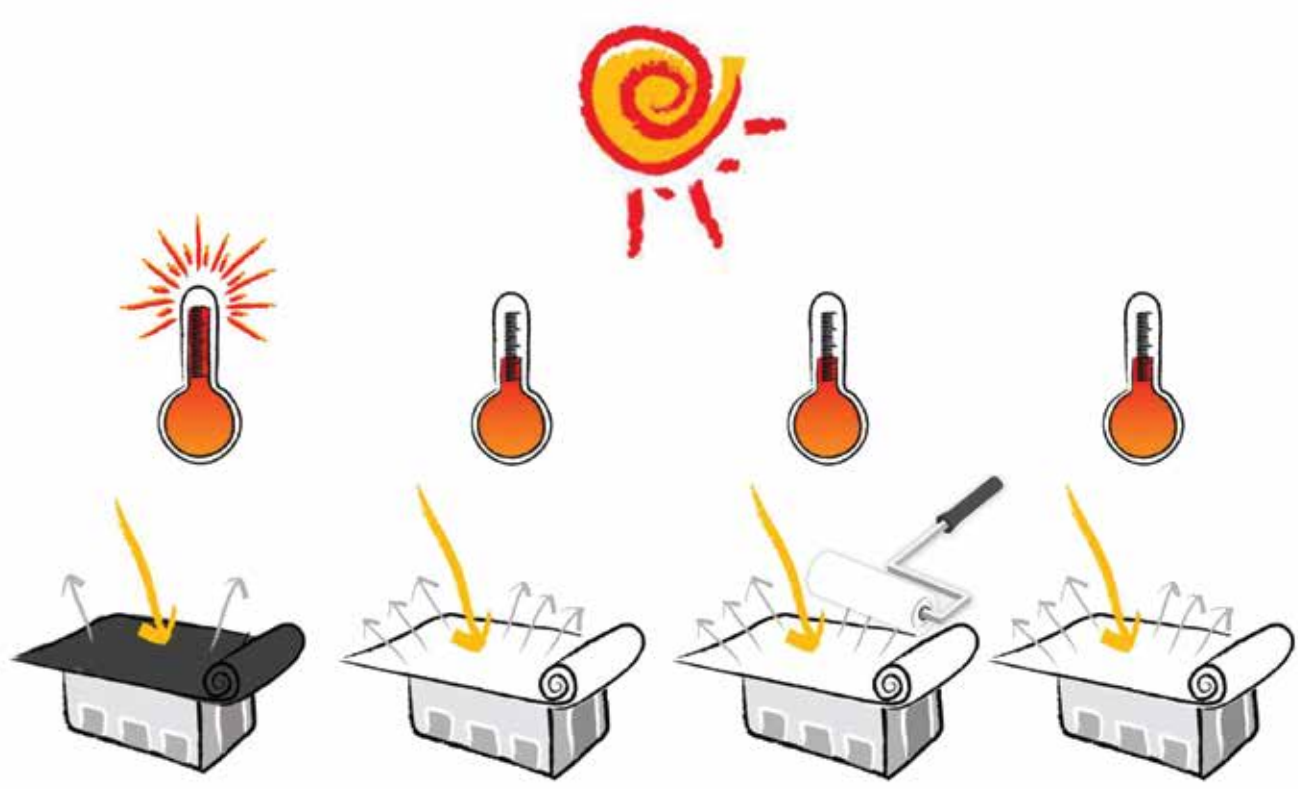


Figura B

1. Deck
2. IDROPRIMER or POLYPRIMER HP 45 Professional adhesion-promoting primer
3. POLYVAP RADONSHIELD P-AL or POLYVAP FIX P-AL vapour control layer
4. Mechanically fastened insulation layer
5. POLYFLEX ULTRA bitumen waterproofing membrane
6. POLYFLEX ULTRA P G F Super White bitumen waterproofing membrane

It is important to point out **that polymer distilled bitumen membranes laminated with insulation (insulation systems POLYSOL, POLYMANT and INCLIMANT) should never be regarded as a first waterproofing layer.**
On this note, the waterproofing system should always be produced with two membrane layers or with a certified **single-layer membrane (at least 5 mm thick)** as required by the relevant code of practice (issued by Italy's IGLAE institute).
The laminated membrane comes with a fibre glass mat carrier or polyester carrier. The polyester carrier is, to date, by far the preferred solution given its superior mechanical properties, which are required if panels are to be mechanically fastened.
After the insulation, the waterproofing system with the Smart White top layer can be laid to produce a highly reflective cool roof.
Care must also be taken to **eliminate any reflective surfaces on the roof** - such as the cladding on rooftop services, if any - **with the aid of mattifying paints**. This is because reflected light leads to a considerable increase in surface temperature (as much as double), which negates the building's energy efficiency and causes the surface of the polymer bitumen membrane to melt and the thermal insulation layer to deteriorate.

