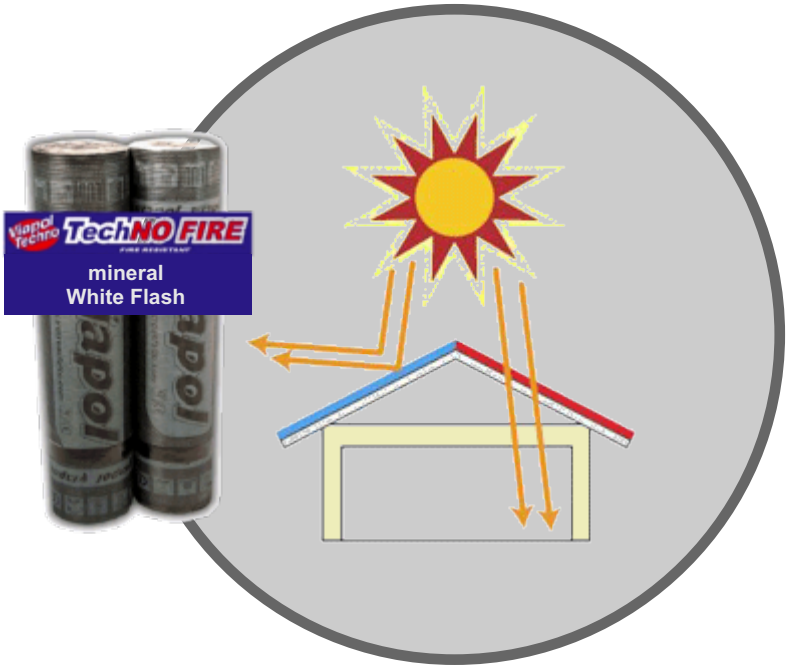
“Cool Roofs”



Viapol Techno Fire mineral White Flash

Cool Roofs 006 ENG - 10.02.2016

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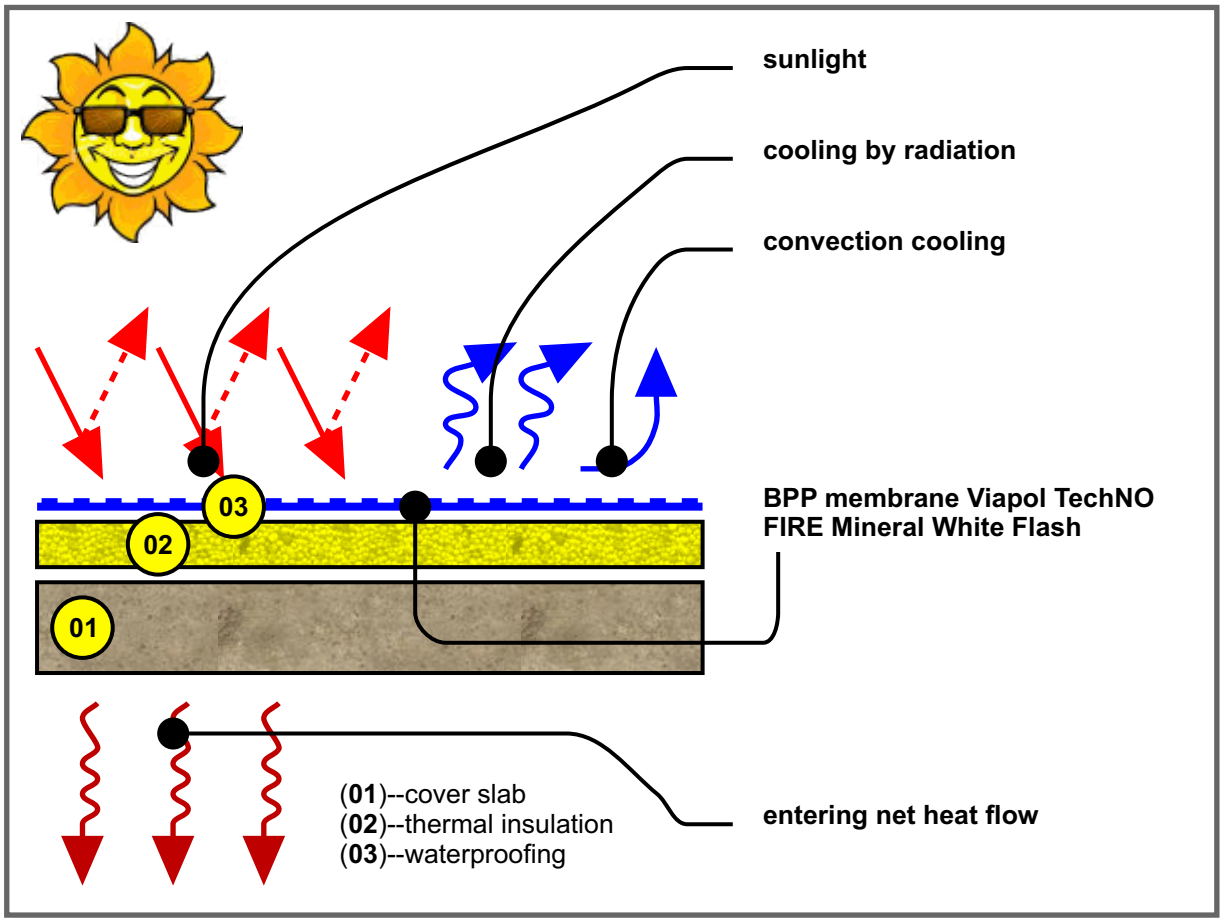
“ COOL ROOFS “ 01

