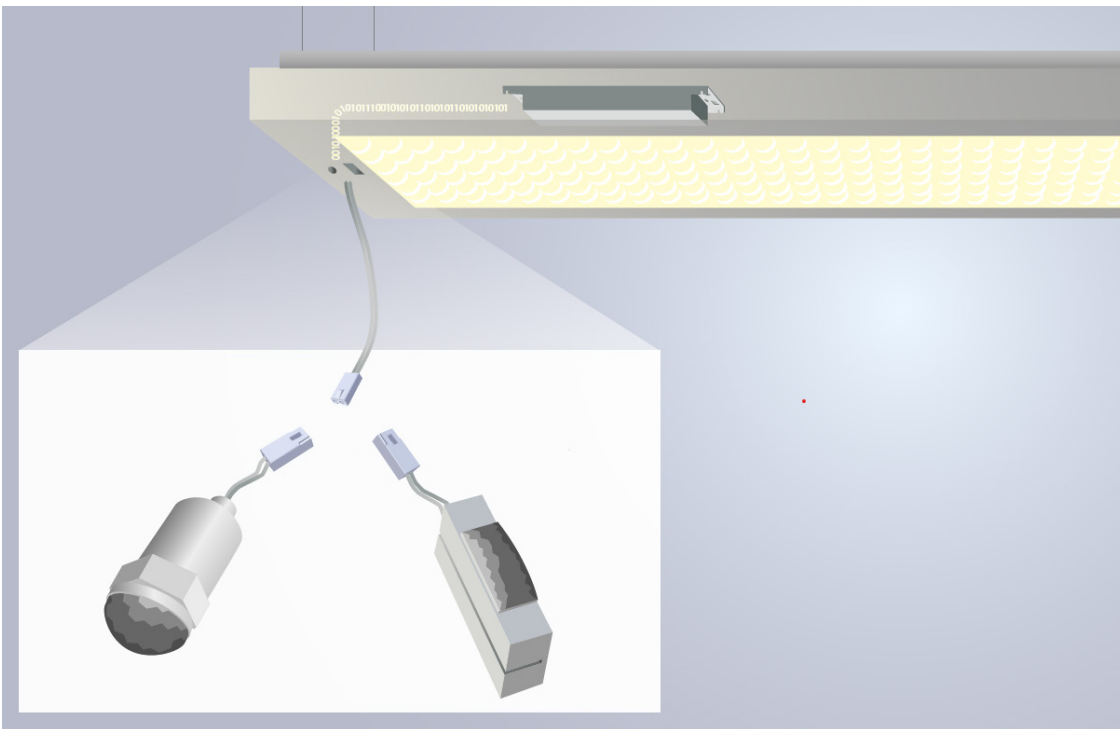


Book 20

Smart interface between indoor luminaires and sensing/communication modules

Edition 1.1 / May 2021



Zhaga Interface Specification Book 20

Summary (informative)

Background

Zhaga is a global association of lighting companies that is standardizing interfaces of components of LED luminaires, including LED light engines, LED modules, LED arrays, holders, electronic control gears (LED drivers), sensors, communication modules and connectivity fit systems. This helps to streamline the LED lighting supply chain, and to simplify LED luminaire design and manufacturing. Zhaga continues to develop specifications based on the inter-related themes of interoperable components, smart and connected lighting, and serviceable luminaires.

Contents

Book 20 defines a smart interface between an indoor LED luminaire and a sensing/communication module. The module connects to the LED driver and control system, and typically can provide sensory inputs or enable communication between network components. Modules can be installed and replaced in the field.

Key benefits are provided for

- luminaire makers, as certified sensors from multiple suppliers are available with a range of different functions
- installers, as certification on interoperability of components exists
- end-users, as the luminaire can be adapted with modules for different functions, like air quality, presence detection, light levels etc.

This Book should be read together with Zhaga Book 1.

Intended Use

The luminaire extension module defined in this Book 20 is intended to be installed and replaced by professionals and non-professionals.

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The information contained in this document is marked as confidential.

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For any further explanation of the contents of this document, or in case of any perceived inconsistency or ambiguity of interpretation, visit www.zhagastandard.org or contact info@zhagastandard.org.

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1 General

1.1 Introduction

Zhaga is a global association of lighting companies that is standardizing interfaces of components of LED luminaires, including LED light engines, LED modules, LED arrays, holders, electronic control gears (LED drivers), sensors, communication modules and connectivity fit systems. This helps to streamline the LED lighting supply chain, and to simplify LED luminaire design and manufacturing. Zhaga continues to develop specifications, called books, based on the inter-related themes of interoperable components, smart and connected lighting, and serviceable 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

Book 20 defines a smart interface between an indoor LED luminaire and a sensing/communication module. The module connects to the LED driver and control system, and typically can provide sensory inputs or enable communication between network components. Modules can be installed and replaced in the field.

1.3 Conformance and references

1.3.1 Conformance

All provisions in the Zhaga interface Specifications are mandatory, unless specifically indicated as recommended, optional, or informative. Verbal expressions of provisions in the Zhaga interface specifications follow the rules provided in Annex H of ISO/IEC Directives, Part 2. For clarity, the word “shall” indicates a requirement that is to be followed strictly in order to conform to the Zhaga interface specifications, 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.

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.
[DALI - Part 101]	IEC 62386-101:2014, Digital addressable lighting interface - Part 101: General requirements – System components, Edition 2.0, 2014-11.
[DALI - Part 102]	IEC 62386-102:2014, Digital addressable lighting interface - Part 102: General requirements – Control gear, Edition 2.0, 2014-11.
[DALI - Part 103]	IEC 62386-103:2014, Digital addressable lighting interface - Part 103: General requirements – Control devices, Edition 2.0, 2014-11.
[DALI - part 207]	IEC 62386-207:2009, Digital addressable lighting interface - Part 207: Particular requirements for control gear - LED modules, Edition 1.0.
[DALI - Part 250]	DiiA specification - DALI Part 250 – Integrated Bus Power Supply, Device Type 49, Version 1.1, October 2019.
[DALI - Part 251]	DiiA specification - DALI Part 251 – Memory bank 1 extension, Device Type 50, Version 1.1, October 2019.
[DALI - Part 252]	DiiA specification - DALI Part 252 – Energy reporting, Device Type 51, Version 1.1, October 2019.

[DALI - Part 253]	DiiA specification - DALI Part 253 – Diagnostics & Maintenance, Device Type 52, Version 1.1, October 2019.
[DALI - Part 351]	DiiA specification - DALI Part 351 – Luminaire-mounted Control Devices, Version 1.0, October 2019.
[D4i Requirements]	DiiA Requirements - D4i Certification and Trademark use, Version 1.0, October 2019.
[DiiA Database]	https://www.digitalilluminationinterface.org/products
[IEC60598-1]	IEC 60598-1; 2014, Luminaires – Part 1: General requirements and tests. Edition 8.0.
[IEC 60529]	IEC 60529:1989/AMD2:2013, Degrees of protection provided by enclosures.
[LoC-Luminaire]	Template for letter of confirmation for Book-20 Luminaires, published on the Zhaga website.
[LoC-LEX-M]	Template for letter of confirmation for Book-20 LEX-Ms, published on the Zhaga website.
[LoC-LEX-LP]	Template for Letter of confirmation for Book-20 LEX-LP, published on the Zhaga website.
[LoC-LEX-MR]	Template for Letter of confirmation for Book-20 LEX-MR, published on the Zhaga website.

1.4 Definitions

This section defines terms that have a specific meaning in the context of this Book 20. Terms that have a specific meaning across all Zhaga Books are defined in [Book 1].

Luminaire Extension Module	Module attachable to the Luminaire according to the specifications in this book.
Luminaire Extension Slot	Slot in the Luminaire according to the specifications in this book.
Luminaire Extension Module Receptacle	Module Receptacle according to the specifications in this book.
Luminaire Extension Luminaire Plug	Luminaire Plug according to the specifications in this book.
Luminaire Extension Bus	Intra Luminaire bus according to the specifications in this book.

1.5 Acronyms

This section defines acronyms that have a specific meaning in the context of this Book 20. Acronyms that have a specific meaning across all Zhaga Books are defined in [Book 1].

LEX-M	Luminaire Extension Module
LEX-S	Luminaire Extension Slot
LEX-MR	Luminaire Extension Module Receptacle
LEX-LP	Luminaire Extension Luminaire Plug
LEX-B	Luminaire Extension Bus

1.6 Symbols

Symbols that have a specific meaning across all Zhaga Books defined in [Book 1].

1.7 Conventions

This section defines the notations and conventions used in the Zhaga Interface Specifications.

1.7.1 Precedence

In the case of any perceived discrepancy between the defined requirements provided in Part 1 of this document (Interface Definition) and the test specifications provided in Part 2 of this document (Compliance Testing), the test specifications provided in Part 2 take precedence over the requirements provided in Part 1.

1.7.2 Cross references

Unless indicated otherwise, cross references to sections include the sub sections contained therein.

1.7.3 Informative text

Informative text is set in italics unless the whole section is marked as informative.

1.7.4 Terms in capitals

Terms that have a specific meaning in the context of this Book 20 are capitalized. See section 1.4.

1.7.5 Units of physical quantities

Physical quantities are expressed in units of the International System of Units. All lengths that omit an explicit unit indication are in millimeters.

1.7.6 Decimal separator

The decimal separator is a point.

1.7.7 Limits

Values that are indicated as typical, as well as values between parentheses, are informative.