COOL ROOF
SYSTEMS COMPARISON



Grey membrane
Solar Reflectance 0,52
Solar Reflectance Index (SRI): 45%
Thermal emissivity: 0,91
Surf. temp: approx. 65-80 °C

Mineral-surfaced membrane in Super White
Solar Reflectance 0,69
Solar Reflectance Index (SRI): 85%
Thermal emissivity: 0,94
Surf. temp: approx. 45-55 °C

Membrane painted white with Polysint Sun Reflect
Solar Reflectance 0,83
Solar Reflectance Index (SRI): 105%
Thermal emissivity: 0,91
Surf. temp: approx. 40 °C

Synthetic membrane in Smart White
Solar Reflectance 0,81
Solar Reflectance Index (SRI): 102%
Thermal emissivity: 0,91
Surf. temp: approx. 40 °C

APPLICATION DETAILS

MECHANICAL FASTENING

The correct design of the mechanical fastening system - which applies to both thermal insulation panels and synthetic membranes - is laid down by current relevant regulations:

- Italian legislation (D.M. 17 January 2018 - NTC 2018)
- Calculation of wind action.
- Eurocode 1-4 (UNI EN 1991-1-4) - calculation of wind action where NTC 2018 technical standards prove inadequate.
- UNI 11442 - calculation of mechanical fixings.
- ETAG 006: guidelines for technical approval of fastening systems.

Here are some practical recommendations regarding the minimum requirements for mechanical fastening of synthetic membranes

- CONCRETE DECK

Compressive strength: class C12/15 or higher according to standard UNI EN 206.
Minimum thickness 40 or 60 mm depending on the type of fastening.
If it fails to meet the requirements, a 5 cm-thick cement sand screed can be produced on top.

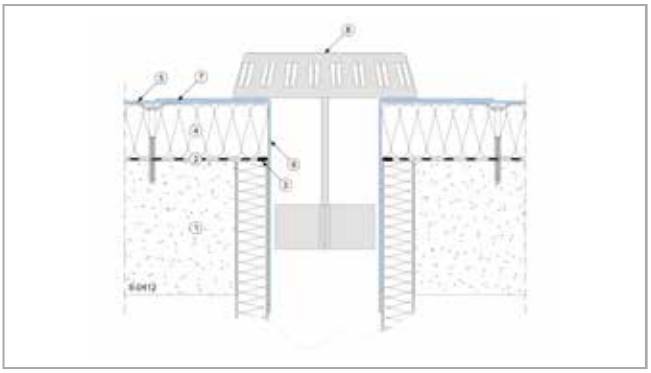
- PROFILED METAL DECK

Made from stainless or galvanized steel. Minimum thickness 0,75 mm.
Otherwise the use of peel rivets is compulsory (and is frequently advisable anyway).

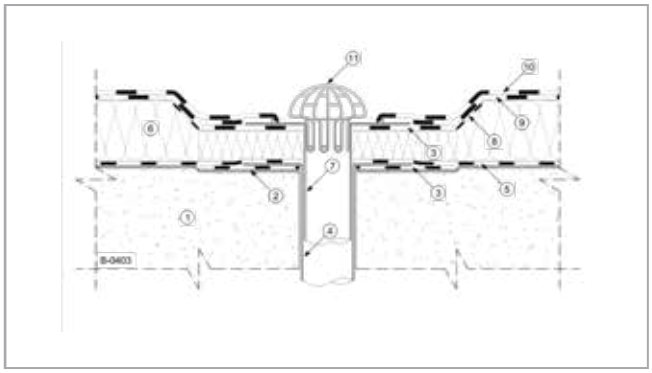
- DECK MADE FROM SANDWICH PANELS Use of peel rivets is compulsory.
- WOODEN DECK

OSB load-bearing panels according to UNI EN 300 - minimum thickness 18 mm.
Grade P5 particleboards according to UNI EN 312 - minimum thickness 19 mm.
C24 solid wood according to UNI EN 338 - minimum thickness 22 mm.

DRAIN OUTLET

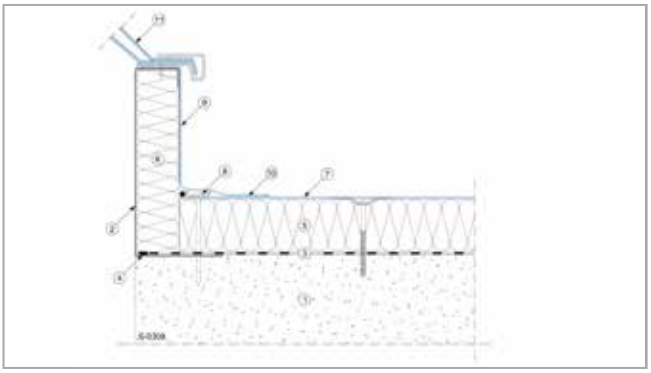


① Deck
② Vapour barrier layer sealed around outside edges and at overlaps (e.g. **IDROPRIMER** + **POLYVAP**)
③ Mechanically fastened thermal insulation layer
④ Mechanically fastened **MAPEPLAN® T M** waterproofing membrane
⑤ Weld
⑥ Perimeter sealing
⑦ Leaf/gravel guard
⑧ Drain outlet

