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## ASPHERES AND FREEFORM LENSES FOR PROJECTION HEADLIGHTS

### FACTS ABOUT



THE NEW WORLD  
OF LED HEADLIGHTS



MATURE  
SIGNLIGHT FUNCTIONALITY



TEXTURED  
PROJECTION LENSES



COATED  
PROJECTION LENSES

# THE NEW WORLD OF LED HEADLIGHTS CALLS FOR RELIABLE, LONG-TERM SOLUTIONS.

## THE WORLD'S FIRST SUV FEATURING LED HEADLIGHTS. WITH PROJECTION LENSES FROM DOCTER OPTICS.

Docter Optics is the world market and technology leader in the economical production of aspheres and free-form lenses for projection headlights.

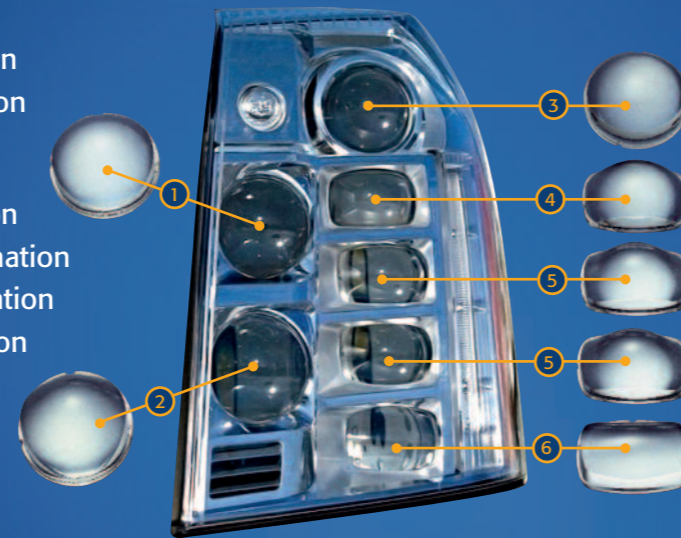
The Cadillac Escalade Platinum – The world's first SUV to feature LED headlights as standard equipment with free-form glass projection lenses from Docter Optics.

### High beam

- ① Channel: Free-form lens for long range illumination
- ② Channel: Free-form lens for basic range illumination

### Low Beam

- ③ Channel: Free-form lens for long range illumination
- ④ Channel: Free-form lens for medium range illumination
- ⑤ Channel: Free-form lenses for basic range illumination
- ⑥ Channel: Free-form lens for close range illumination



The low beam LED's (channels 3-6) are dimmed for daytime running light.

## THE RIGHT CHOICE: GLASS LED PROJECTION LENSES.

High-performance LED's feature extremely long service life. That means the lenses of LED headlights have to feature the same high quality. The possibility of cloudiness, which can occur in the case of plastic lenses, or the stress cracks and occlusions found in inferior, low-quality glass lenses has to be eliminated from the very beginning.

As a result, Docter Optics LED projection lenses are typically made from Doctan®, a Docter Optics optical glass that is especially well-suited for full-LED headlights.

Doctan® features exceptional thermal stability, high corrosion resistance and outstanding strength. Doctan® combines excellent optical performance with the exclusive sparkling clarity of "crystal."



## WHERE FORM MEETS FUNCTION:

### DOC3D® FROM DOCTER OPTICS

Docter Optics proprietary DOC3D® technology makes it possible to turn virtually any idea into optical reality. The ultimate result is a unique combination of advanced technology and design.

This creative freedom is what it takes to meet the automobile industry's unique selling requirements for quality and specific model design.

When it comes to multiple-lens systems, arrays or even more unusual variants, Docter Optics partners with headlight manufacturers to develop the free-form lenses and lens systems they need for future LED headlights.

### Comparison Polymer vs. Glass

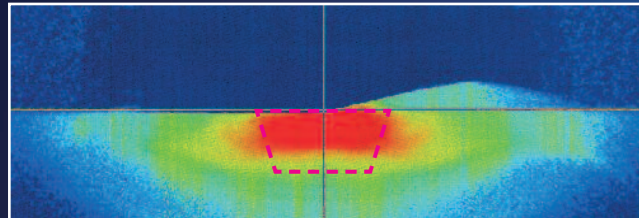
	Polymer	Glass
Transmission	different, depending temperature	stable
Refraction Index	different, depending temperature	stable
Dispersion	different, depending temperature	stable
Thermal Endurance	limited	given
Birefringence	critical	uncritical
UV – Resistance / Solarisation	limited	given
Hygroscopy	critical	uncritical
Initial Tooling Cost-Index	1,000	100 .. 300
Sensitivity for Microcracks	critical	uncritical
Cycle Time Lens Production	long	very short
Integration of Mounting Features	simple	challenging
Weight Index	100	250

# A MATTER OF SAFETY: THE OPTIMAL SIGNLIGHT FOR EVERY HEADLIGHT

## OVERHEAD SIGNLIGHTS BY DOCTER OPTICS

Everyone is talking about “signlights” – not only manufacturers of automobiles and headlights, but also lawmakers in many countries throughout the world. In general, it is already obvious that signlights will have to meet stringent requirements.

