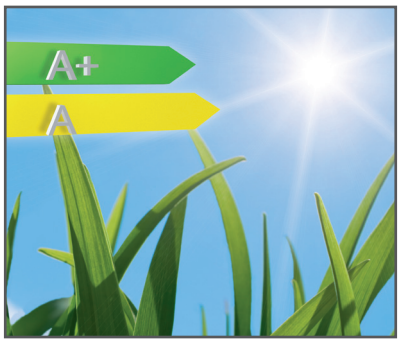
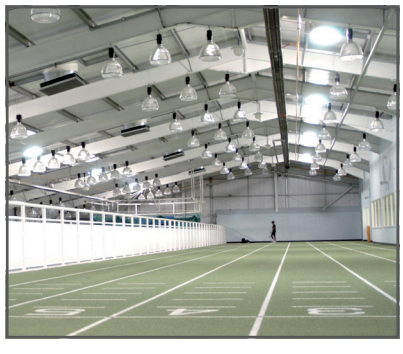
vega





Daylighting application

ALMECO
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Daylighting Application

Almeco daylighting solutions

Daylighting systems take many forms, from grand architecural atria and light capturing apertures and vaults to encapsulated reflective window blinds. One thing common to most of these systems is reflective material. Essential for re-directing and distributing light, high reflectance materials are at the heart of almost every daylighting project. Thanks not only to its optical properties, which can be varied and shaped to give glare free efficiency, but also due to its ductility, lightness and resistance to corrosion, high reflectance Aluminium is used for interior and exterior daylight systems, both for light deflection and diffusion.

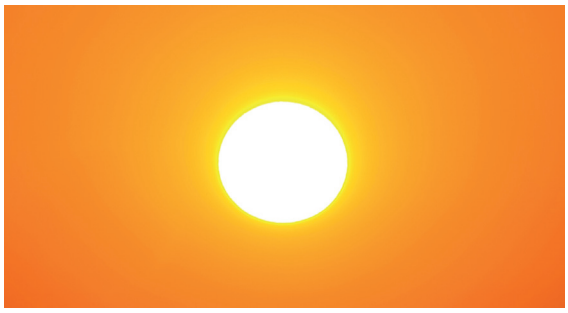
Architectural daylighting features

Efficient natural lighting starts with the basic architecture of a project, from the orientation and window layout to the inclusion of built-in rooflights. New build projects can also incorporate daylighting vaults which illuminate the core of the building and whose efficiency and aesthetic appeal can be augmented by introducing large mirror reflectors to conserve and re-distribute the incoming light and help to smooth out variations in daylight quality as the sun's position changes. High reflectance **vega** aluminium is ideal for such applications due to its light weight and formabilty. An alternative approach is to mount curved mirrors on the building facades to collect natural light. These systems can become quite sophisticated with compound parabolic collectors used to create so-called anidolic systems. Almeco's **vega** WR193 is ideal for such outdoor applications.

Daylighting through windows is the traditional way of bringing light into a building but it can lead to high levels of glare and heat. Venetian blinds in the form of mirrors can easily be produced from **vega** reflective aluminium and these can be incorporated in advanced double glazing systems with variable blind angle to re-direct light where it is needed while avoiding direct glare. These sytems, like the compound parabolic systems described above, can be used in combination with special reflective aluminium ceiling fixtures to re-distribute the light downwards into an office space. By using special coatings on the reverse side of a blind's lamellae, optical performance can be combined with thermal control for greater occupant comfort.

Fresenius laboratory with light pipes, Baggilux, Italy

Daylight using system, T-Soleil, Japan



Almeco's **vega** SP198 and **vega** SP298 have been developed specially for the energy saving market and in particular for light pipe applications. Almeco has adopted light pipe technology in its head office building in Milan, using **vega** SP198 to maximise efficiency in bringing light to its corridors. The ready formability of the **vega** material and its durability combined with its excellent optical characteristics to make it the material of choice for light pipe manufacturer.