"**Cool Roofs**" are defined as coverings and roofs characterized by high capacity to reflect incident solar radiation and, at the same time, to emit infrared heat energy. They can provide an effective solution to the problem of overheating in summer of individual buildings and large urban areas

A "cool roof", has a roof identified by a high albedo value, that is, the ability to reflect solar incident radiation, combined with a high infrared emission, which allows the surface the return to the atmosphere the majority of the absorbed solar radiations

In practice, a cool roof can be obtained by applying to the surface of the cover a layer of very light-coloured outer surface finish, preferably white with non-metallic material characteristics. A type of coverage with similar properties can provide a solution to both the problem of overheating in summer, with its negative effects on thermoclimatic welfare; related to the urban island problem, which causes an increase in temperature than the surrounding countryside during summer

You may therefore have direct benefits, related to the lesser heating of the cover such as a greater internal thermal comfort, it also lower the energy consumption and costs for air conditioning furthermore to slower the degradation of building structures. Indirect benefits consist of a reduction of the urban warming and the resulting phenomenon of photochemical smog with health and social costs related to this, as well as lower overall energy consumption, lower peak loads on the electricity grid and reduce emission of greenhouse gases in the atmosphere.



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The **reflectance or Albedo** (from latin Albedo, "whiteness") of a surface is the fraction of light or, more generally, of the incident radiation that is reflected back. The exact value of the fraction depends, for the same material, the wavelength of the radiation considered. If the word Albedo is used without further specification, it is meant the visible light. The maximum Albedo grade is equal to 1, when all the incident light is reflected. The minimum Albedo is 0, when no fraction of the light is reflected. In terms of visible light, the first case is that of a perfectly white object, the other of a perfectly black object. intermediate values signify intermediate situations. The albedo of fresh snow goes up to 0.9, Coal has very low Albedo

A blackboard has an Albedo of about 0.15. The Albedo can also be measured as a percentage where 1 means 100%. The Earth has an average Albedo of 0.37 ÷ 0.39 (equivalent to 37% to 39%).

The Albedo of a pine forest at 45 ° north latitude, is just 9%, among the lowest of a natural environment on the mainland. This low value is derived in part from the color of the pine trees, and in part from the different reflections of light in the trees, which decreases the amount of light reflected upward. The Albedo of the ocean, thanks to the fact that the light penetrates into the water, it is even lower: about 3.5%, which can, however, change much with the angle of incident radiation. Dense bushes are between 9% and 14%. A lawn is around 20%. An arid land has an Albedo that depends on the color of the ground, and can be as low as 9% or up to 40%, with the arable fields which fall 15%. A desert or large beach are situated generally around 25%, with large variations due to the different colors of sands.

