Key Facts on the Mechanical Properties of Book 3 Modules

Ralph Bertram from Osram and Martin Creusen from Philips Lighting present the mechanical properties of Zhaga compliant modules of the “Book 3 - Spot LED Light Engine with Separate Electronic Control Gear”.

To enable interchangeability of LED light sources, the Zhaga consortium has created several interface specifications for LED light engines covering different general lighting applications. One of these interface specifications is called “Book 3: Spot LED Light Engine with Separate Electronic Control Gear”. This Book defines the interface between a luminaire and a LED light source consisting of a round ø50 mm LED module and its associated electronic control gear (driver) in separate housings.

LED light sources that comply with “Book 3” are interchangeable. That means that a luminaire manufacturer can replace the light source with another Book 3 compliant light source without any change in the mechanical, thermal, and photometric components of the luminaire.

In this article we explain how the outlines of the LED module are defined and which freedom both the LED module and the luminaire manufacturer still have when designing their products. We will also discuss why the mechanical dimensions are specified in this way and how it stimulates interchangeability of LED light sources.

Zhaga Defines Mechanical Outlines for the LED Module

The first and most obvious task when creating an interchangeability specification is to define the mechanical dimensions of the exchangeable part. Zhaga interface specifications provide sufficient freedom to manufacturers to create their own designs, while ensuring interchangeability between modules of different manufacturers.

As an optimum trade-off between module compactness versus proper thermal management, Zhaga has decided to use 50 mm as a typical module diameter and allow a module height of maximum 7.2 mm. To provide good thermal contact, the module is intended to be screwed to the heatsink base of a luminaire by an (OEM) luminaire manufacturer. Extensive thermal investigations have shown that two M3 screws at a distance of 35 mm are sufficient. Exact size and position of screw holes and screw head supports are prescribed in the specification.

Light is emitted from an area in the center of the module, called the Light Emitting Surface (LES). Zhaga does not limit the technology for light generation, as clearly shown by the prototypes that were developed to test the specifications (Figure 1). Regarding the LES specification, the light emission height is variable and sufficient space is foreseen for elements like outcoupling domes, optical mixing elements or electrical safety barriers around and above the LES itself.

The LED modules specified in Zhaga Book 3 are expected to be used primarily with reflector optics provided by the luminaire manufacturer. Consequently, to allow a reflector to be mounted close to the LES in the center of the module, Zhaga defined a recessed reference surface for attachment of the reflector (Optics Contact Area – OCA / Figure 2). This OCA has a defined height of 4 mm, so a luminaire construction can rely on a mechanical support and make sure that no light is escaping

Figure 1:
Spot module prototypes made by different Zhaga members to test the Book 3 specification