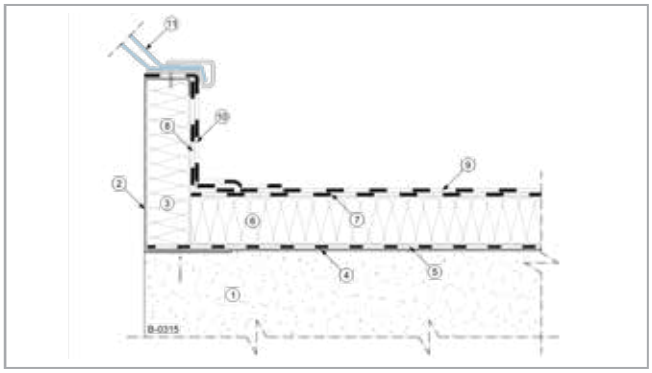


① Deck
② Adhesion-promoting primer (e.g. **IDROPRIMER**)
③ POLYGLASS waterproofing membrane patch under outlet 50 x 50 cm
④ Drain outlet for vapour barrier
⑤ POLYGLASS vapour barrier
⑥ Glued or mechanically fastened thermal insulation layer
⑦ Drain outlet
⑧ Junction with POLYGLASS self-adhesive membrane
⑨ POLYGLASS waterproofing membrane (first layer)
⑩ POLYGLASS waterproofing membrane (second layer) *1
⑪ Leaf/Gravel guard

SKYLIGHT JUNCTION

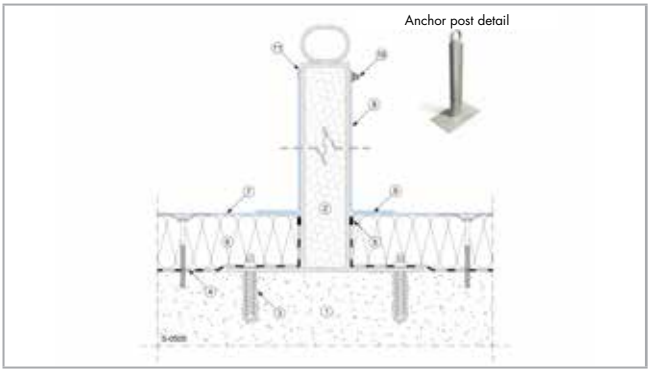


① Deck
② Vapour barrier layer sealed around outside edges and at overlaps (e.g. **IDROPRIMER** + **POLYVAP**)
③ Mechanically fastened thermal insulation layer
④ Mechanically fastened **MAPEPLAN® T M** waterproofing membrane
⑤ Weld
⑥ Perimeter sealing
⑦ **MAPEPLAN® METALBAR** mechanical fastening
⑧ Glued **MAPEPLAN® T** membrane
⑨ Polyurethane + glass fleece panel
⑩ Skylight base
⑪ Skylight

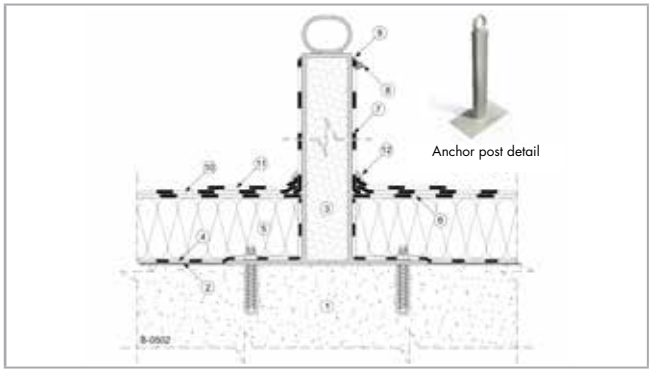


① Deck
② Metal base of skylight (galvanized sheet metal)
③ Filler insulation panel
④ Adhesion-promoting primer (e.g. **IDROPRIMER**)
⑤ POLYGLASS vapour barrier
⑥ Glued or mechanically fastened thermal insulation layer
⑦ POLYGLASS waterproofing membrane (first layer)
⑧ Membrane vertical turn-up (first layer)
⑨ POLYGLASS waterproofing membrane (second layer) *1
⑩ Skylight

FALL ARREST ANCHOR FASTENING



① Deck
② Vapour barrier layer sealed around outside edges and at overlaps (e.g. **IDROPRIMER** + **POLYVAP**)
③ Mechanically fastened thermal insulation layer
④ Mechanically fastened **MAPEPLAN® T M** waterproofing membrane
⑤ Weld
⑥ Perimeter sealing
⑦ **MAPEPLAN® T** covering
⑧ Stainless steel clamp
⑨ Sealing with **MAPEPLAN® SEALANT KIT**
⑩ Fall arrest anchor post
⑪ Fall arrest anchor fastening