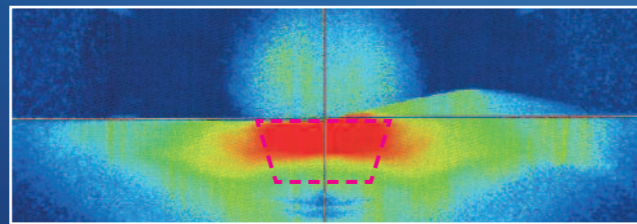
In any case, all signlight solutions will have to comply with legal requirements and illuminate the specific country’s signs without blinding the drivers of oncoming vehicles.



Light distribution with a standard asphere: The signlight zone is not illuminated

Standard projection systems cannot do the job. Up to now, it has only been possible to comply with legal requirements by resorting to complicated, cost-intensive solutions.

The aspheric projection lenses developed by Docter Optics change all that by allowing optimum integration of signlight function into the lens itself. Unique glass molding technology – and in particular the **DOC3D**® process – guarantees the most efficient and cost effective reproduction of even the most complex surfaces. The advanced production processes employed by Docter Optics enable headlight manufacturers to simplify the design of their projection modules considerably since additional apertures and complex shutter designs are no longer necessary. For example, the beam of light for the overhead signlight is shaped by the lens itself. These lenses make it possible to take into account not only the design of vehicles but also various types of light sources as well as country’s legal requirements and laws. The aspheric projection lenses shown are only a few typical examples of the many possible signlight solutions that are available.



Docter Optics signlight asphere: The signlight zone is well illuminated

## VARIETY AND DESIGN FREEDOM

Aspheric lens with textured prisms



This design is intended especially for bending light and makes it possible to incorporate signlight into adaptive front lighting systems.

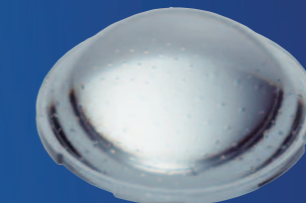
Lens with sloped aspheric and textured surface



This signlight solution can be used with both a halogen or xenon light source.

The size of the lens surface significantly reduces glare.

Aspheric lens with micro cylinder



The micro cylinder type gives new design effects and outstanding performance.

Aspheric lens with signlight prism



The signlight prism design is a very efficient solution for best signlight and can be adapted to various types of headlights.

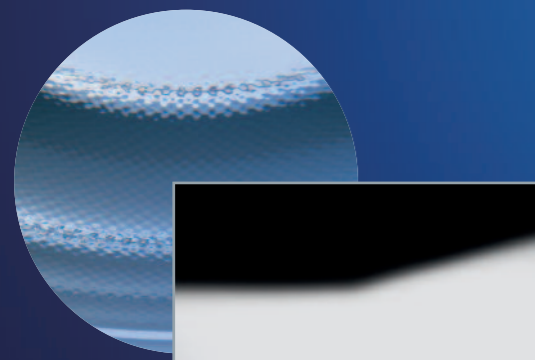
The orientation of the aspheres shown here illustrates only the signlight features and not the orientation of the projection headlights.

# CHOOSE ANY DESIRED CUT-OFF LINE WITH TEXTURED PROJECTION LENSES BY DOCTER OPTICS

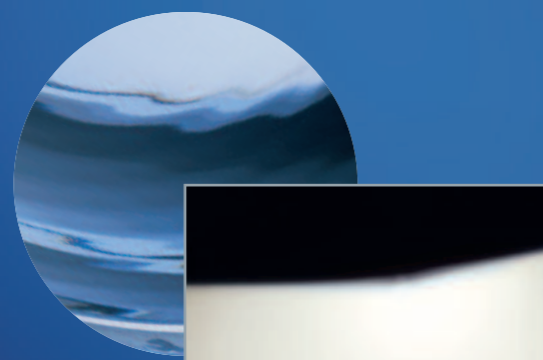
The market and technology leader when it comes to precision-molded projection lenses, Docter Optics maintains dedicated R&D resources to support headlight manufacturers and carmakers worldwide. Production-ready textured projection lenses give headlight designers and automobile stylists a wide range of options for adapting light distribution to customer specifications. The laboratory photos show typical cut-off lines for different textures. Of course, any desired degree of texturing is possible.