2 Overview (Informative)

2.1 General

General information with respect to the Zhaga Interface Specifications and certification of products that comply with this Book 20 can be found in [Book 1], section 2.

2.2 Overview of the indoor connectivity system.

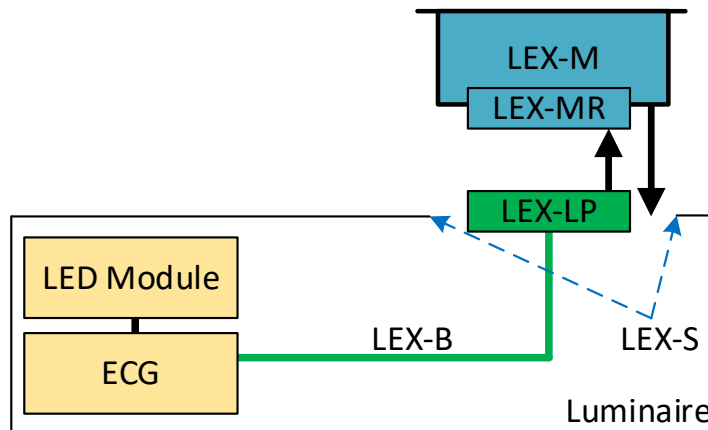


Figure 2-1: Schematic overview of a typical Book 20 Luminaire and a Luminaire Extension Module.

A schematic overview of a typical Book 20 Luminaire and a Luminaire Extension Module (LEX-M) is depicted in Figure 2-1.

The Luminaire features:

- An opening in the housing for mounting a Luminaire Extension Module. This opening is denoted Luminaire Extension Slot (LEX-S)
- An ECG with appropriate functionality and a connection to the Luminaire Extension Bus (LEX-B)
- A LEX-B cable with a LEX Luminaire Plug (LEX-LP)

The LEX-M is a separate unit which can easily be mounted in the LEX-S. Typically, it holds additional functionality to enrich the functionality of the total system.

The LEX-M features a Luminaire Extension Module Receptacle (LEX-MR) for mating with the LEX-LP.

This Book 20 defines:

- The mechanical interface of 5 categories of the LEX-M and the LEX-S with different dimensions and identified by designations:
 - R44x17 (rectangular 44x17 mm)
 - R60x22 (rectangular 60x22 mm)
 - C22-T1A (round Ø 22 mm)
 - C22-T1B (round Ø 22 mm)
 - C22-T2 (round Ø 22 mm)
- The mechanical interface of the LEX-LP

- The mechanical interface of the LEX-MR
- The electrical and communication interface of the LEX-B defined at the interface between LEX-LP and LEX-MR.

2.3 Plug-and-play and Performance

The aim of this standard is to enable interoperability by design of the LEX-M and the Luminaire. This means that any LEX-M compliant with this specification is interoperable with any Luminaire compliant with this specification. The specification aims for plug-and-play operation. At the same time, there are no guarantees for the performance of the combination. For example, when adding a presence sensor with a poor performance to the Luminaire the combination will operate but obviously the presence detection will be poor.

2.4 Outline of this Book

This Book 20 consists of two parts:

Part 1, Interface Definition, defines the Luminaire/LEX-M interface in terms of the two sub interfaces:

- The mechanical interface (section 3).
- Electrical & Communication Interface (section 4).

Part 2, Compliance Tests, defines:

- Compliance test tools (section 5)
- LEX-MR compliance tests (section 6)
- LEX-LP compliance tests (section 7)
- LEX-M compliance tests (section 8)
- Luminaire compliance tests (section 9)

The Annexes to this Book 20 provide the following additional information:

- Product data set requirements (Annex A)

Part 1: Interface Definition

3 Mechanical interface

For of this section, also the provisions in [Book 1] - section 3.3, apply.

3.1 Drawing principles

The characteristics of the mechanical interface are specified according to the following principles:

- Third angle projection is used.

3.2 Mechanical references

The reference plane, the reference point and the reference axes of LEX-M and LEX-S are defined in Figure 3-1.

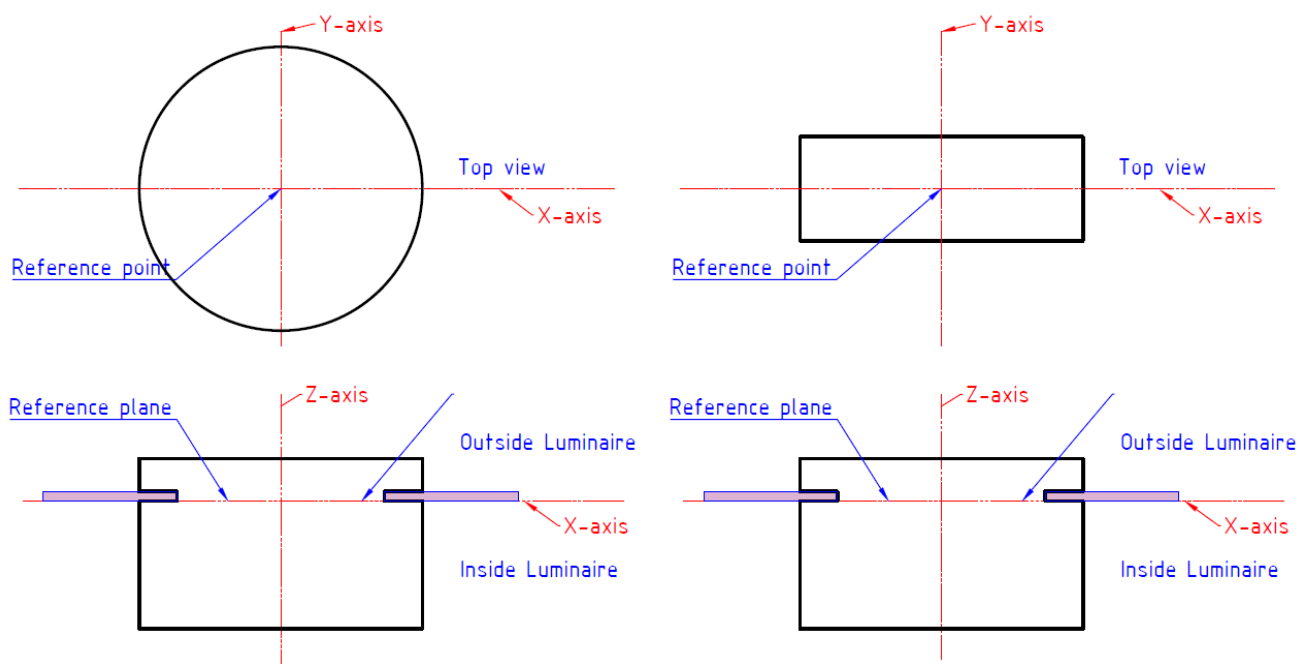


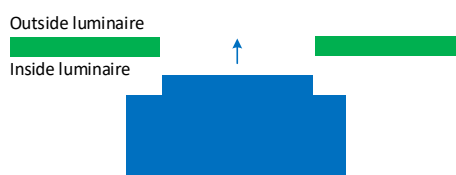
Figure 3-1: Positions of the reference point, the reference plane and the reference axes of the LEX-S and LEX-M for circular and rectangular formfactors.

3.3 Overview (informative)

The specification of the mechanical interface allows the LEX-M to be mounted in the Luminaire in three different ways:

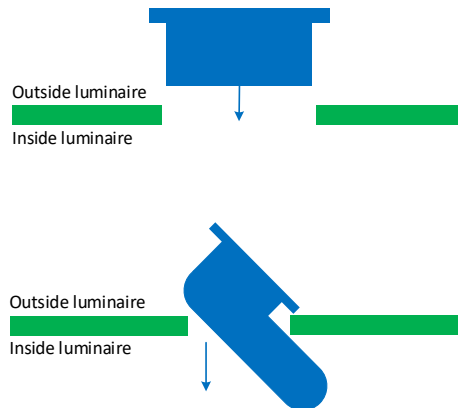
Configuration 1:

- LEX-M is mounted from the inside of the Luminaire into the LEX-S



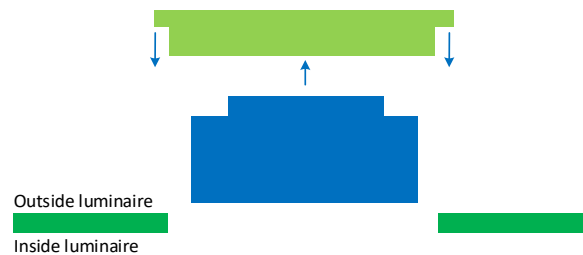
Configuration 2:

- LEX-M is mounted from the outside of the Luminaire into the LEX-S



Configuration 3:

- The Luminaire features an opening larger than LEX-S and a bracket that fits in that opening
- The bracket features a LEX-S
- The LEX-M is mounted from the outside of the Luminaire by
 - Removal of the bracket
 - Attachment of the LEX-M to the bracket
 - Attachment of the bracket + LEX-M to the Luminaire



3.4 Method used to specify the mechanical interface of the Luminaire and the LEX-M (informative)

For all categories, specified in this section 3 the same method is used to specify the mechanical interface of the Luminaire and the LEX-M. This method is schematically depicted in Figure 3-2. The following aspects are specified:

- The LEX-S with nominal dimensions + tolerances
- The thickness of the mounting plate with lower and upper limit.
- Area around the LEX-S where the mounting surface shall be even.
- The demarcation inside the Luminaire and outside the Luminaire