The urban structures have very different values of Albedo, because the artificial structures often absorb light before it can reach the surface. In the northern parts of the world, cities are often very dark, with an average Albedo of about 7% and a small increase during the summer. In tropical nations we have an Albedo of around 12%. Different values are derived directly from different materials and styles of buildings. The fresh fallen snow on a uniform landscape has an albedo of 90%. A more common snow field (for example, the Antarctic plains) are at around 80%

Reflectance (Albedo) - Comparative Table

Black bituminous membrane	<0,10	
Coated membrane with aluminium painting	0,40÷0,45	
Self-protected membrane “Mineral White Flash”	**0,44**	**ASTM E 903**
Bituminous membrane with high reflectance paint	>0,80	

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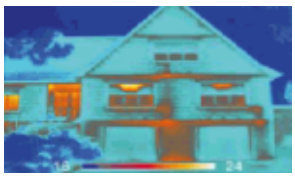
The **emissivity** of a material **defines the fraction of energy radiated from that material compared to the energy radiated by a black body which is at the same temperature**. An hypothetical true black body would have an emissivity of 1 while any real body has a value between 0 and 1. The emissivity depends on various factors such as the temperature, the emission angle, the wavelength and the surface finish of the body observed. In general, metals have rather low emissivity that increase with the temperature, while non-metals (metal oxides must be included) have relatively high emissivity and decreasing emissivity as the temperature increase.

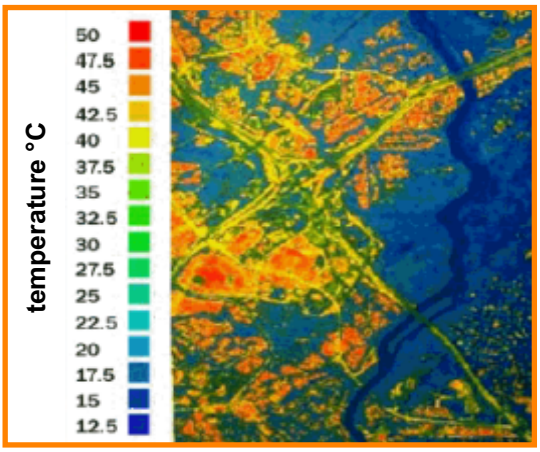
With “surface finish” we intend also the surface roughness (average value, shape and direction of the roughness) of the body as the possible presence of foreign inclusions or chemically and physically altered areas. A high level of roughness and no preferential directions increases the emissivity and makes it less sensitive to variations of the angle of emission. It follows that it is not always possible to uniquely determine the emissivity of a body. In case there are strong variations is more correct to speak of emittance at a given point, in a certain direction, at a certain temperature and at a given wavelength.

A typical engineering simplification is to consider that for the same surface, emissivity and absorption coefficient does not depend on the wavelength, so that the emissivity represents a constant.
This is known as the gray body radiation; when treating non-black surfaces deviations from an ideal black body behavior are determined by both the geometrical structure aswell as the chemical composition. Following the principle that the emissivity equals the absorption coefficient (principle also known as Kirchhoff's Law), an object that does not absorb all the incident light also emit less radiation than a blackbody



Emissività - Comparative Table

Black bituminous membrane	>0,80	
Coated membrane with aluminium painting	<0,60	
Self-protected membrane "Mineral White Flash"	**0,90**	**ASTM C 1371**
Bituminous membrane with high emissivity paint	>0,90	



"**Cool Roofs**" were born in the US in response to the problem of the “ Urban heat islands"

Roofing and road surfaces become hotter than in the countryside due to solar radiation.

Buildings and the road surfaces release much heat to the air and its temperature, measured in urban areas, also becomes 4 to 5 °C higher than that measured levels in the surrounding countryside.

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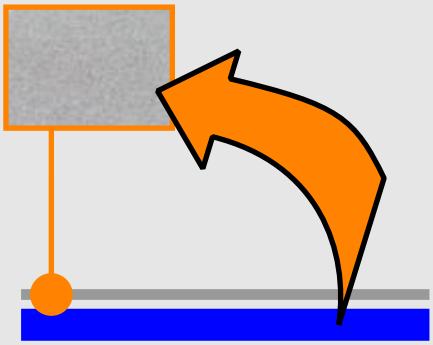

The "**WHITE FLASH**" version of **Viapol TECHNO FIRE Mineral “WHITE FLASH”** is protected by a ceramic coated white slate with a high power reflectance (Albedo = 0.44), This value is of great importance especially if compared to that of a membrane with self-protection mineral standard gray color (the surface temperature, in conditions of maximum insolation, passes from 74 to 65 °C ca

The **Viapol Techno FIRE** membrane is certified **B (roof)t2** according to the classification EN 13501-5. It should take account also of the recent Fire Department Circular- No. 1234 (7 February 2012) and subsequent clarifications

Although it is an unlikely event (including lightning, vandalism, aircraft in flames, etc.) it must also be considered the event of a fire coming from outside

These eventualities instead taken on a specific value in circumstances where there are several adjacent buildings of varying height and the fire had its origin in a building relatively higher than the surrounding ones. In the latter situation, because of a possible wind, lava and incandescent fragments or burning may fall on the cover at the lower level and so trigger a fire. The roofing systems are to be considered as ideal media for the construction of photovoltaic benches.

