The Light System

New Design Language, More Variants, Efficient Design

Headlights and taillights play a significant role in establishing the character of a vehicle brand's design. The taillights in particular are extremely important when driving in the dark. What is referred to as the "night graphic" provides a special opportunity for conveying the brand image of each brand and its models. In the Polo, the new language of form has been consistently implemented both in the front and in the rear lighting.

1 Front Lighting

Black and gloss-chrome surfaces in the headlight of the new Polo provide a pronounced three-dimensional impression, communicating a high level of dynamics. This design topic is implemented in both available halogen headlights – both in the basic headlight with its dominating main reflector for low and high beams (H4 technology) and in the new double-round headlight with separate reflectors for the low and high beams (H7 technology). In the double headlight, the shiny wing with its delicate surface structure functions firstly as a stylistic element which will be echoed as a signature in all new Volkswagen faces. The shape of the wing and the interplay between bright and dark surfaces ensures a significant depth effect. Together with the reflectors detectable as round components, this will give an unmistakable appearance to the front of each Volkswagen, **Cover Figure**.

The offering of two headlight variants – H4 and H7 headlights – is tailored both to the requirements of fleet and company cars as well as to those of private customer. The double-round headlight uses halogen bulbs (H7) both in the low and high beams, which give about 10 % more light than the predecessor. The new screen over the bulb in the low-beam headlight has a specific and precisely calculated shape to prevent light scattering without reducing

the light intensity for the low-beam headlight.

The intermediate lens in front of the indicator light appears to be purely design orientated, with a technical lens both on the inside and outside in order to provide the level of visibility for the indicator demanded in law. Despite the significant arrowhead shape of the front of the car, the intermediate lens makes it possible to avoid the need for a pronounced lens on the outer lens of the headlight. It is only the lenses that are parallel with the radiator grille that provide corresponding visibility of the position light.

The headlight development took account of lighting technology challenges as well as, and in particular, the highly compact installation space available in the front end of the Polo. The components surrounding the headlight block access to the bulbs from the rear, with the effect that a concept rarely used in this class has been employed to allow customers to change the bulbs themselves without needing to take the car to a garage. A screwdriver included in the toolkit is all that the customer needs in order to unfasten two easily accessible screws, following which the headlight can be pressed out of its lower clip holder. With the headlight removed, it is then a straightforward matter to change the bulb, push the headlight back in and refasten the screws. Exact positioning in the car is assured by a stop in the top area, which is adjusted at the factory when the headlight is installed. To extend intervals between bulb changes, Volkswagen uses bulbs with an extra-long service life in the most common light functions (low beam and position light), which are referred to as longlife bulbs (LL).

Volkswagen is offering a separate daytime driving light in the Polo for customers who are both safety and environmentally conscious. This is positioned in the light module next to the fog lamp with cornering light, which is also an option, **Figure 1**.

Use of the separate daytime driving light with a "P21W Super Longlife" (SLL) bulb saves about 3.5 g CO_2/km, compared to the predecessor with continuous driving lights, corresponding to about 0.15 l fuel/100 km. This means the Polo is really offering a separate daytime driving light in the A0 class, something which is not going to be a legal requirement in Europe until early 2011, but will significantly improve road safety in the opinion of recognised experts.

The fog lamp is specifically configured for this and the cornering light function, which means that Volkswagen is offering a cornering light in the Polo which was previously reserved for more exclusive vehicle classes in conjunction with the Advanced Frontlighting System (AFS – xenon).

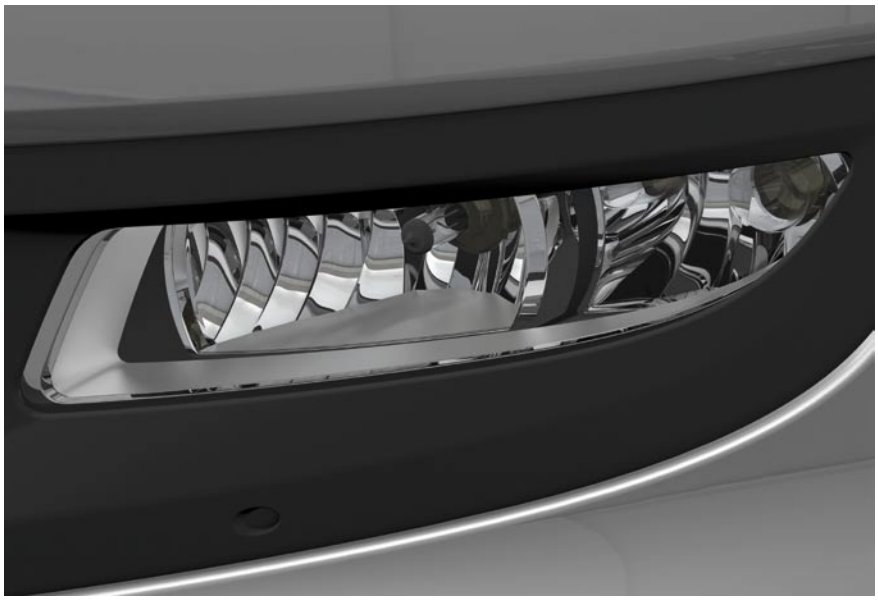

Figure 1: Light module in bumper with fog lamp, cornering light and daytime driving light function

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Figure 2: Polo rear lighting seen from behind

Figure 3: Schematic night graphic of the new Polo

2 Rear Lighting

The tail/brake light is also of great relevance in terms of safety and design technology both in daylight and at night. When the car is driven at night, it is especially its lights that are of outstanding importance in characterising a vehicle brand. What is referred to as the night graphic gives each brand and its models a special opportunity to communicate the brand image.