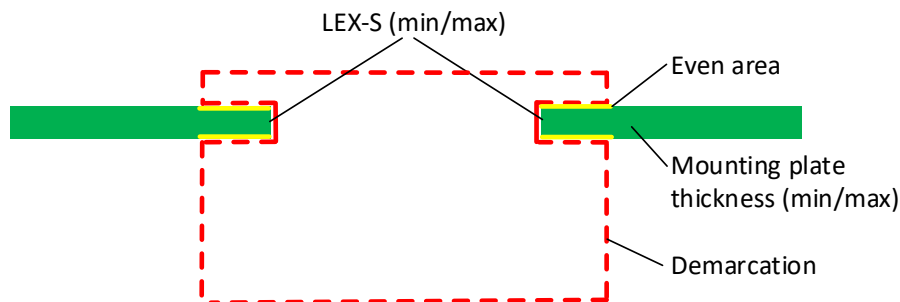


Figure 3-2: Method of specification of the mechanical interface of the Luminaire and the LEX-M

3.5 Mechanical interface of the Luminaire and LEX-M - Category R44x17

3.5.1 LEX-M demarcation model

The geometry of the LEX-M shall be such that the total set of LEX-M + (optional) wire to LEX-MR + LEX-MR + maximum LEX-LP in mated position does not cross the boundaries of the LEX-M Demarcation as defined in Figure 3-3. The keep-in volume for the total set of LEX-M + (optional) wire to LEX-MR + LEX-MR + maximum LEX-LP is indicated by the green area. The maximum size of the LEX-LP is defined in section 3.10.3.2.

Note that the height of the external part of the demarcation (A.4) is defined with reference to the top surface of the mounting plate whereas the height of the internal part of the demarcation (A.3) is defined with reference to the bottom surface of the mounting plate. The Luminaire housing has a variable thickness as defined in section 3.5.3.3.

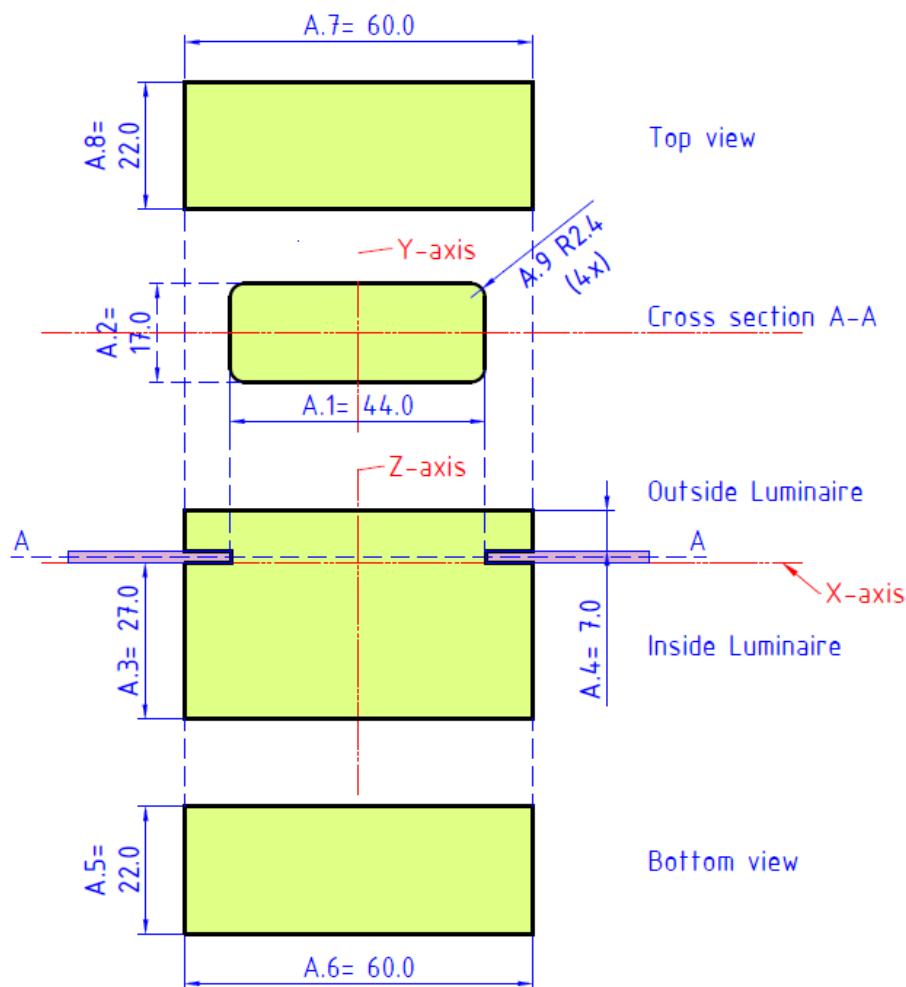


Figure 3-3: Demarcation model for the LEX-M - category R44x17.

Notes to Figure 3-3:

- X-axis, Y-axis and Z-axis are symmetry axes.
- The X-axis, Y-axis and Z-axis in this figure coincide with those in other figures of section 3.5.

3.5.2 Fixation of the LEX-M to the Luminaire

The fixation of the LEX-M to the Luminaire shall be provided by features of the LEX-M and shall not depend on specific features in the Luminaire other than the LEX-S as defined in section 3.5.3.3.

The means of fixation implemented in the LEX-M shall be such that the LEX-M can be detached from the Luminaire without damaging the LEX-M nor the Luminaire.

The means of fixation implemented in the LEX-M shall be such that it works for all thicknesses of the mounting plate within in the allowed range as defined in section 3.5.3.3.

3.5.3 Luminaire

3.5.3.1 Multiple LEX-Bs

The Luminaire may hold multiple sections with independent LEX-Bs, each connecting ECGs, Bus Power supply unit and one LEX-LP. In this case, each section of the Luminaire shall comply with all the requirements for Luminaires and LEX-S in sections 3.5.3.2 and 3.5.3.3 .

3.5.3.2 General

The Luminaire shall provide at least one LEX-S according to the definitions in section 3.5.3.3.

The Luminaire shall provide exactly one LEX Luminaire Plug according to the definitions in section 3.10.3.

The Luminaire (including optional bracket) shall not cross the boundaries of the LEX-M Demarcation as defined in Figure 3-3. The keep-out volume for the Luminaire is indicated by the green area.

3.5.3.3 Luminaire Extension Slot (LEX-S)

The Luminaire or the bracket shall have a LEX-S with dimensions as depicted in Figure 3-4. The thickness of the mounting plate shall be in the range $0.4 \leq D \leq 1.5$ mm and the typical value is 0.7 mm.

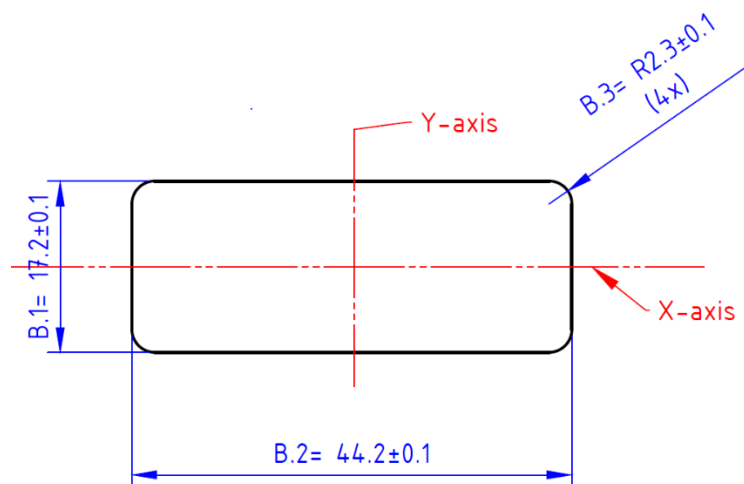


Figure 3-4: Dimensions of the LEX-S- category R44x17.

Notes to Figure 3-4:

- X-axis and Y-axis are symmetry axes.
- The X-axis and Y-axis in this figure coincide with those in other figures of section 3.5.

The surrounding area of the LEX-S as indicated in yellow in Figure 3-5 shall have an even surface at the exterior of the Luminaire as well as at the interior of the Luminaire.

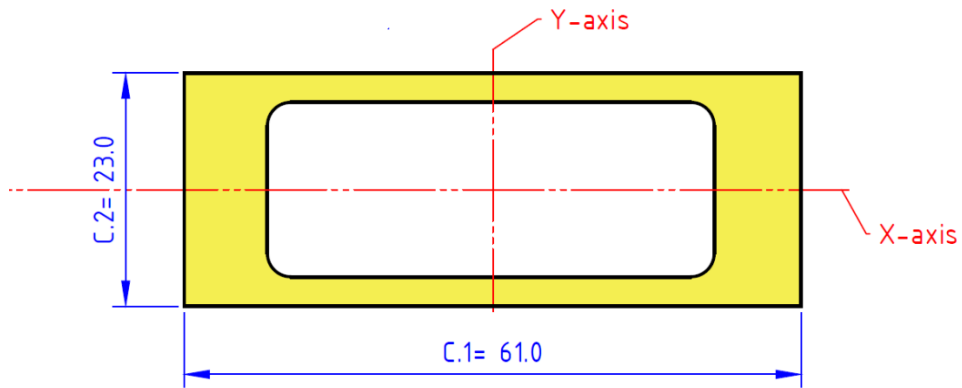


Figure 3-5: Border of the LEX-S - category R44x17.