The flat roofs are favored as it is easier to implant orientation in the more powerful position and so get the best efficiency of the photovoltaic panel. A standard PV system must have an operational lifetime of at least 20 years. In this context, the Waterproof system must provide, after appropriate maintenance conditions, predetermined and well-managed, functional results of reliability and the height; the hypothesized temporal duration

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Description : elastoplastomeric BPP polymer-bitumen membrane. The compound in distilled modified bitumen with synthetic polymers of high molecular weight, nonwoven stabilized polyester reinforce. **Superior finish in reflective white slate flakes**, lower surface finish of polypropylene fabric "Uptex". **Method of Application** : portable propane torch. **Hazardous substances** : the product does not contain any dangerous substances. **MSDS** : see our dedicated card "Mbdp", current version. The outer covering **Mineral "White Flash"** is made by a dual production process : a first step of ceramization and UV stabilization and, thereafter, a second stage of chromatic exaltation of white color base

Viapol TechNO FIRE Mineral “White Flash”

mechanical-physical characteristic	norm	u.measure	values	tol.ce
Reinforcement	**nonwoven stabilized polyester reinforce**			
Thickness (Selvedge)	EN 1849-1	mm	4,0÷5,0	-10%
Max Tensile Force (L / T)	EN 12311-1	N/5cm	750-550	-20%
Elongation (L / T)	EN 12311-1	% ass	40-40	-15 ass
Resistance to Tearing (L / T)	EN 12310-1	N	150-150	pass
Resistance to Static Loading / Impact	EN 12730-A	kg-mm	15-900	pass
Plyability (Cold Flex)	EN 1109	°C	-15	pass
Plyability (Cold Flex) - Aged	EN 1296	°C	-10	+15
Watertightness	EN 1928-B	kPa	60	pass
Water Vapour Permeability	EN 1931	μ x 1.000	20	default
Form Stability (New - Aged)	EN 1110	°C	130-130	pass
Dimensional Stability Long	EN 1107-1	%	-0,25	pass
Dimensional Stability Transv	EN 1107-1	%	+0,15	pass
External Fire Performance	**EN 13501-5**	**class**	**Broof(t2)**	**pass**
Fire Performance	EN 13501-1	EuroClass	F	npd
Granule Adhesion	EN 12039	%	<= 15	pass
Thermal Conductivity	EN 13786	W/mK	0,20	pass
Solar Reflectance (Albedo) - ASTM	**E-903**	**%**	**44**	**pass**
Emissivity in the Infrared - ASTM	**C-1371**	**%**	**90**	**pass**
SRI Solar Reflectance Index - ASTM	**C-1980**	**%**	**48÷52**	**pass**

Rolls Dimensions	1,00 x 7,50 m (-1% - EN 1848-1)
Rolls Packaging	shrinkable pe film, on pallets
Rolls x Pallet	25 (4 mm) --- 20 (5 mm)
Top Finish	**self-protected with slate flakes (with high reflectivity white colour)**
Lower Finish	woven polypropylenne (pp) “Uptex”

CE coding : EN 13707 - single-layer self-protected in a cover system not walkable, isolated or not - finishing layer self-protected in a multi-layer roofing system, isolated or not, not walkable