① Deck
② Adhesion-promoting primer (e.g. **IDROPRIMER**)
③ Fall arrest anchor post
④ POLYGLASS vapour barrier
⑤ Glued or mechanically fastened thermal insulation layer
⑥ POLYGLASS waterproofing membrane (first layer)
⑦ POLYGLASS waterproofing membrane flashing *1
⑧ Stainless steel clamp
⑨ Sealant (e.g. **POLYDETAIL MS**)
⑩ POLYGLASS waterproofing membrane (second layer) *1
⑪ POLYGLASS waterproofing membrane top patch 40 x 40 cm *1
⑫ Sealant (e.g. **POLYDETAIL MS**, where necessary protected with slate chippings)

ROOF GARDEN
COMPLIANT BUILD-UPS

APPLICATION DETAILS

Roof garden build-ups have the same characteristics as ballasted roofing systems.
When it comes to thermal insulation, the **compressive strength required is at least 150 kPa**, hence the use of rock wool insulation is not an option.
For **inverted roofing** systems (with the thermal insulation on top of the waterproof component), you can opt instead to use XPS extruded expanded polystyrene panels, which feature high compressive strength (> 200 kPa) and good watertightness, and are loose laid.
When dealing with warm green roofs with polymer bitumen membrane waterproofing, it is advisable to protect the waterproof component with a concrete overlay, separated from the membrane by a macro-perforated polyethylene sheet and a pinhole-perforated PE sheet. There is **no need to produce the concrete slab when producing an extensive roof garden using the COMPLETA™ pre-vegetated system** as no further work is required on the roof, and there are no loads other than the weight of the modular system itself.
The waterproofing system must still be produced in **two layers**, the second of which should be enhanced with the addition of a root inhibitor, featuring **the same dimensional stability** (for example, POLYFLEX EL C 4 mm for the first layer and ANTIRADICE EL C 4 mm for the second layer, both having a dimensional stability ≤ 0,2%).

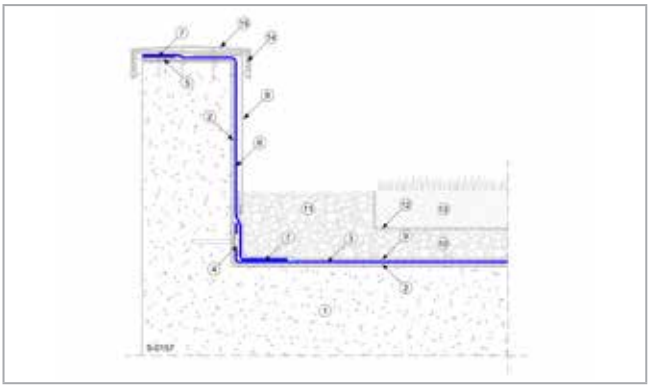
Extensive roof garden build-ups with waterproofing produced using synthetic or bitumen membranes.

1. Deck
2. IDROPRIMER or POLYPRIMER HP 45 Professional adhesion-promoting primer
3. POLYVAP RADONSHIELD P-AL or POLYVAP FIX P-AL vapour control layer
4. Thermal insulation layer
5. MAPEPLAN® T B 18 waterproofing membrane
6. POLYSTUOIA geocomposite filter and drainage layer
7. Growing medium

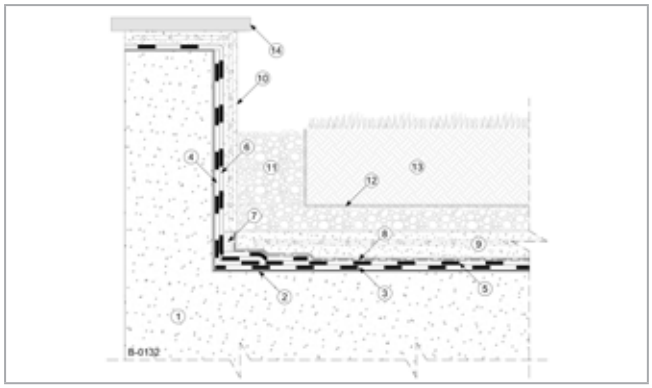
1. Deck
2. IDROPRIMER or POLYPRIMER HP 45 Professional adhesion-promoting primer
3. POLYVAP RADONSHIELD P-AL or POLYVAP FIX P-AL vapour control layer
4. Thermal insulation layer
5. POLYFLEX ULTRA bitumen waterproofing membrane
6. ANTIRADICE EL C P bitumen waterproofing membrane
7. MAPEPLAN® PE MACRO FORATO + MAPEPLAN® PE MICROFORATO LDPE slip and waterlogging-prevention layer
8. Protective concrete screed overlay
9. POLYSTUOIA geocomposite filter and drainage layer
10. Growing medium