Notes to Figure 3-5:

- X-axis and Y-axis are symmetry axes.
- The X-axis and Y-axis in this figure coincide with those in other figures of section 3.5.

3.6 Mechanical interface of the Luminaire and LEX-M - category R60x22

3.6.1 LEX-M demarcation model

The geometry of the LEX-M shall be such that the total set of LEX-M + (optional) wire to LEX-MR + LEX-MR + maximum LEX-LP in mated position does not cross the boundaries of the LEX-M Demarcation as defined in Figure 3-6. The keep-in volume for the total set of LEX-M + (optional) wire to LEX-MR + LEX-MR + maximum LEX-LP is indicated by the green area. The maximum size of the LEX-LP is defined in section 3.10.3.2.

Note that the height of the external part of the demarcation (D.4) is defined with reference to the top surface of the mounting plate whereas the height of the internal part of the demarcation (D.3) is defined with reference to the bottom surface of the mounting plate. The Luminaire housing has a variable thickness as defined in section 3.6.3.3.

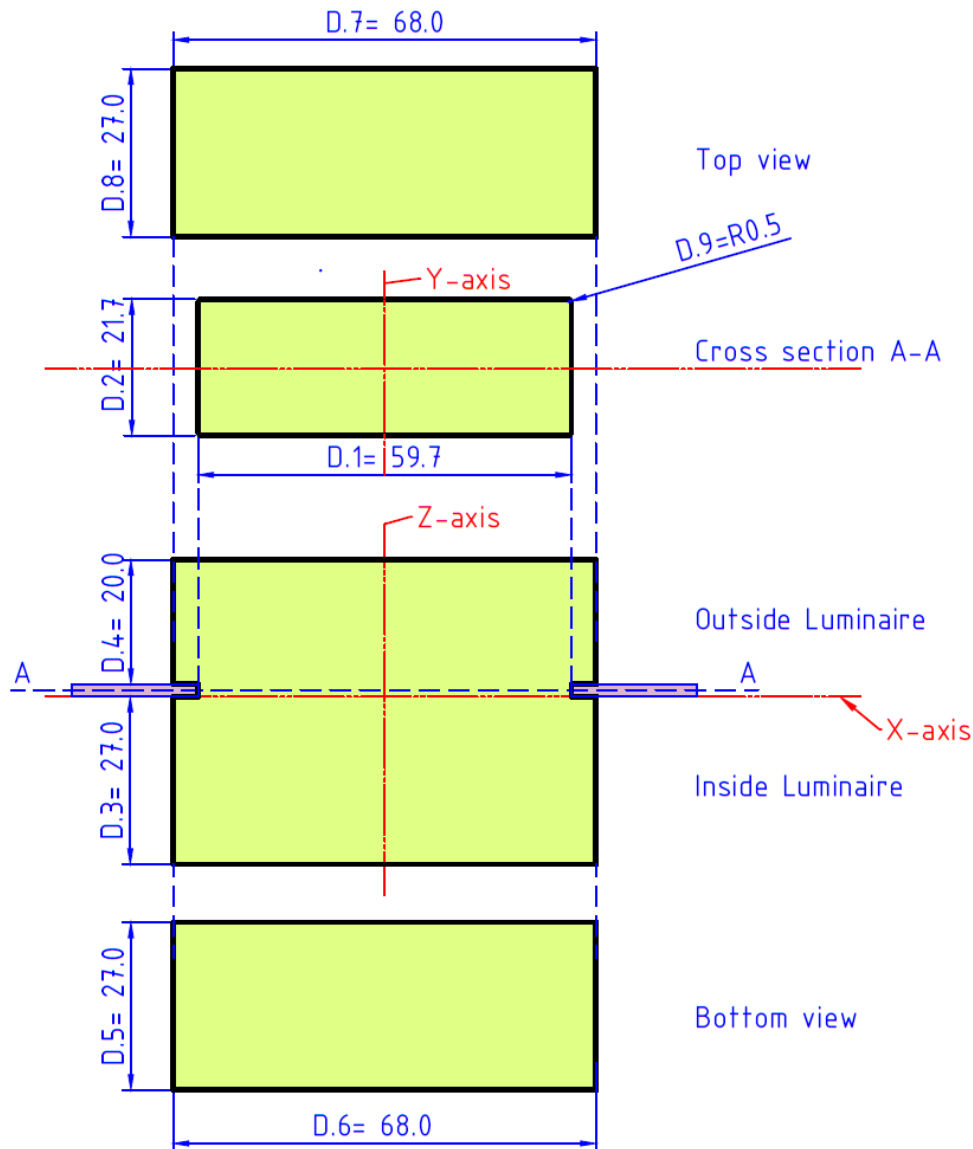


Figure 3-6: Demarcation model for the LEX-M - category R60x22.

Notes to Figure 3-6:

- X-axis, Y-axis and Z-axis are symmetry axes.
- The X-axis, Y-axis and Z-axis in this figure coincide with those in other figures of section 3.6.

3.6.2 Fixation of the LEX-M to the Luminaire

The fixation of the LEX-M to the Luminaire shall be provided by features of the LEX-M and shall not depend on specific features in the Luminaire other than the LEX-S as defined in section 3.6.3.3.

The means of fixation implemented in the LEX-M shall be such that the LEX-M can be detached from the Luminaire without damaging the LEX-M nor the Luminaire.

The means of fixation implemented in the LEX-M shall be such that it works for all thicknesses of the mounting plate within in the allowed range as defined in section 3.6.3.3.

3.6.3 Luminaire

3.6.3.1 Multiple LEX-Bs

The Luminaire may hold multiple sections with independent LEX-Bs, each connecting ECGs, Bus Power supply unit and one LEX-LP. In this case, each section of the Luminaire shall comply with all the requirements for Luminaires and LEX-S in sections 3.6.3.2 and 3.6.3.3.

3.6.3.2 General

The Luminaire shall provide at least one LEX-S according to the definitions in section 3.6.3.3.

The Luminaire shall provide exactly one LEX Luminaire Plug according to the definitions in section 3.10.3.

The Luminaire (including optional bracket) shall not cross the boundaries of the LEX-M Demarcation as defined in Figure 3-6. The keep-out volume for the Luminaire is indicated by the green area.

3.6.3.3 Luminaire Extension Slot (LEX-S)

The Luminaire or the bracket shall have a LEX-S with dimensions as depicted in Figure 3-7. The thickness of the mounting plate shall be in the range $0.4 \leq D \leq 1.5$ mm and the typical value is 0.7 mm.

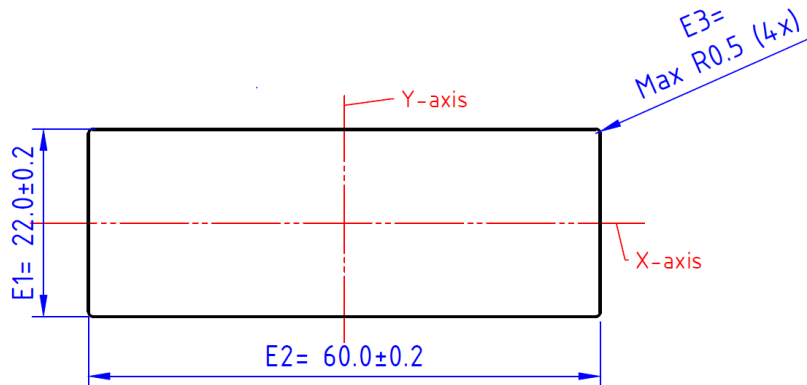


Figure 3-7: Dimensions of the LEX-S- category R60x22.

Notes to Figure 3-7:

- X-axis and Y-axis are symmetry axes.
- The X-axis and Y-axis in this figure coincide with those in other figures of section 3.6.

The surrounding area of the LEX-S as indicated in yellow in Figure 3-8 shall have an even surface at the exterior of the Luminaire as well as at the interior of the Luminaire.

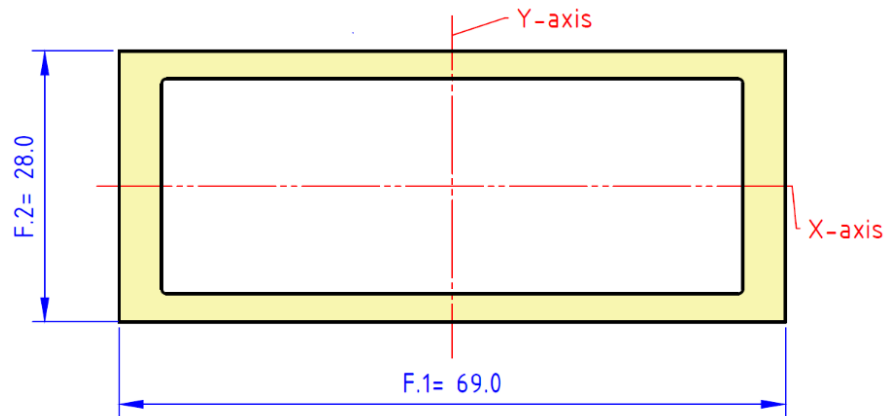


Figure 3-8: Border of the LEX-S - category R60x22.

Notes to Figure 3-8:

- X-axis and Y-axis are symmetry axes.
- The X-axis and Y-axis in this figure coincide with those in other figures of section 3.6.

3.7 Mechanical interface of the Luminaire and LEX-M - category C22-T1A

3.7.1 LEX-M demarcation model

The geometry of the LEX-M shall be such that the total set of LEX-M + (optional) wire to LEX-MR + LEX-MR + maximum LEX-LP in mated position does not cross the boundaries of the LEX-M Demarcation as defined in Figure 3-9. The keep-in volume for the total set of LEX-M + (optional) wire to LEX-MR + LEX-MR + maximum LEX-LP is indicated by the green area. The maximum size of the LEX-LP is defined in section 3.10.3.2.

