



IEC PAS 63166

Edition 1.0 2018-04

# PUBLICLY AVAILABLE SPECIFICATION



---

**Zhaga interface specification book 1 and book 7**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 29.140.01; 29.140.99

ISBN 978-2-8322-5627-5

**Warning! Make sure that you obtained this publication from an authorized distributor.**

# CONTENTS

<b>FOREWORD</b> .....	<b>6</b>
<b>1 General</b> .....	<b>9</b>
1.1 Introduction .....	9
1.2 Scope (informative).....	9
1.3 Conformance and References.....	9
1.3.1 Conformance .....	9
1.3.2 References .....	9
1.4 Definitions.....	9
1.5 Acronyms .....	10
1.6 Symbols.....	10
1.7 Conventions .....	10
1.7.1 Precedence .....	10
1.7.2 Cross references .....	10
1.7.3 Informative text.....	10
1.7.4 Terms in capitals.....	10
1.7.5 Units of physical quantities .....	10
1.7.6 Decimal separator .....	10
1.7.7 Limits .....	10
<b>2 System Overview (informative)</b> .....	<b>11</b>
2.1 General.....	11
2.2 Description of the LED Module .....	11
2.3 Outline of this Book .....	11
<b>3 Mechanical Interface</b> .....	<b>13</b>
3.1 Drawing principles .....	13
3.2 Mechanical references.....	13
3.3 Book-7 LED Module categories .....	13
3.3.1 L6W6.....	14
3.3.2 L14W2.....	16
3.3.3 L28W2.....	18
3.3.4 L28W4.....	20
3.3.5 L28W6.....	22
3.3.6 L28W28.....	24
3.3.7 L38W38.....	26
3.3.8 L56W56.....	28
3.3.9 L56W2.....	30
3.3.10 L56W4.....	32
3.4 Requirements on the mechanical interface of the Book-7 Luminaire .....	34
3.4.1 Flatness and roughness of the Thermal Interface Surface .....	34
3.4.2 Luminaire keep-out for interconnect .....	34
<b>4 Photometric Interface</b> .....	<b>35</b>
4.1 Light Emitting Surface .....	35
4.2 Operating conditions for measuring photometric parameters .....	35

4.3	Luminous flux .....	35
4.4	Luminous intensity distribution .....	35
4.5	Luminance uniformity .....	35
4.6	Correlated color temperature (CCT) .....	36
4.7	Color rendering index (CRI) .....	36
<b>5</b>	<b>Electrical Interface .....</b>	<b>37</b>
5.1	Electrical interface to the ECG .....	37
5.2	Electrical insulation .....	37
5.3	Mechanical aspects of the electrical interface to the ECG .....	37
<b>6</b>	<b>Thermal Interface .....</b>	<b>38</b>
6.1	Background information (informative) .....	38
6.2	General thermal requirements for Book-7 LED Modules .....	38
6.3	Thermal headroom of Book-7 LED Modules .....	38
<b>7</b>	<b>Compliance test tools .....</b>	<b>40</b>
7.1	LED Module test tools .....	40
7.1.1	Test Fixture PETF (photometric and electrical) .....	40
7.1.2	Test Fixture THTF (Thermal Headroom) .....	40
<b>8</b>	<b>LED Module Compliance Tests .....</b>	<b>44</b>
8.1	LED Module mechanical interface tests .....	44
8.1.1	Test of the mechanical interface of the LED Module .....	44
8.2	LED Module photometric interface tests .....	44
8.2.1	Test of Luminous Flux .....	44
8.2.2	Test of correlated color temperature (CCT) .....	45
8.2.3	Test of color rendering index (CRI) .....	45
8.2.4	Test on luminance uniformity data .....	45
8.3	LED Module thermal interface tests .....	46
8.3.1	Test of thermal headroom of the LED Module .....	46
8.4	LED Module electrical interface tests .....	46
8.5	LED Module Product Data Set test .....	46
<b>9</b>	<b>Luminaire compliance tests .....</b>	<b>47</b>
9.1	Luminaire mechanical interface tests .....	47
9.1.1	Test on the mechanical interface of the Luminaire for mounting the LED Module(s) .....	47
9.2	Luminaire Product Data Set test .....	47
<b>Annex A</b>	<b>Product Data Set requirements .....</b>	<b>49</b>
A.1	LED Module Product Data Set .....	49
A.2	Luminaire Product Data Set .....	49
<b>Annex B</b>	<b>Measurements on Luminance uniformity (informative) .....</b>	<b>50</b>
B.1	Test equipment .....	50
B.2	Test conditions .....	50
B.3	Test procedure .....	51