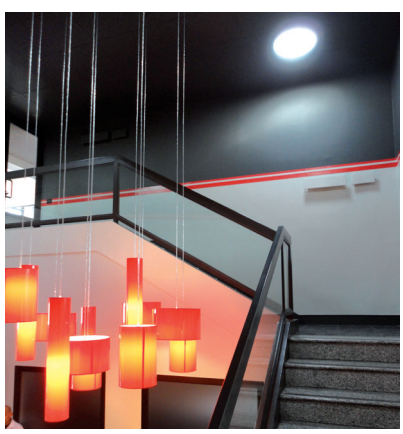
Key optical properties in a light pipe

It is clear that the higher the total reflectance of the material making up the light pipe, the better will be its output. What may not be quite so clear is the extent to which total reflectivity affects this. To understand this you need to consider the losses due to absorption of light. Quite simply, for each reflection from the surface, a 96% reflective surface will lose twice as much light by absorption as a 98% reflective surface. In a 15 inch diameter light pipe, with light reflecting perfectly internally at 45 degrees, there will be eight reflections in a straight 20 foot length. The 98% material will give 18% more light output than the 96% under these conditions. Almeco **vega** SP198 metal for light pipes typically has 98.5% total reflectance over the visible range and optimises output from any light pipe configuration.

Mirror reflection is also important in a light pipe because scattering of the light by diffuse surfaces leads to more internal reflections and lower efficiency. The most important aspect of this is the limit of spread of diffuse reflection.

If light is scattered or diffused within a cone of a few degrees around the mirror reflection point, the effect on efficiency will be low. A small degree of diffusion can even soften the lighting effect and for artificial lighting technologies there are high reflectance materials made specially for this purpose. For high efficiency, **vega** SP198 surfaces direct 95% of the reflected light within a 2.5 degree cone of the mirror beam centre. Less precise competitive materials can give wider scattering of the light leading to much higher absorption and light losses. This is why high reflection paint coatings are not suitable for light pipes.