Note that the height of the external part of the demarcation (G.3) is defined with reference to the top surface of the mounting plate whereas the height of the internal part of the demarcation (G.2) is defined with reference to the bottom surface of the mounting plate. The Luminaire housing has a variable thickness as defined in section 3.7.3.3.

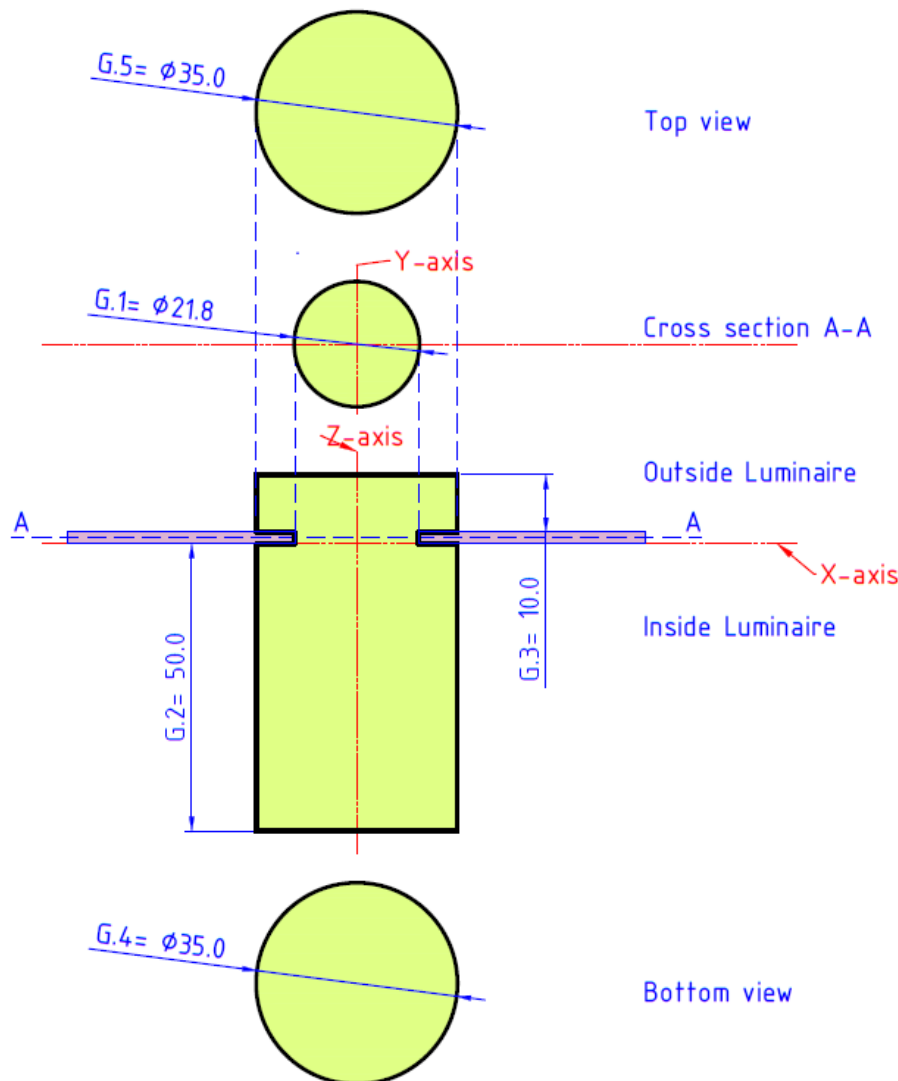


Figure 3-9: Demarcation model for the LEX-M - category C22-T1A.

Notes to Figure 3-9:

- X-axis, Y-axis and Z-axis are symmetry axes.
- The X-axis, Y-axis and Z-axis in this figure coincide with those in other figures of section 3.7.

3.7.2 Fixation of the LEX-M to the Luminaire

The fixation of the LEX-M to the Luminaire shall be provided by features of the LEX-M and shall not depend on specific features in the Luminaire other than the LEX-S as defined in section 3.7.3.3.

The means of fixation implemented in the LEX-M shall be such that the LEX-M can be detached from the Luminaire without damaging the LEX-M nor the Luminaire.

The means of fixation implemented in the LEX-M shall be such that it works for all thicknesses of the mounting plate within in the allowed range as defined in section 3.7.3.3.

3.7.3 Luminaire

3.7.3.1 Multiple LEX-Bs

The Luminaire may hold multiple sections with independent LEX-Bs, each connecting ECGs, Bus Power supply unit and one LEX-LP. In this case, each section of the Luminaire shall comply with all the requirements for Luminaires and LEX-S in sections 3.7.3.2 and 3.7.3.3.

3.7.3.2 General

The Luminaire shall provide at least one LEX-S according to the definitions in section 3.7.3.3.

The Luminaire shall provide exactly one LEX Luminaire Plug according to the definitions in section 3.10.3.

The Luminaire (including optional bracket) shall not cross the boundaries of the LEX-M Demarcation defined in Figure 3-9. The keep-out volume for the Luminaire is indicated by the green area.

3.7.3.3 Luminaire Extension Slot (LEX-S)

The Luminaire or the bracket shall have LEX-S with dimensions as depicted in Figure 3-10. The thickness of the mounting plate shall be in the range $0.4 \leq D \leq 1.5$ mm and the typical value is 0.7 mm.

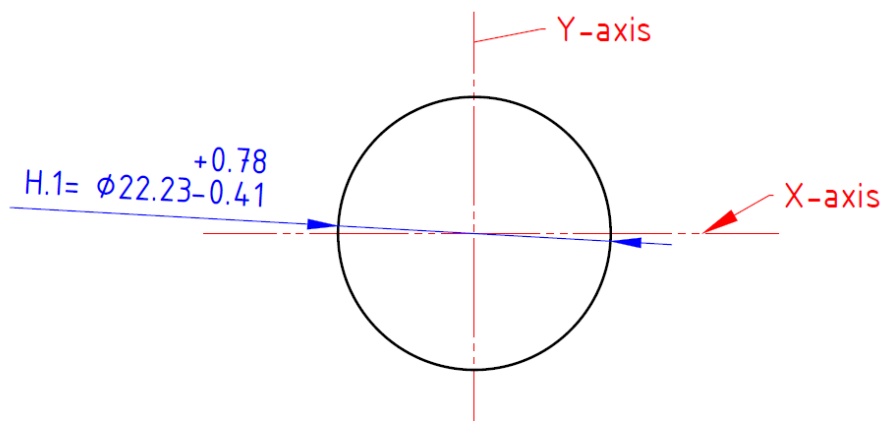


Figure 3-10: Dimensions of the LEX-S- category C22-T1A.

Notes to Figure 3-10:

- X-axis and Y-axis are symmetry axes.
- The X-axis and Y-axis in this figure coincide with those in other figures of section 3.7.

The surrounding area of the LEX-S as indicated in yellow in Figure 3-11 shall have an even surface at the exterior of the Luminaire as well as at the interior of the Luminaire.

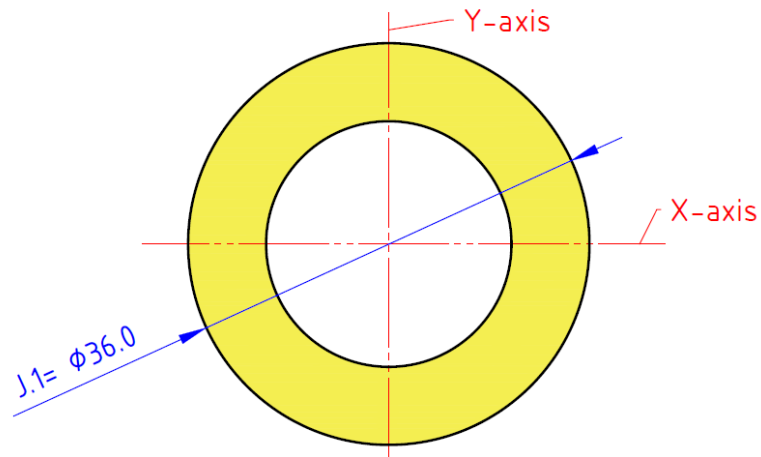


Figure 3-11: Border of the LEX-S – category C22-T1A.

Notes to Figure 3-11:

- X-axis and Y-axis are symmetry axes.
- The X-axis and Y-axis in this figure coincide with those in other figures of section 3.7.

3.8 Mechanical interface of the Luminaire and LEX-M - category C22-T1B

3.8.1 LEX-M demarcation model

The geometry of the LEX-M shall be such that the total set of LEX-M + (optional) wire to LEX-MR + LEX-MR + maximum LEX-LP in mated position does not cross the boundaries of the LEX-M Demarcation as defined in Figure 3-12. The keep-in volume for the total set of LEX-M + (optional) wire to LEX-MR + LEX-MR + maximum LEX-LP is indicated by the green area. The maximum size of the LEX-LP is defined in section 3.10.3.2.

Note that the height of the external part of the demarcation (G.3) is defined with reference to the top surface of the mounting plate whereas the height of the internal part of the demarcation (G.2) is defined with reference to the bottom surface of the mounting plate. The Luminaire housing has a variable thickness as defined in section 3.7.3.3.