ROOF GARDEN
COMPLIANT BUILD-UPS

ROOF EDGE

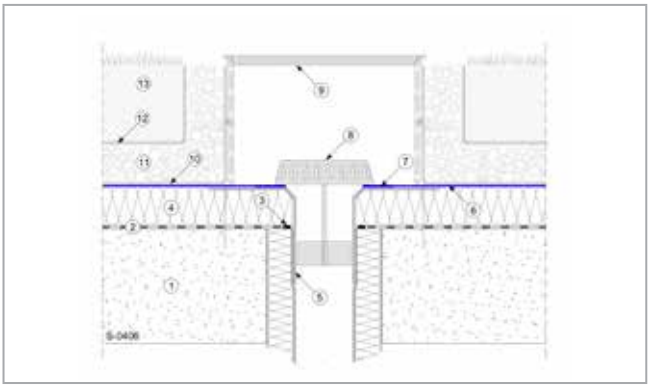


① Deck
② **POLYDREN PP** levelling layer
③ **MAPEPLAN® T B** waterproofing membrane
④ Perimeter mechanical fixing
⑤ **MAPEPLAN® T** flat profile
⑥ **MAPEPLAN® T** membrane
⑦ Weld
⑧ Protective flashing
⑨ **POLYDREN PP** protective layer
⑩ Aggregate (gravel or expanded clay) drainage or drainage/reservoir layer
⑪ Drainage ballast perimeter edge strip
⑫ **POLYDREN PP** filter layer
⑬ Growing substrate
⑭ Anchor bracket
⑮ Finishing flashing

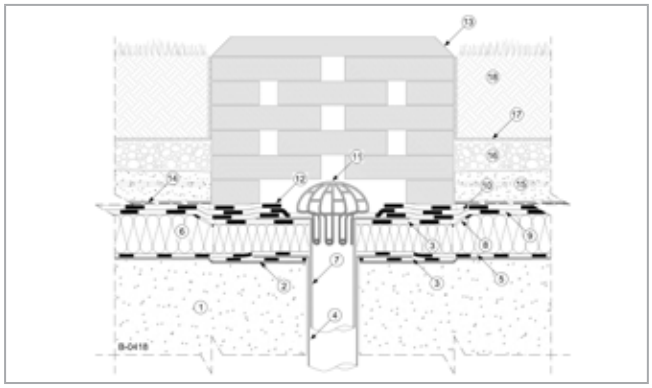


① Deck
② Adhesion-promoting primer (e.g. **IDROPRIMER**)
③ POLYGLASS waterproofing membrane (first layer)
④ Membrane vertical turn-up (first layer)
⑤ POLYGLASS waterproofing membrane (second layer)
⑥ Membrane vertical turn-up (second layer)
⑦ Cushioning expanded foam component
⑧ Dual **MAPEPLAN® PE MACRO FORATO** + **MAPEPLAN® PE MICROFORATO** LDPE separating layer
⑨ Protective reinforced or fibre-reinforced concrete screed
⑩ Vertical turn-up protected with mesh and render
⑪ Gravel or expanded clay drainage layer
⑫ **POLYDREN PP 200** filter layer
⑬ Soil
⑭ Finishing detail (e.g. stone slabs)