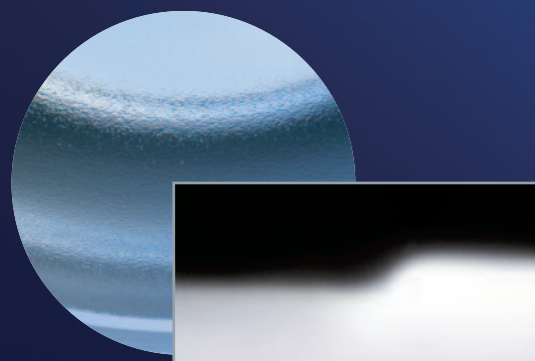
Clear lens, as reference  
for sharp cut off line



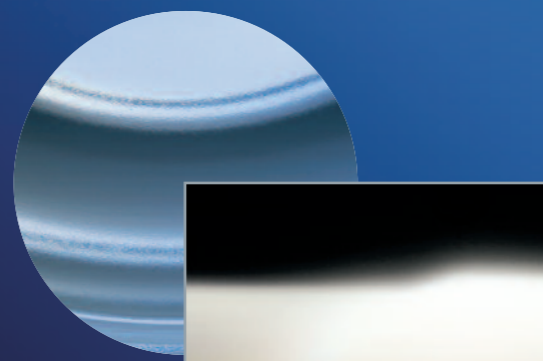
Microstructure ECE HID



Modulation ECE Halogen



Single Frost SAE HID

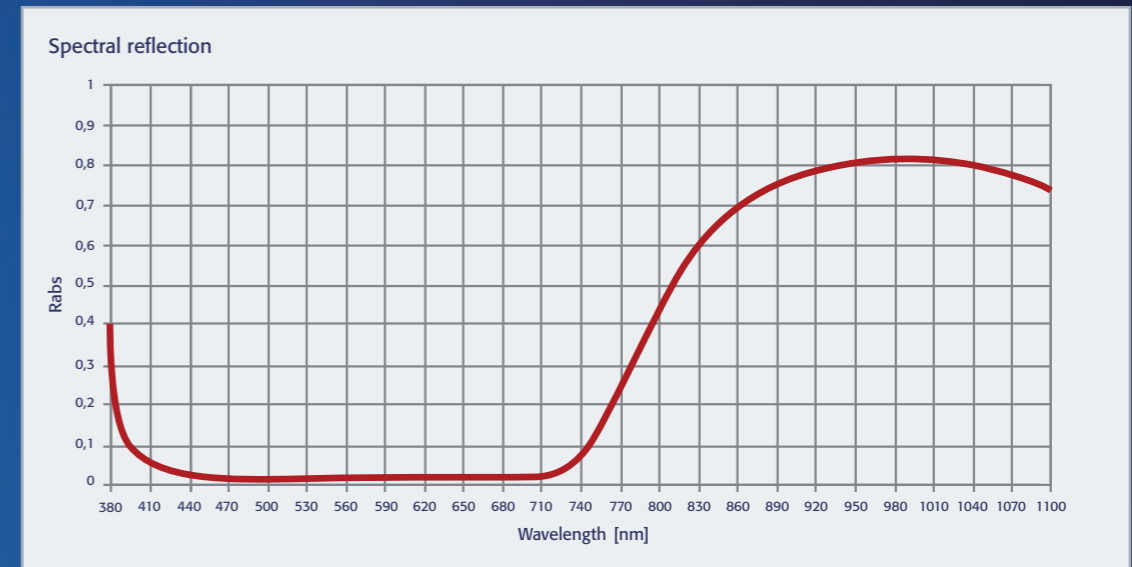


Double Frost SAE Halogen

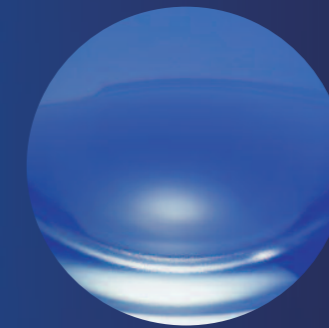
# HIGH-TECH COATED PROJECTION LENSES BY DOCTER OPTICS

Docter Optics IR coatings have become part of the company's standard product portfolio, especially when it comes to headlights that feature compact design with halogen or bi-halogen projection modules.

Coatings shield the plastic covers of the headlights against most of the IR radiation from the light source, which makes it possible to reduce packaging depth. IR coatings reduce the transmissivity of the lens in the infrared range, but not for the visible spectrum seen by the driver.



Uncoated lens



**US Blue Coating**  
Provides a deep blue reflex  
and additional IR protection



**DO-US Coating**  
Provides a blue reflex and additional IR protection  
and transmits white light