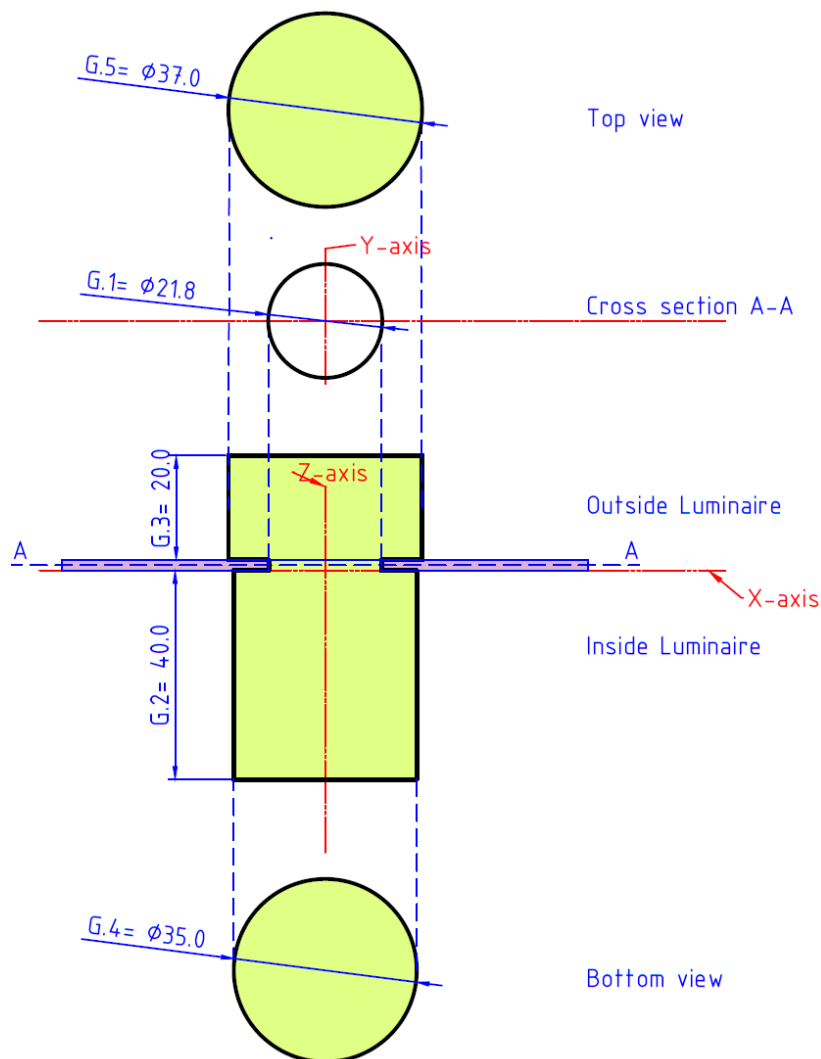


Figure 3-12: Demarcation model for the LEX-M - category C22-T1B.

Notes to Figure 3-12:

- X-axis, Y-axis and Z-axis are symmetry axes.
- The X-axis, Y-axis and Z-axis in this figure coincide with those in other figures of section 3.8.

3.8.2 Fixation of the LEX-M to the Luminaire

The fixation of the LEX-M to the Luminaire shall be provided by features of the LEX-M and shall not depend on specific features in the Luminaire other than the LEX-S as defined in section 3.8.3.3.

The means of fixation implemented in the LEX-M shall be such that the LEX-M can be detached from the Luminaire without damaging the LEX-M nor the Luminaire.

The means of fixation implemented in the LEX-M shall be such that it works for all thicknesses of the mounting plate within in the allowed range as defined in section 3.8.3.3.

3.8.3 Luminaire

3.8.3.1 Multiple LEX-Bs

The Luminaire may hold multiple sections with independent LEX-Bs, each connecting ECGs, Bus Power supply unit and one LEX-LP. In this case, each section of the Luminaire shall comply with all the requirements for Luminaires and LEX-S in sections 3.8.3.2 and 3.8.3.3.

3.8.3.2 General

The Luminaire shall provide at least one LEX-S according to the definitions in section 3.8.3.3.

The Luminaire shall provide exactly one LEX Luminaire Plug according to the definitions in section 3.10.3.

The Luminaire (including optional bracket) shall not cross the boundaries of the LEX-M Demarcation defined in Figure 3-12. The keep-out volume for the Luminaire is indicated by the green area.

3.8.3.3 Luminaire Extension Slot (LEX-S)

The Luminaire or the bracket shall have LEX-S with dimensions as depicted in Figure 3-13. The thickness of the mounting plate shall be in the range $0.4 \leq D \leq 1.5$ mm and the typical value is 0.7 mm.

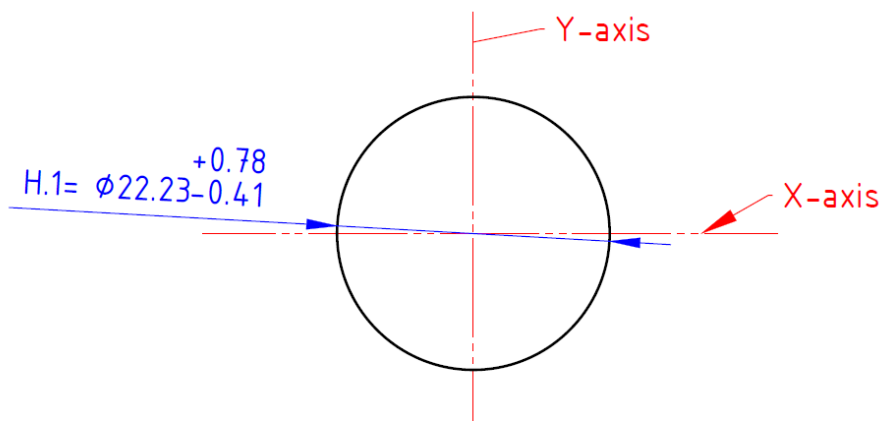


Figure 3-13: Dimensions of the LEX-S- category C22-T1B.

Notes to Figure 3-13:

- X-axis and Y-axis are symmetry axes.
- The X-axis and Y-axis in this figure coincide with those in other figures of section 3.8.

The surrounding area of the LEX-S as indicated in yellow in Figure 3-14 shall have an even surface at the exterior of the Luminaire as well as at the interior of the Luminaire.

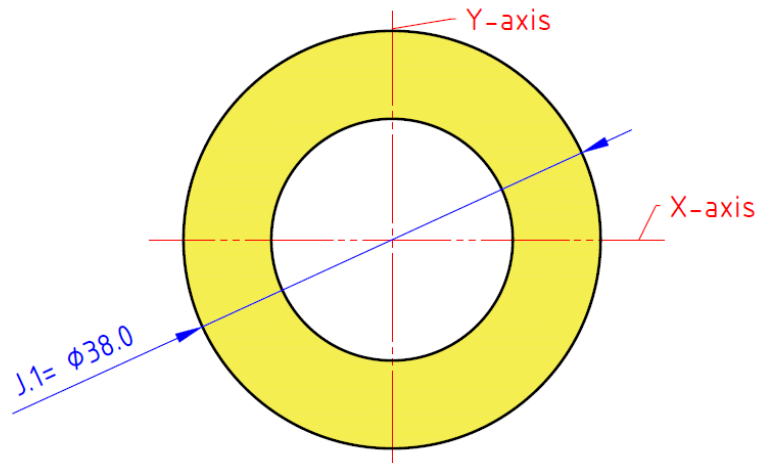


Figure 3-14: Border of the LEX-S – category C22-T1B.

Notes to Figure 3-14:

- X-axis and Y-axis are symmetry axes.
- The X-axis and Y-axis in this figure coincide with those in other figures of section 3.8.

3.9 Mechanical interface of the Luminaire and LEX-M - category C22-T2

3.9.1 LEX-M demarcation model

The geometry of the LEX-M shall be such that the total set of LEX-M + (optional) wire to LEX-MR + LEX-MR + maximum LEX-LP in mated position does not cross the boundaries of the LEX-M Demarcation as defined in Figure 3-15. The keep-in volume for the total set of LEX-M + (optional) wire to LEX-MR + LEX-MR + maximum LEX-LP is indicated by the green area. The maximum size of the LEX-LP is defined in section 3.10.3.2.

Note that the height of the external part of the demarcation (K.6) is defined with reference to the top surface of the mounting plate whereas the height of the internal part of the demarcation (K.2) is defined with reference to the bottom surface of the mounting plate. The Luminaire housing has a variable thickness as defined in section 3.9.3.3.