<b>Annex C</b>	<b>Guidelines for mechanical interface test (informative)</b>	<b>52</b>
<b>Annex D</b>	<b>History of Changes</b>	<b>54</b>
<b>1</b>	<b>General</b>	<b>56</b>
1.1	Introduction	56
1.2	Scope	56
1.3	Conformance and references	56
1.3.1	Conformance	56
1.3.2	Normative references	56
1.3.3	Informative references	57
1.4	Common definitions	57
1.5	Common acronyms	59
1.6	Common symbols	59
1.7	Common conventions	60
1.7.1	Cross references	60
1.7.2	Informative text	60
1.7.3	Terms in capitals	60
1.7.4	Units of physical quantities	60
1.7.5	Decimal separator	60
<b>2</b>	<b>Overview of Zhaga (informative)</b>	<b>61</b>
2.1	About Zhaga	61
2.2	Zhaga building blocks and interfaces	61
2.3	Compatibility and Interchangeability	63
2.4	Product Data Set	63
2.5	Compliance testing	63
2.5.1	Certification	64
2.5.2	Market surveillance	64
2.6	Compatibility check	64
2.7	Zhaga product certification	65
<b>3</b>	<b>Mechanical interface</b>	<b>66</b>
3.1	Drawing principles	66
3.2	Mechanical interface between Separate ECG and Luminaire	66
3.3	Thermal expansion	66
<b>4</b>	<b>Photometric interface</b>	<b>67</b>
4.1	Light Emitting Surface	67
4.1.1	LES categories	67
4.2	Operating conditions for measuring photometric parameters	68
4.3	Luminous flux	69
4.4	Luminous intensity distribution	69
4.4.1	Beam angle and beam angle categories	70
4.5	Luminance uniformity	70
4.6	Correlated color temperature (CCT)	70

4.7 Color rendering index (CRI) .....	71
4.8 Luminaire Optics (informative) .....	71
<b>5 Electrical interface .....</b>	<b>72</b>
5.1 Electrical insulation (informative) .....	72
<b>6 Thermal interface .....</b>	<b>73</b>
6.1 Background information (informative) .....	73
6.2 Generic thermal interface model .....	73
6.2.1 General case .....	73
6.2.2 Test Fixture TPTF .....	75
6.2.3 Rated Operating Temperature and safety (informative) .....	75
6.2.4 Thermal overload protected LED Light Engine (Informative) .....	75
6.2.5 Ambient Temperature .....	76
6.2.6 Luminaires with multiple LLEs or multiple LED Modules .....	76
6.2.7 Thermal compatibility check .....	76
6.2.8 Thermal uniformity .....	77
6.2.9 Thermal Interface Material .....	78
6.2.10 Surface planarity and roughness .....	78
6.2.11 Aging of LED Light Engine or LED Module (informative) .....	78
6.2.12 Influence of the Electronic Control Gear on the thermal interface (informative) .....	78
6.2.13 Ambient Temperature and thermal resistance ( $R_{th}$ ) .....	79
<b>7 Control interface .....</b>	<b>80</b>
<b>Annex A Compliance tests .....</b>	<b>81</b>
A.0 LED Module compliance tests .....	81
A.0.1 LED Module mechanical interface test .....	81
A.0.2 LED Module photometric interface tests .....	81
A.0.3 LED Module thermal interface tests .....	83
A.0.4 LED Module electrical interface tests .....	84
A.0.5 LED Module Product Data Set test .....	84
A.1 LLE compliance tests .....	85
A.1.1 LLE mechanical interface tests .....	85
A.1.2 LLE photometric interface tests .....	85
A.1.3 LLE thermal interface tests .....	88
A.1.4 LLE electrical interface tests .....	93
A.1.5 LLE control interface tests .....	93
A.1.6 LLE Product Data Set test .....	93
A.2 Luminaire compliance tests .....	93
A.2.1 Luminaire mechanical interface tests .....	93
A.2.2 Luminaire photometric interface tests .....	94
A.2.3 Luminaire thermal interface tests .....	94
A.2.4 Luminaire electrical interface tests .....	94
A.2.5 Luminaire control interface tests .....	95
A.2.6 Luminaire Product Data Set test .....	95
<b>Annex B History of changes .....</b>	<b>96</b>

# INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

## ZHAGA INTERFACE SPECIFICATION BOOK 1 AND BOOK 7

### FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

A PAS is a technical specification not fulfilling the requirements for a standard, but made available to the public.

IEC PAS 63166 has been processed by subcommittee 34A: Lamps, of IEC technical committee 34: Lamps and related equipment.