Roof at Gimec, Baggilux, Italy

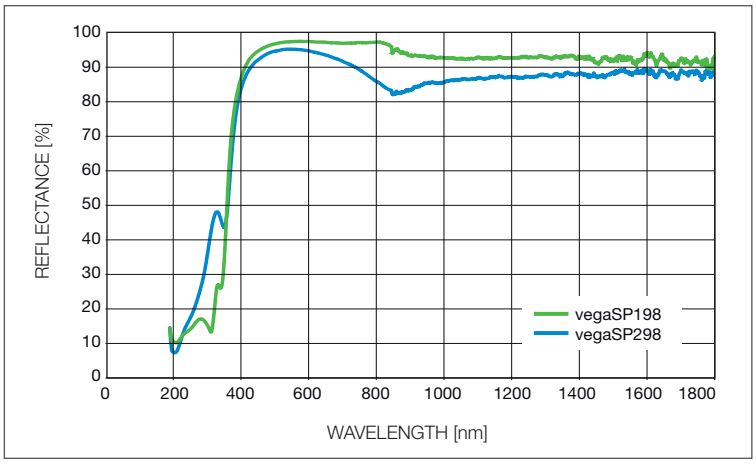


Office building with light pipes, Lightway, Czech Republic

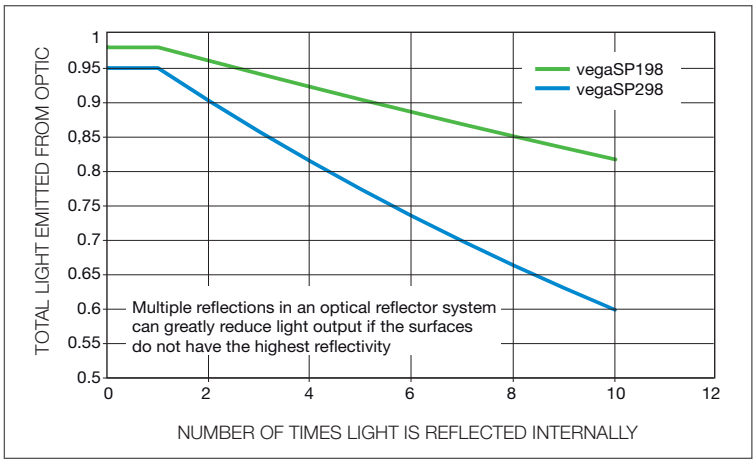


Maintained high reflection at different incident angles. The total reflectance of vega SP198 is usually measured according to the European standard (DIN 5036 part 3) which measures at <10 degrees from the vertical, at which angle total reflection values of about 98.5% are found. Measuring to the US specification ASTM E-1651 with the Technidyne TR2 instrument at 30 degrees from the vertical shows values of 99%. As the angle moves further away from the vertical the reflectance increases. This seems hardly possible with a 98.5% reflective product, but measurements of mirror reflection with specular gloss meters show that specular reflectance increases from 93% at 20 degrees from vertical to 100% at an angle of 85 degrees from the vertical.

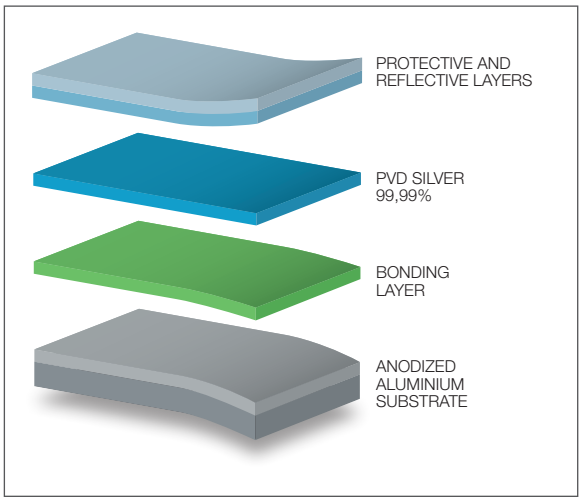
Colour. vega SP198 has a uniform spectral reflectance response over almost all of the visible range, with only a small lowering of reflectivity in the violet part of the spectrum. This leads to a neutral colour rendition with a slight tendency for yellow with light reflected in the tube at a shallow angle. L* a* b* coordinates are within 1% of neutral and remain so after prolonged accelerated UV tests.



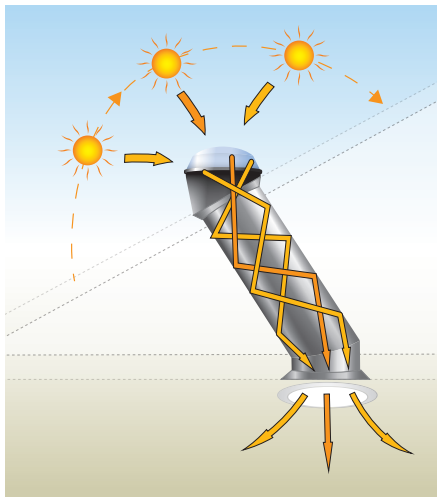
Comparison of spectral reflectance curves for vegaSP198 vs vegaSP298 and pre-anodized specular aluminium



Graph showing reduction in light output with multiple reflections for 86%, 95% and 98% reflective materials



Coating system diagram vega98®



Light pipes scheme

Reflectance characteristics

	Total reflectance [%] ASTM E 1651	Total reflectance [%] DIN 5036-3	Specular reflectance [%] 60° long	Specular reflectance [%] 60° trans	Diffuse reflectance [%] DIN 5036-3
vegaSP198	> 98	> 98	92	91	< 10
vegaSP298	> 98	> 98	93	93	< 7

Mechanical characteristics

	Alloy	Reflection layer	Temper	Min. tensile stregth	Min. proof stress (0.2%)	[%] Min. elongation
vegaSP198	1090	99.99% silver	H18	125	105	2
vegaSP298	1090	99.99% silver	H18	125	105	2

Durability tests

Test	Type	Standard	Duration	Reflectance before [%]	Reflectance after [%]	L*, a*, b*, values	
Humidity resistance	40° C 100%rh	ISO 6270 - 1	100h	98.0	97.8	before UV test	99.8, - 0.1; +0.4
UV resistance	65°C xenon test	ISO 11341	1,000h	98.4	98.6	after UV test	99.7, - 0.1; +0.5

Milan, Italy - Bernburg, Germany
Goncelin, France - Atlanta, USA - Shenzhen, China

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