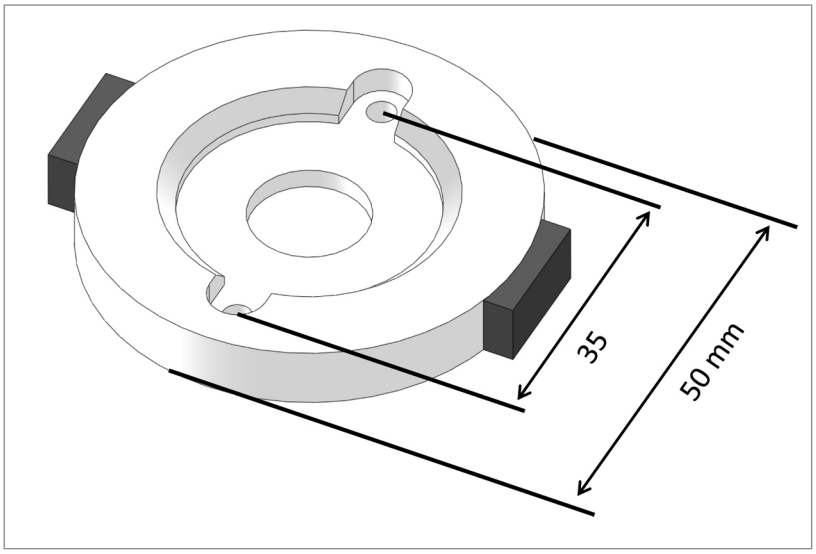

Figure 2:
Module maximum outlines

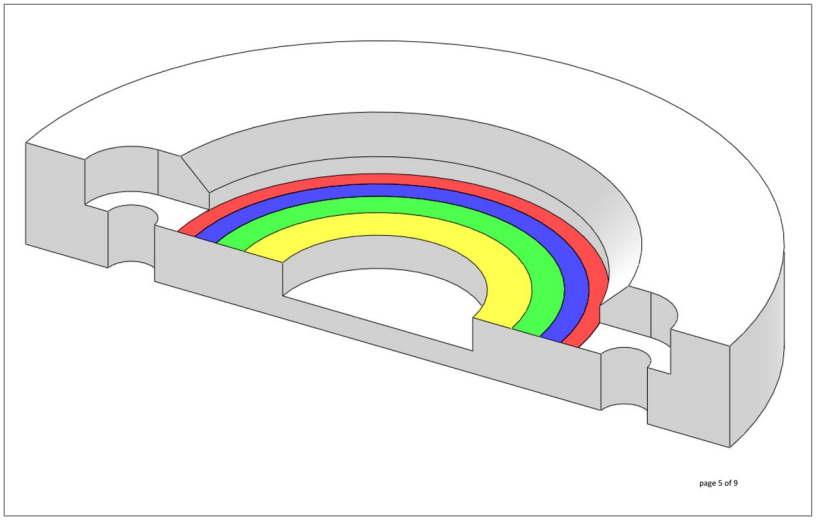

Figure 3:
Four Optical Contact Area (OCA) categories defining a mechanical reference plane positioning different (external) reflector geometries

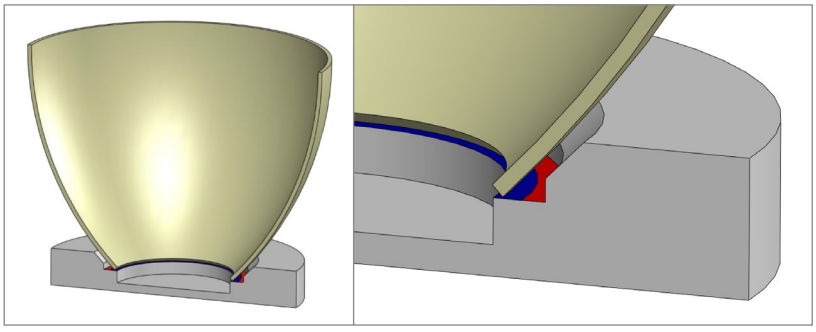

Figure 4:
Different reflector designs and materials can be accommodated by the Zhaga spot module design (drawings by P. Sachsenweger)

below the reflector. The OCA outer dimension has a defined diameter for all modules. The inner dimension depends on the LES size and is classified in 4 OCA categories (Figure 3). This categorization enables consistent design of different reflector geometries.

Except the OCA height, the rest of the module shape is defined as a maximum outline only. Thus, LED module manufacturers may decide to reduce the module height or even completely change the shape of the resulting module, as long as the module is smaller or equal to the maximum module outline indicated in figure 2. On the other hand, the luminaire designer exactly knows the maximum space that may be occupied by the module and can design his luminaire such that every Zhaga certified module will mechanically fit into the fixture. Furthermore, Zhaga carefully designed the module outline to accommodate typical reflector materials and shapes, as can be seen in figure 4.

For connecting the LED module to the Electronic Control Gear (ECG) or to interconnect another LED module, space for electrical (inter)connection should be foreseen as indicated in the grey area in figure 2.

Summarizing, Zhaga has brought together luminaire and LED module designers and defined the mechanical interface of LED modules to facilitate both module and luminaire design enabling interchangeability of LED light sources. ■

Definitions and References:

LED Light Engine: A combination of one ECG (Electronic Control Gear) and one or more LED modules.

LED Module: A light source that is supplied as a single unit. In addition to one or more LEDs, their mechanical support and their electrical connection, it may contain components to improve its photometric, thermal, mechanical and electrical properties, but it does not include the electronic control gear.

Book 3: The interface specification for a spotlight LED light engine, consisting of an LED module and an electronic control gear in separate housings. See also: http://www.zhagastandard.org/specifications/book-3.html

Electronic Control Gear or ECG: A unit that is located between the external power and one or more LED modules to provide the LED module(s) with an appropriate voltage or current. It may consist of one or more separate components, and may include additional functionality, such as means for dimming, power factor correction, and radio interference suppression.