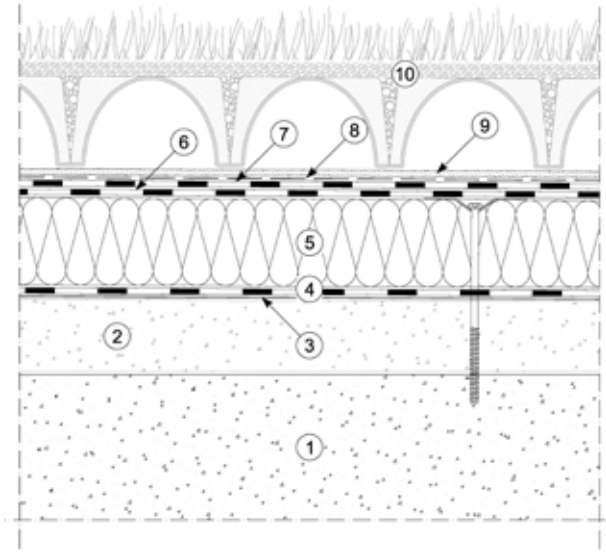
DRAIN OUTLET

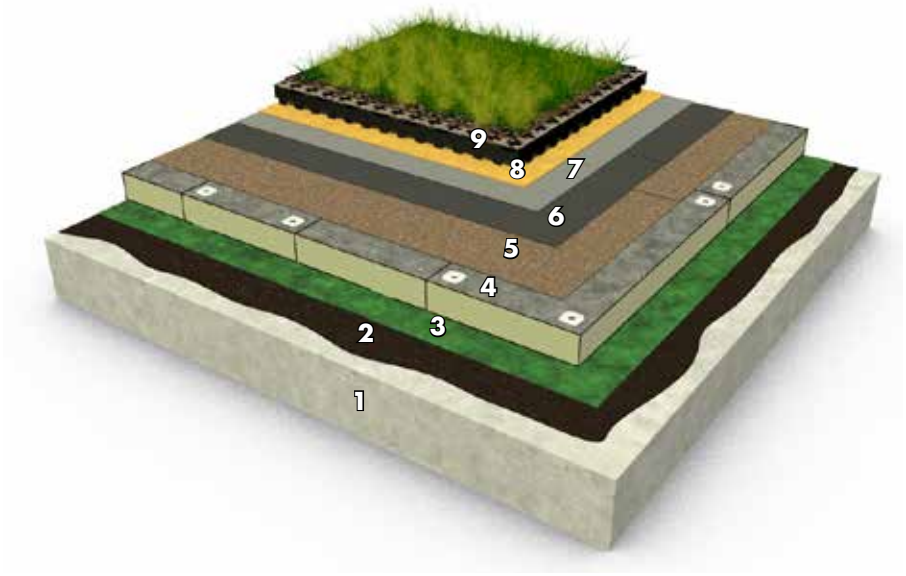


① Deck
② Vapour barrier sealed around outside edges and at overlaps s (e.g. **IDROPRIMER** + **POLYVAP**)
③ Perimeter sealing
④ Thermal insulation layer
⑤ Drain outlet
⑥ **MAPEPLAN® T B** waterproofing membrane
⑦ Weld
⑧ Leaf/gravel guard
⑨ Drain chamber
⑩ **POLYDREN PP** protective layer
⑪ Aggregate (gravel or expanded clay) drainage or drainage/reservoir layer
⑫ **POLYDREN PP** filter layer
⑬ Growing substrate



① Deck
② Adhesion-promoting primer (e.g. **IDROPRIMER**)
③ POLYGLASS waterproofing membrane patch under outlet 50 x 50 cm
④ Drain outlet for vapour barrier
⑤ POLYGLASS vapour barrier
⑥ Glued or mechanically fastened thermal insulation layer
⑦ Drain outlet
⑧ Junction with POLYGLASS self-adhesive membrane
⑨ POLYGLASS waterproofing membrane (first layer)
⑩ POLYGLASS waterproofing membrane (second layer)
⑪ Leaf/Gravel guard
⑫ Protective POLYGLASS waterproofing membrane patch
⑬ Drain chamber with hit-and-miss brickwork
⑭ Dual **MAPEPLAN® PE MACRO FORATO** + **MAPEPLAN® PE MICROFORATO** LDPE separating layer
⑮ Protective reinforced or fibre-reinforced concrete screed
⑯ Gravel or expanded clay drainage layer
⑰ **POLYDREN PP 300** protective layer
⑱ Soil





With the COMPLETA™ pre-vegetated system, the module can be simply removed for roof inspection purposes. The module comes out and slots back in easily to accommodate maintenance.

1. Deck
2. IDROPRIMER or POLYPRIMER HP 45 Professional adhesion-promoting primer
3. POLYVAP RADONSHIELD P-AL or POLYVAP FIX P-AL vapour control layer
4. Thermal insulation layer
5. POLYFLEX ULTRA bitumen waterproofing membrane
6. ANTIRADICE EL C P bitumen waterproofing membrane
7. MAPEPLAN PE MICROFORATO LDPE slip layer
8. POLYDREN PP 800 g/m^2 geotextile filter layer
9. COMPLETA™ pre-vegetated extensive green roof system

PRODUCT RANGE
COOL ROOF

POLYMER BITUMEN MEMBRANES

POLYFLEX ULTRA Super White
There is an extensive range of polymer bitumen membranes in Smart White

SINTHETIC MEMBRANES

MAPEPLAN® T M **MAPEPLAN® M**

They also come in a B_{ROOF} version

PROTECTIVE LIQUID MEMBRANES

POLYSINT SUN REFLECT

POLYVER SUPER WHITE

PRODUCT RANGE
FOR ROOF GARDENS

POLYMER BITUMEN MEMBRANES

ANTIRADICE EL C (ANTI-ROOT)

ANTIRADICE PE P (ROOT RESISTANT)

SINTHETIC MEMBRANES

MAPEPLAN® T B

MAPEPLAN® B

PROTECTIVE LIQUID MEMBRANES

IDROPLAST ANTIRADICE (ROOT BARRIER)