This PAS is a reproduction of Zhaga Books 1 and 7 with no changes introduced.

The document layout, terms and definitions, etc. within this PAS therefore do not follow the normal IEC drafting rules that would be applied for an International Standard.

Subdivision 1 comprises Zhaga Book 7 – Rectangular LED Module with undefined LES.

Subdivision 2 comprises Zhaga Book 1 – Overview and common information, which is essential to the interpretation of Zhaga Book 7 (and future Zhaga books).

The future intention is for the content of this PAS to be incorporated within one or more International Standards and at this time any conflict with IEC Directives and drafting rules will be addressed.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

<b>Draft PAS</b>	<b>Report on voting</b>
34A/2048/PAS	34A/2054/RVDPAS

Following publication of this PAS, the technical committee or subcommittee concerned may transform it into an International Standard.

This PAS shall remain valid for an initial maximum period of 2 years starting from the publication date. The validity may be extended for a single period up to a maximum of 2 years, at the end of which it shall be published as another type of normative document, or shall be withdrawn.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## ZHAGA INTERFACE SPECIFICATION BOOK 1 AND BOOK 7

### Subdivision 1

## Zhaga Interface Specification Book 7 Rectangular LED Module with undefined LES

### Summary (informative)

#### Background

The Zhaga Consortium is a global lighting-industry organization that aims to standardize LED light engines and associated components such as LED modules, holders and electronic control gear (LED drivers).

Zhaga has created a set of interface specifications, known as Books. Each Book defines an LED light engine and/or associated components by means of the mechanical, photometric, electrical, thermal, and control interfaces of the product to its environment. This makes such products interchangeable in the sense that it is easy to replace one product with another, even if they have been made by different manufacturers.

#### Contents

This book 7 defines several LED modules. Each LED module has a rectangular shape and the only restriction to the light emitting surface is that no light is emitted in the direction of the reference plane of the LED module.

This book must be read together with book 1, which is included as Subdivision 2 of this document.

#### Intended Use

The Book-7 LED module can be mounted in a luminaire, for example by means of screws. Book-7 LED modules are intended to be replaced by professionals only.



# 1 General

## 1.1 Introduction

The Zhaga Consortium is a global organization that aims to standardize LED Light Engines and associated components. A LED Light Engine is a light source for general lighting that is based on solid state technology, and typically consists of one or more LEDs combined with an Electronic Control Gear. Examples of associated components are LED Modules, Electronic Control Gears, and Holders. Zhaga has created a set of interface specifications, known as Books defining interfaces between LED Light Engines, associated components and Luminaires.

Book 1 is a special Book in the sense that it provides common information, which is relevant to all other Books in the series. In addition, Book 1 defines requirements and compliance tests, which are applicable across multiple Zhaga books. Such Books refer to those requirements and compliance tests as applicable.

## 1.2 Scope (informative)

This Book 7 defines LED Modules, which can be fixed in a Luminaire. This document defines:

- Ten categories of the rectangular shaped LED Modules.
- Luminaires that provide the appropriate environment for the Book-7 LED Module(s).

Book 7 LED Modules are intended to be installed and replaced by Luminaire manufacturers only. Book 1 is included as Subdivision 2 of this document.

## 1.3 Conformance and References

### 1.3.1 Conformance

All provisions in the Zhaga interface Specification are mandatory, unless specifically indicated as recommended, optional or informative. Verbal expressions of provisions in the Zhaga Interface Specification follow the rules provided in Annex H of ISO/IEC Directives, Part 2:2011. For clarity, the word “shall” indicates a requirement that is to be followed strictly in order to conform to the Zhaga Interface Specification, and from which no deviation is permitted. The word “should” indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited. The word “may” indicates a course of action permissible within the limits of the Zhaga Interface Specification. The word “can” indicates a possibility or capability, whether material, physical or causal.

### 1.3.2 References

For references that are not listed in this section, see [Book 1]. For undated references, the most recently published edition applies.

[Book 1]	Zhaga Interface Specification, Book 1: Overview and Common Information. Book 1 is included as Subdivision 2 of this document.
[ISO/IEC 15948]	Information technology – Computer graphics and image processing – Portable Network Graphics (PNG): Functional specification.
[IEC 60598-1]	Luminaires – Part 1: General requirements and tests
[LEDset-Inf]	LEDset1 Information Interface Specification, Edition 1.2, November, 2016 available from md-sig.org.
[LEDset-Pow]	LEDset Power Interface Specification, Edition 1.1, November, 2016 available from md-sig.org.