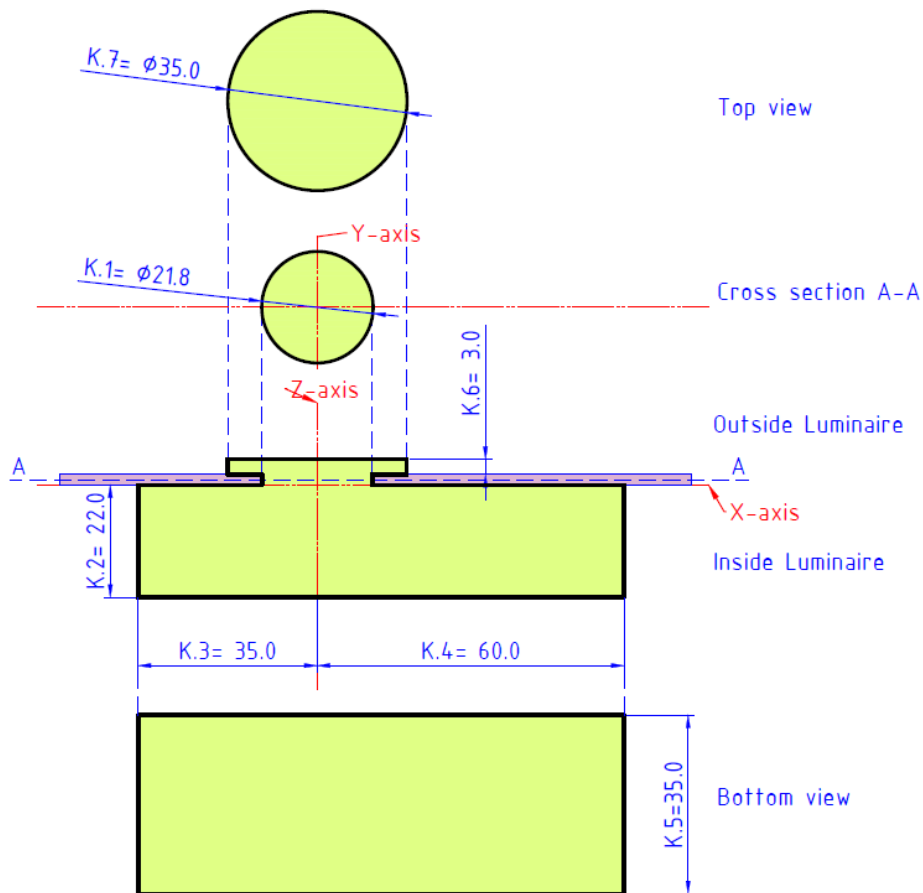


Figure 3-15: Demarcation model for the LEX-M - category C22-T2.

Notes to Figure 3-15:

- X-axis, Y-axis and Z-axis are symmetry axes.
- The X-axis, Y-axis and Z-axis in this figure coincide with those in other figures of section 3.9.

3.9.2 Fixation of the LEX-M to the Luminaire

The fixation of the LEX-M to the Luminaire shall be provided by features of the LEX-M and shall not depend on specific features in the Luminaire other than the LEX-S as defined in section 3.9.3.3.

The means of fixation implemented in the LEX-M shall be such that the LEX-M can be detached from the Luminaire without damaging the LEX-M nor the Luminaire.

The means of fixation implemented in the LEX-M shall be such that it works for all thicknesses of the mounting plate within in the allowed range as defined in section 3.9.3.3.

3.9.3 Luminaire

3.9.3.1 Multiple LEX-Bs

The Luminaire may hold multiple sections with independent LEX-Bs, each connecting ECGs, Bus Power supply unit and one LEX-LP. In this case, each section of the Luminaire shall comply with all the requirements for Luminaires and LEX-S in sections 3.9.3.2 and 3.9.3.3.

3.9.3.2 General

The Luminaire shall provide at least one LEX-S according to the definitions in section 3.9.3.3.

The Luminaire shall have exactly one LEX Luminaire Plug according to the definitions in section 3.10.3.

The Luminaire (including optional bracket) shall not cross the boundaries of the LEX-M Demarcation defined in Figure 3-15. The keep-out volume for the Luminaire is indicated by the green area.

3.9.3.3 Luminaire Extension Slot (LEX-S)

The Luminaire or the bracket shall have a LEX-S with dimensions as depicted in Figure 3-16. The thickness of the mounting plate shall be in the range $0.4 \leq D \leq 1.5$ mm and the typical value is 0.7 mm.

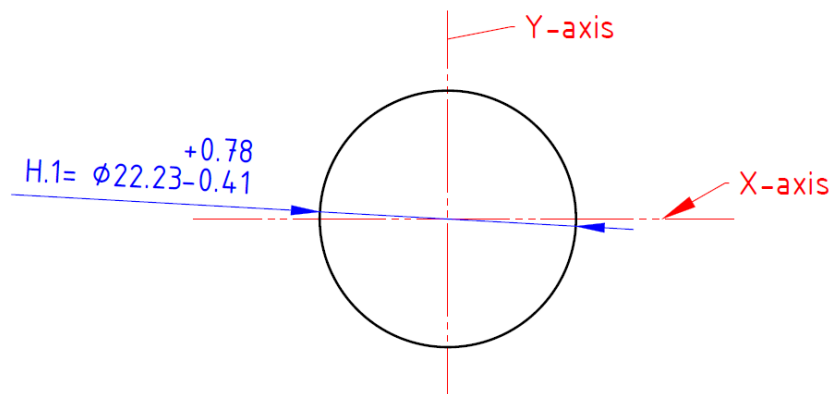


Figure 3-16: Dimensions of the LEX-S- category C22-T2.

Notes to Figure 3-16:

- X-axis and Y-axis are symmetry axes.
- The X-axis and Y-axis in this figure coincide with those in other figures of section 3.9.

The surrounding area of the LEX-S as indicated in yellow in Figure 3-17 shall have an even surface at the exterior of the Luminaire.

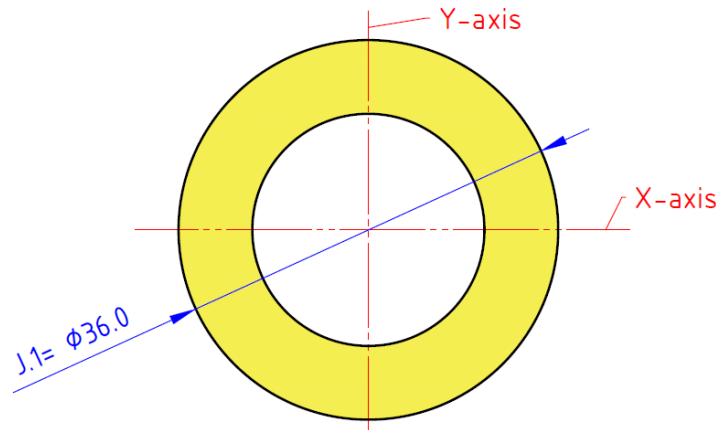


Figure 3-17: Border of the LEX-S - category C22-T2.

Notes to Figure 3-17:

- X-axis and Y-axis are symmetry axes.
- The X-axis and Y-axis in this figure coincide with those in other figures of section 3.9.

The surrounding area of the LEX-S as indicated in yellow in Figure 3-18 shall have an even surface at the interior of the Luminaire.

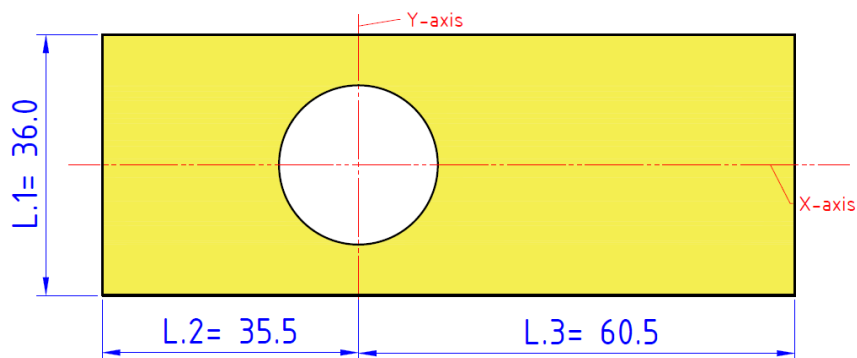


Figure 3-18: Internal border of the LEX-S - category C22-T2.

Notes to Figure 3-18:

- X-axis and Y-axis are symmetry axes.
- The X-axis and Y-axis in this figure coincide with those in other figures of section 3.9.

3.10 Mechanical interface of the LEX-MR and LEX-LP

3.10.1 Overview (informative)

A schematic overview of the connection system of the LEX-M is depicted in Figure 3-19. This connection system consists of a LEX-MR and a LEX-LP. This specification is intended to support two configurations:

- Wire-to-board configuration, shown on the left side in Figure 3-19. In this case the LEX-MR is fixed to the LEX-M.
- Wire-to-wire configuration, shown on the right side in Figure 3-19. In this case the LEX-MR is connected to the LEX-M via a wire.

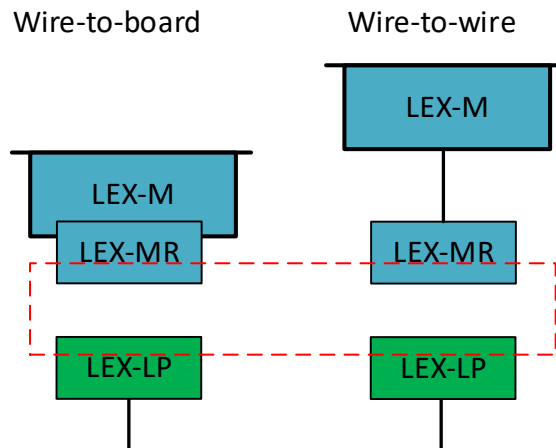


Figure 3-19: Supported configurations and scope of the specification.

This specification defines the interface indicated in Figure 3-19 by the red dashed box further referred to as the mating area. On top of that, the maximum sizes of the LEX-LP and the LEX-MR are specified. Apart from that, the designs of the LEX-MR and the LEX-LP are not restricted.

3.10.2 LEX Module Receptacle (LEX-MR)

For illustration purpose, examples of the wire-to-wire LEX-MR (left) and the wire-to-board LEX-MR (right) are shown in Figure 3-20. These drawings are informative and not part of the specification.