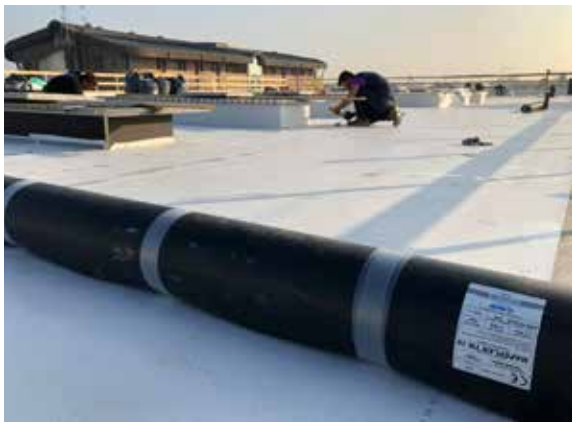
ACRIPLAST ANTIRADICE (ROOT BARRIER)

MAPEPLAN T M 18 B_{ROOF} T2

COOL ROOF PAST PROJECT: SUPERMARKET

YEAR OF COMPLETION: 2019

The brief: to produce a reflective roof that would offer ultimate longevity, accommodating a photovoltaic system.
Solution: the waterproofing system chosen for the roof on the new supermarket was produced using MAPEPLAN® T M 18 synthetic membranes, **laid loose** on the new building structure with EPS thermal insulation with graphite for a total depth of 14 cm. Woven glass fleece was laid between the insulation and membrane to achieve a **certified B_{ROOF} (t2) fire rating** as prescribed by the building code.
With the membrane's reflectance and SRI ratings, the roof is set to provide a **life expectancy of several decades** and **considerable savings in terms of summer cooling**. In addition, the lower surface temperature **boosts photovoltaic panel efficiency** compared to a traditional roof. The building's **sale value also increases** as a result.
Products used: POLYVAP RADONSHIELD P-AL, DURAGLASS TYPE DH 120 TL, MAPEPLAN® T M 18 B_{ROOF} (t2).
Specific advantages:with the MAPEPLAN® T M 18 B_{ROOF} (t2) system, the resulting cool roof delivers ultimate energy efficiency and longevity, complying with fire performance requirements for roofs accommodating photovoltaic systems.



POLYFLEX ULTRA P G F SUPER WHITE

COOL ROOF PAST PROJECT: INDUSTRIAL BUILDING

YEAR OF COMPLETION: 2015

The brief: to waterproof an industrial building with a long-lasting system.
Solution: a cool roof system was chosen to increase the service life of the whole roofing system. The slate chippings in Super White provide UV protection and keep the surface temperature down, **thus increasing the life expectancy of the membrane and thermal insulation underneath**.
POLYFLEX ULTRA P G F Super White delivers high performance with its special compound featuring flexibility at low temperature down to -20 °C, and -10 °C following ageing, and carrier featuring **high tensile strength** (950 and 700 N/50 mm), which earn the membrane an **S rating, which denotes «superior» performance according to the guidelines given in the relevant Code of Practice (issued by Italy's IGLAE institute)**.
Products used: POLYFLEX ULTRA P G F SUPER WHITE, POLYVAP RADONSHIELD P-AL, IDROPRIMER.
Specific advantages: POLYFLEX ULTRA P G F SUPER WHITE complies with Italian legislation (D.M. 26.06.2015) and counts towards LEED credits and environmental compliance.

POLYSINT SUN REFLECT

COOL ROOF PAST PROJECT: SUPERMARKET

YEAR OF COMPLETION: 2016

The brief: to produce a highly energy-efficient roof.
Solution: the chosen solution involved applying liquid membrane POLYSINT SUN REFLECT over the bitumen membrane to bring the roof in line with Italy's **current regulatory requirements and take full advantage of the energy benefits**.
Solar Reflectance 0,83 > 0,65 required by Italian law (D.M. 26.06.2015)
Solar Reflectance Index (SRI): 105% > 78% counts towards LEED credits and environmental compliance.
Thermal emissivity: 0,91
Product used: POLYSINT SUN REFLECT.
Specific advantages: POLYSINT SUN REFLECT protects bitumen membranes from UV radiation and delivers high reflectance, which promotes energy savings, especially when it comes to summer cooling.

COOL ROOF PAST PROJECT: TERRACE REFURBISHMENT

YEAR OF COMPLETION: 2019

The brief: to protect the waterproofing system on a seaside building with a **cool roof**.
Solution: the POLYSINT SUN REFLECT system was chosen for its **ease of application**, being particularly well suited to a roof with curved lines. Excellent solar reflectance values translate into an **effective cost saving**, especially in a climate zone known for its high temperatures and sunshine hours.
Solar Reflectance 0,83 > 0,65 required by Italian law (D.M. 26.06.2015) Solar Reflectance Index (SRI): 105% > 78% counts towards LEED credits and environmental compliance.
Thermal emissivity: 0,91
Product used: POLYSINT SUN REFLECT.
Specific advantages: POLYSINT SUN REFLECT protects the roof from UV radiation, while its liquid nature means it can be used to coat irregularly shaped elements effortlessly.