specifications are subject to change or updating without prior notice

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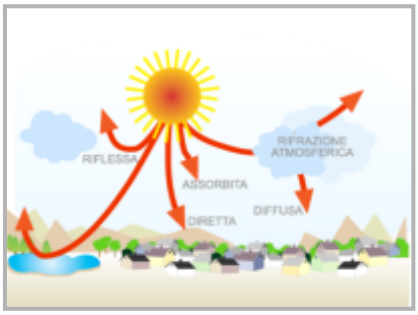
General :
The solar radiation, what we take into account and use for practical purposes, is emitted from the surface of the sun at a temperature of about 6,000 ° C. This radiation consists of a continuous spectrum of radiation whose wavelengths are between 0.2 and 4 mμ (mμ where 1 = 1 millimicrons = 1/1000 mm), that is, from ultraviolet to infrared. The maximum intensity is detected in correspondence of the wave length of about 0.5 microns (within the visible spectrum, which extends from 0.4 up to about 0.8 m). The intensity of solar radiation outside the earth's atmosphere is, with good approximation, equal to 1353 watts / m². At the Earth's surface such intensity is significantly reduced due to atmospheric effect. The main mechanisms are given by: the Absorption, especially on the part of the water vapour, oxygen, ozone and carbon dioxide; Reflection caused mainly by clouds; the Spread, due to water vapour, to the atmospheric dust and under the same air molecules. At sea level and with the sun at the zenith, the radiation intensity is of the order of 1,000 Watt / m². With the lower sun intensity is further reduced as the sun's rays have to pass through a greater thickness of atmosphere

Solar Radiation :
The solar radiation that reaches the earth's surface is composed of two parts: the direct one, that is, coming directly from the solar disk and the diffused one, coming from the rest of the celestial vault (excluding solar disk). The set of direct sun radiation and of the widespread constitutes the so-called global radiation. The intensity of the scattered radiation over the global setting can have very different values. Because of the mechanism of diffusion and the variability of the parameters involved, it is practically impossible to predict and calculate the scattered radiation components. It can vary from a minimum of 5 ÷ 10% (compared to the global radiation) until reaching a maximum of 25 ÷ 30% (for example in those days with covered sky by altostratus of milky appearance and with slight blurring of the solar disk). The solar radiation as an energy source depends on a number of parameters: the local weather conditions: a massive cloud cover that dramatically reduces the solar radiation, the local latitude, time, day and month, the inclination and the orientation of the surface receiving the solar radiation



Int (global) = Int (direct) + Int (diffuse)
The intensity of global radiation, to a flat horizontal surface, as the sum of the intensities of direct and diffuse radiation, it is possible to write an expression that provides the overall intensity of incident, at a given moment of the day, on a flat surface anyway tilted toward the horizon

Thermal behavior of flat roofs :
The thermal state, that is, the temperature of external surfaces of buildings exposed to solar radiation, is determined by the convective exchanges with the outside air, by radiative exchanges with the external environment, by the heat exchange with the 'internal environment. In summer, in the presence of solar radiation, the surface temperature of a construction component can be very high, definitely higher than those of the air, as a function of the portion of solar energy absorbed or absorption index. (See Comparison Table pg 02)

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“ COOL ROOFS “ - ENDNOTES

The impact that have the emissive properties on a surface of a cover (albedo and emissivity) on the heating of a building, in particular on the heat flow transmitted to the inside, can be estimated for stationary thermal conditions. To be noted that the assumption of stationarity is plausible only in the first approximation, and that goes for building structures with low thermal inertia, but is nonetheless adequate to the purposes of a basic treatment. The heat flow that crosses the external surface of a cover, in stationary conditions, must also pass through all the layers of material which constitute the aforesaid cover (waterproofing, thermal insulation, cover slab made of concrete or brick, plaster, any hollow spaces, etc.), to be finally transmitted to the below spaces

An “Albedo” increase involves a proportional reduction of the heat flow. A similar effect occur with the increasing of the emissivity. By increasing the thermal resistance provided by the isolation, it reduces the heat flow transmitted, but it also has an increase of the external surface temperature of the cover. Higher temperatures of the outer layers of the cover involve a more rapid chemical-physical degradation of the materials, as well as greater fatigue stresses of the structures for the expansions and contractions related to thermal cycles

The thermal energy supplied to the coverage by the solar radiation absorbed, which is then transferred by convection and radiation, goes to contribute almost entirely to the heating of the air close to the ground, which does not occur for the reflected solar radiation. It follows that a little reflective surface of the cover can be deleterious not only from the point of view of the thermo-climate of welfare and local energy consumption, but also for what concerns the “urban heat island”. The best result is what you can get, inserting a covering extrados of a bop membrane (slate granules "white flash" or reflective paint)

Both solutions are considered "cool roof", as they produce a reduction of the trasmitted thermal flow transmitted comparable to that obtained adopting an important thermal insulator thickness, but with temperatures of roof structures much more contained. Furthermore, from the point of view of the "heat island", only the thermal energy connected to the fraction of solar radiation absorbed is then transferred to the close air to the ground, while the reflected fraction will be of interest to the high altitude atmosphere and outer space