With its striking night graphic in the rear lights, the Polo is one of the first vehicles to show the new taillight design, **Figure 2** and **Figure 3**. It was necessary to take a range of boundary conditions into account in the technical implementation of this light design. One of the objectives was to achieve homogenous illumination of the taillight function from all viewing angles. Secondly, it was necessary to provide an energy-efficient possibility for lighting. Furthermore, the technical lighting concept would have to be applicable as the basis for further model series with a similar graphic.

With these requirements in mind, and in order to establish the design sustainably at an early stage, the entire concept of the lighting technology was undertaken in house. For the first time, methods developed as part of the front-loading approach for lighting configuration were used during the concept development of the lights in conjunction with expertise gained from prototyping, all combined into one process. By connecting virtual methods for designing and verifying the lighting system for the light, it was possible to define the entire lens concept within a period of only three weeks. The main point of attention was to design the taillight function. The objective of achieving a striking, very precise shape for the taillight at the same time as giving it a homogenous appearance from all viewing angles was achieved by using a specially adapted interplay of reflector geometry and lens structure on an intermediate lens.

The light beams of a 5 W bulb are aligned in parallel by the reflector, then scattered in the width axis by means of vertically arranged cylindrical optics on the inside of the intermediate lens. Horizontal lens elements were calculated and

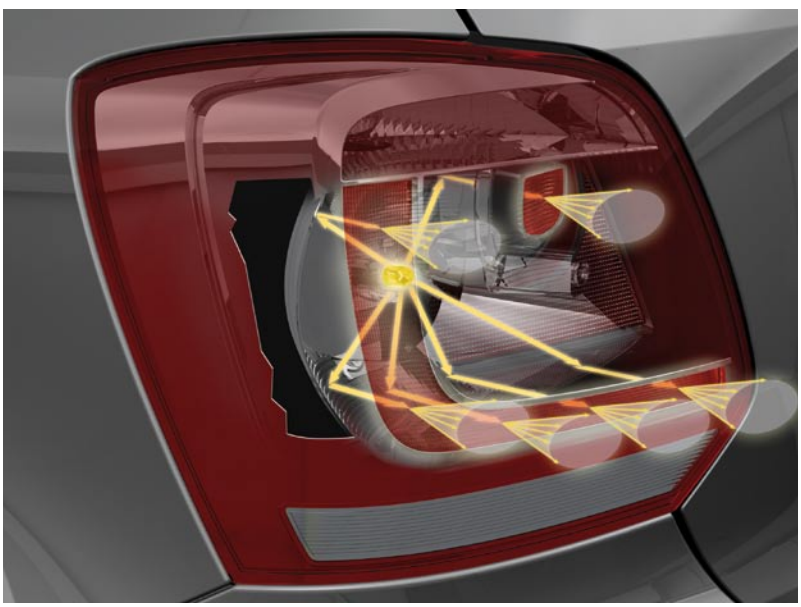

Figure 4: Sectional view of the light with beam path (optical concept)

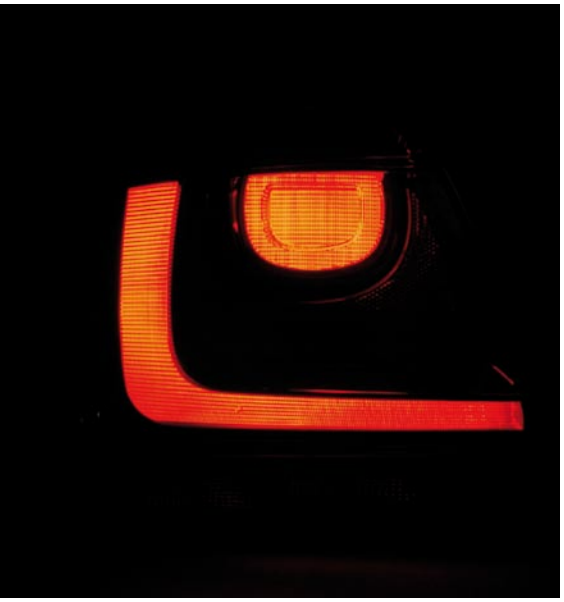

Figure 5: Visualisation of the night graphic

Figure 6: Night view of the rear lighting

positioned on the outside of the intermediate lens in order to provide vertical light distribution, **Figure 4**. This design of the lens made it possible to achieve the horizontal alignment of the light as perceived by the observer, which was the designer's intention.

The lighting technology used in the light configuration to achieve homogeneity has achieved a new quality in the new Polo, because Volkswagen's own methods of visualising the night function with the lens design have been combined into a closed optimisation process. The geometries optimised at the virtual level form the basis for building a real light model. The concluding comparison between virtual configuration and the real prototype delivered impressive confirmation of the performance of the simulation and visualisation tools used in the concept development phase, **Figure 5** and **Figure 6**.

The fastening concept was also redesigned alongside the new light concept for the rear light. As already used in series production of the Golf VI, the new Polo has a central fastening element, **Figure 7**. This involves a special wing screw that matches its counterpart in the light. The spring-mounted design of the attachment means that the light is integrated into the panel gap pattern of the rear end by means of defined contact points against the body. The advantages of this concept are that the light can be installed in the body using only one screw as part of the assembly procedure, and that the entire light unit can be easily removed by hand using the central screw if it is necessary to change a bulb. ■

Figure 7: Fastening of the tail light