COMPLETA™ AND ANTIRADICE EL C

ROOF GARDEN PAST PROJECT: LAKESIDE VILLA

YEAR OF COMPLETION: 2019

The brief: to produce an extensive roof garden for a holiday home. The clients' aim was to have a **sustainable** and **visually striking** project in place within a short timeframe.
Solution: an extensive garden system was chosen that would require the **least possible maintenance** given that the owners would be away for extended periods of time. The pre-vegetated system meant there is **no need for watering** or fertilizing by a specialist gardener on setup, which would instead be required for gardens produced on site. **The element's shallow depth** (totalling 9 cm) made it a perfect fit for a roof produced with a low perimeter. The waterproofing was produced using ANTIRADICE EL C polymer bitumen membranes, which feature **excellent mechanical strength and dimensional stability**, certified resistant to root penetration according to standard EN 13948. An 800 g/m^2 nonwoven was then placed on top to provide the waterproof component with mechanical protection and help further retain moisture to encourage vegetation growth. Lastly, a pinhole-perforated Polyethylene sheet acts as a separating layer between the nonwoven and the bitumen membrane.
The vapour barrier was produced with POLYAP RADONSHIELD P-AL.
Products used: POLYVAP RADONSHIELD P-AL, ANTIRADICE EL C, COMPLETA, POLYDREN PP 800, MICROFORATO pinhole-perforated sheet **Specific advantages**: the COMPLETA pre-vegetated system allowed the client and designer to have a **one-stop** installer for the roof's construction, from waterproofing through to the vegetative cover. If the client has any **roof inspection or maintenance** needs, they just need to contact the specialist applicator, who can even **take the COMPLETA™ module out and put it back in without any issues**.

ANTIRADICE EL C (ANTI-ROOT)

ROOF GARDEN PAST PROJECT: EXHIBITION GROUNDS REDEVELOPMENT

YEAR OF COMPLETION: 2019

The brief: to waterproof a residential and commercial building complex as part of the exhibition grounds redevelopment project. Homes, offices, shops and services are set in extensive green areas in Milan. In addition, various roof gardens have been produced.
Solution: roof gardens are structures that require painstaking waterproofing. ANTIRADICE EL C was chosen for the waterproofing, a bitumen membrane certified to standard UNI 13948 for **resistance to penetration by roots**, featuring excellent **dimensional stability** (≤ 0,2%) and very good mechanical properties in terms of **tensile strength** (950 and 700 N/50 mm). ANTIRADICE EL C **falls into class S**, a rating that denotes **«superior» performance according to** the guidelines given in the relevant code of practice (issued by **Italy's IGLAE institute)**.
Products used: ANTIRADICE EL C 4 mm, POLYFLEX EL C 4 mm, IDROPRIMER.
Specific advantages: ANTIRADICE EL C can be used to waterproof the substrate completely, protecting it from penetration by the roof garden's roots. Creating green areas takes the visibility of these buildings to the next level and gives then a high-end look. The waterproofing systems contributed to the building's certification to the LEED 2009 **standard for Core & Shell** with a **PLATINUM** rating.

MAPEPLAN T B 18

ROOF GARDEN PAST PROJECT: WINERY

YEAR OF COMPLETION: 2020

The brief: to waterproof the roof over a 5,000m^2 winery, covering it entirely with an intensive roof garden planted with vines. The aim of the project is to conserve the area's natural biodiversity, make the most of renewable energy, and restore balance to the native arboreal vegetation.
Solution: the chosen solution involved a **loose-laid flexible polyolefin** waterproofing system placed on top of the thermal insulation layer, featuring a fibre glass mat carrier for the utmost **dimensional stability** during application as well as during its service life. The membrane is certified **resistant to root penetration (FLL tested)**, and features a life expectancy of several decades. MAPEPLAN® T B also comes with an **EPD** and counts towards **LEED** credits. The vapour barrier and expansion joints have been produced using polymer bitumen membranes.
Products used: PLANA P, ELASTOSHIELD TS 4 P for the vapour barrier and expansion joint cover strips; MAPEPLAN® T B 18 for the anti-root waterproofing.
Specific advantages: choosing to produce a green roof comes with a lot of advantages, such as improved thermal insulation, with resulting energy savings, reduced heat island effect and reduced CO_2 emissions, and extended waterproofing life expectancy. This quality makes it a strategic choice for improving wine storage in wineries.
Collaboration with the design practice on the best build-up option allowed us to assess every aspect of the project and solve all issues at the drawing board stage. In this case, the most critical aspects were the sheer size of the building to be covered completely with a roof garden, which comes with its own specific set of issues when it comes to addressing future problems.

MKIPL2052012 - 12/23

POLYGLASS SPA

Via Giorgio Squinzi, 2

31047 Ponte di Piave (TV) - Italy

+39 04227547

+39 0422854118

info@polyglass.it

POLYGLASS®

MAPEI GROUP