The SRI parameter (Solar Reflection index) that combines the values of reflectance and emittance, expresses the ability of a material to repel the solar heat varies from 100 for the standard white to 0 for black standard. All surfaces, especially especially dark ones, absorb sunlight and release it as heat, raising the surrounding temperature: this is the so-called "heat island". It is evident that the nature and color of the materials with which a building is constructed have an important influence on this effect. Choose a cool roof means improving the energy efficiency of a building by reducing its cooling costs. This savings is achieved with a lighter and reflective surface of the cover that absorbs less energy and therefore determines a reduction in consumption for cooling in summer

The cooling value is given by the index of solar reflectance (SRI) and the capacity of thermal emittance. Greater is the reflectance and / or emittance, the lower the temperature of a surface, which results in a decrease of the heat transferred inside a building

The membranes Viapol Techno Fire Mineral “White Flash” get an SR Index equal to 48-50-52 %, in relation to wind speed (low-medium-high)

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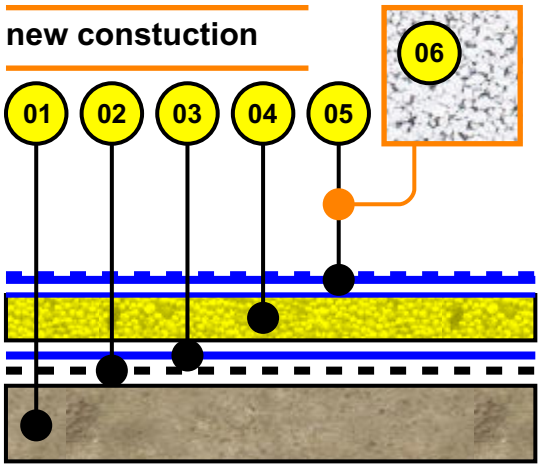
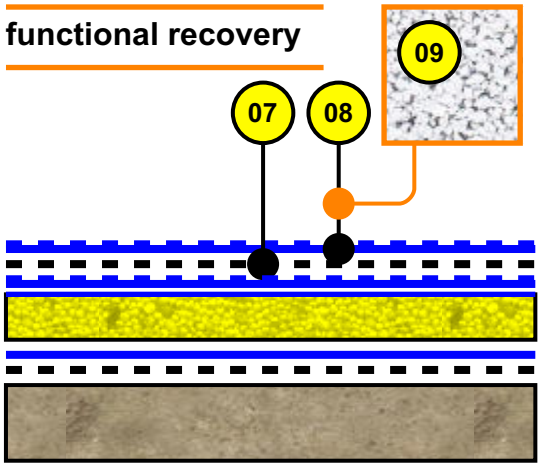
The Perspectives : the thermal and climate benefits in order of energy, economy and environment, which can arise from the adoption of a cool roof, depends in addition to the emissive surface properties and by their duration in time, by a multiplicity of other variables and conditions :
-----the type of coverings --the general characteristics of the building --the urban location
-----the typical climatic conditions of the area of itervention, and the period as well
-----the presence of any historical, artistic or landscape restrictions
The interaction between the various problems is in general complex
The actual convenience of a “cool roof” is therefore not an immediate evaluation. There are among other possibilities situations in which the direct benefits are relatively small, but instead are consistent for the community
In such situations, come into play more conditioning factors such as the taxation rules and the presence of economic incentive programs

two stratigraphic reference to “cool roof” not accessible

new constuction



functional recovery



description

(**01**)--basic carrier support
(**02**)--bituminous solvent primer **ViaBit Plus**
(**03**)--vapour barrier **Viapol Igropol 3**
(**04**)--thermal insulation (compatibilible with the draftinghot membrane) - mechanically fixed
(**05**)--elastoplastomeric single layer **Viapol TecNO FIRE Mineral White Flash 5**
(**06**)--protective coating with stabilized ceramic coated slate granules - UV refletive, colour “super white”

(**07**)--bituminous solvent primer **ViaBit Plus** (saturation and compaction layer)
(**08**)--elastoplastomeric single layer **Viapol TecNO FIRE Mineral White Flash 5**
(**09**)--protective coating with stabilized ceramic coated slate granules - UV refletive, colour “super white”

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