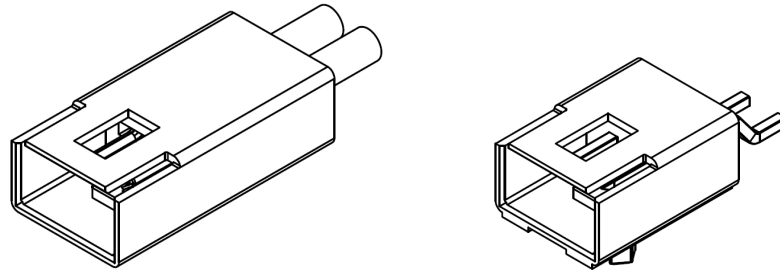


Figure 3-20: Examples of the wire-to-wire LEX-MR and the wire-to-board LEX-MR (informative)

3.10.2.1 LEX-MR mating area

The LEX-MR shall comply with the definitions in Figure 3-21 and Figure 3-22.

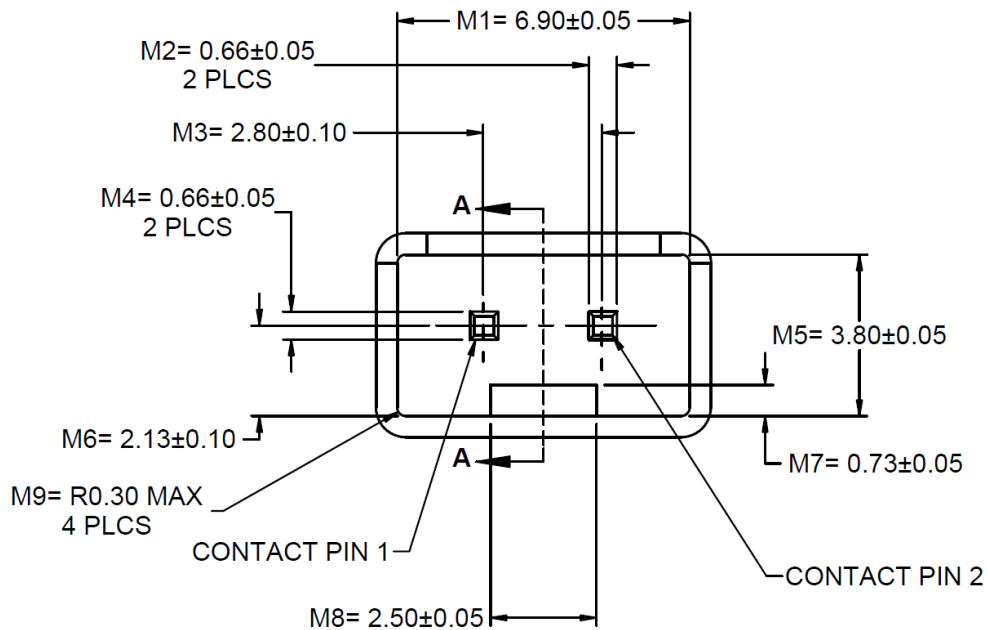


Figure 3-21: Mechanical interface of the mating area of the LEX-MR.

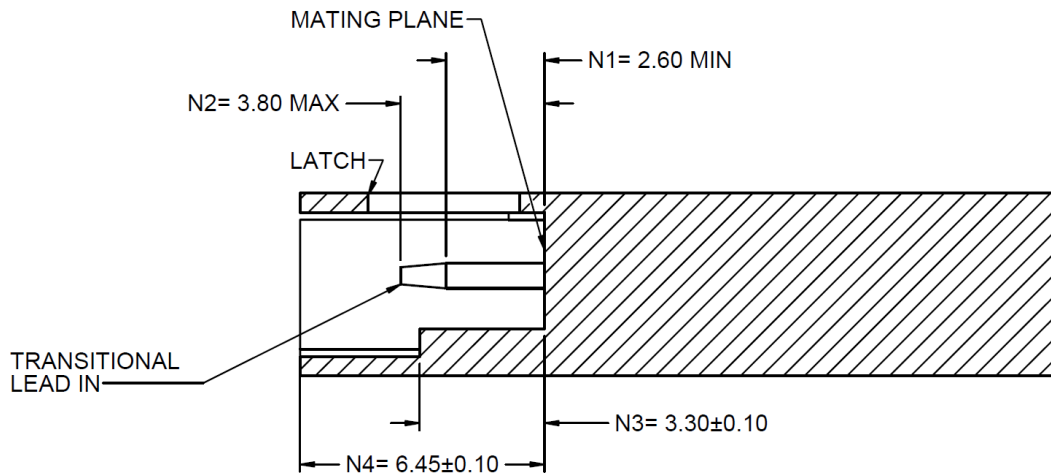


Figure 3-22: Mechanical interface of the mating area of the LEX-MR - cross section A-A

Both contact pins shall be coined on all 4 sides of the pins.

3.10.2.2 LEX-MR wire-to-wire demarcation model

In case the LEX-MR is of type wire-to-wire, it shall not cross the boundaries of the LEX-MR Demarcation as defined in Figure 3-23. The keep-in volume for the LEX-MR is indicated by the green area.

Note that the maximum length in this demarcation model is defined with reference to the mating plane.

Note that the keep-in volume does not include the volume that's necessary for the wires. The Luminaire maker should reserve some extra space for this.

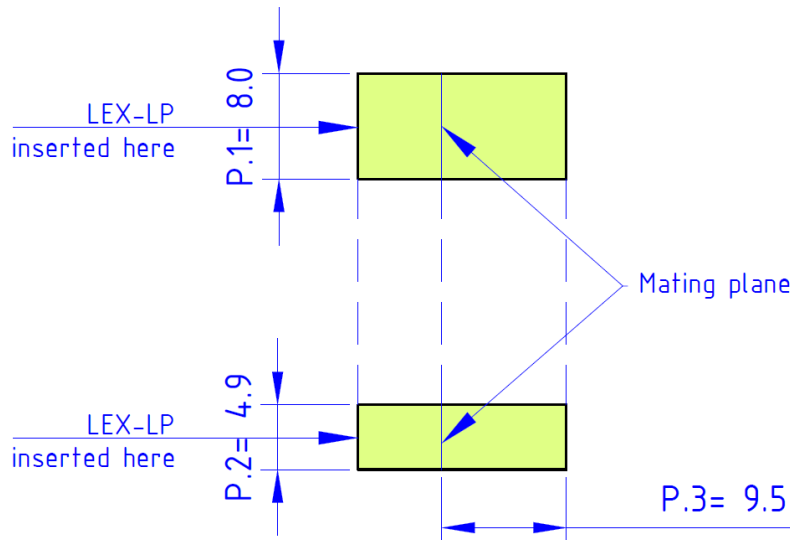


Figure 3-23 Demarcation model of the LEX-MR (top view and side view) - wire-to-wire type.

3.10.2.3 LEX-MR wire-to-board demarcation model

In case the LEX-MR is of type wire-to-board, there are no requirements for its demarcation. *Note that the LEX-MR is considered part of the LEX-M which has its own demarcation model.*

3.10.2.4 LEX-MR additional requirements

After 10 mating cycles with the gauge defined in section 5.1, the force for un-mating shall be 5 N or more.

Both contact pins of the LEX-MR shall be completely tin plated.

When the gauge defined in section 5.1 is fully inserted in the LEX-MR, the latch-on pin housing of the LEX-MR shall not be bent up.

3.10.3 LEX Luminaire Plug (LEX-LP)

For illustration purpose, an example of a LEX-LP is shown in the 3D drawing in **Error! Not a valid bookmark self-reference..** This drawing is informative and not part of the specification.

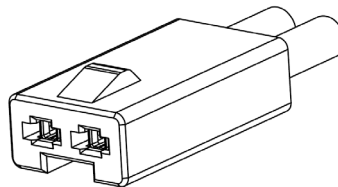


Figure 3-24: Examples of a LEX-LP (informative)

3.10.3.1 LEX-LP mating area

The LEX-LP shall comply with the definitions in Figure 3-25 and Figure 3-26.

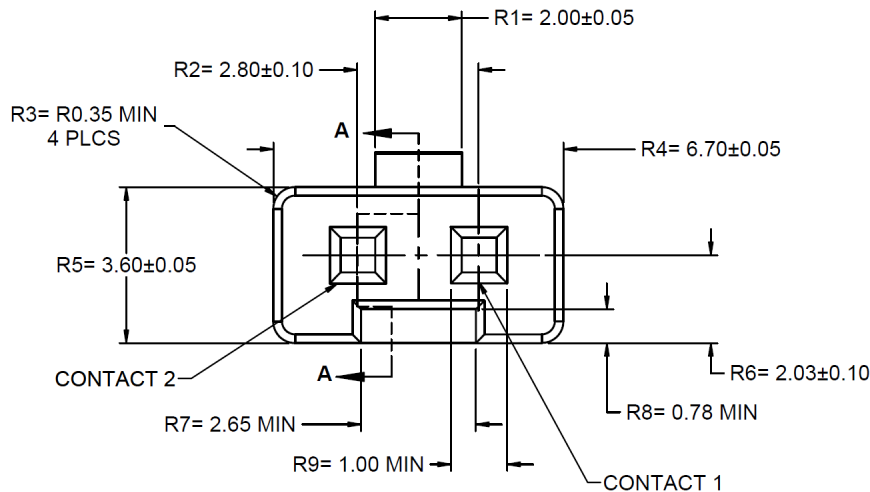


Figure 3-25: Mechanical interface of the mating area of the LEX-LP.

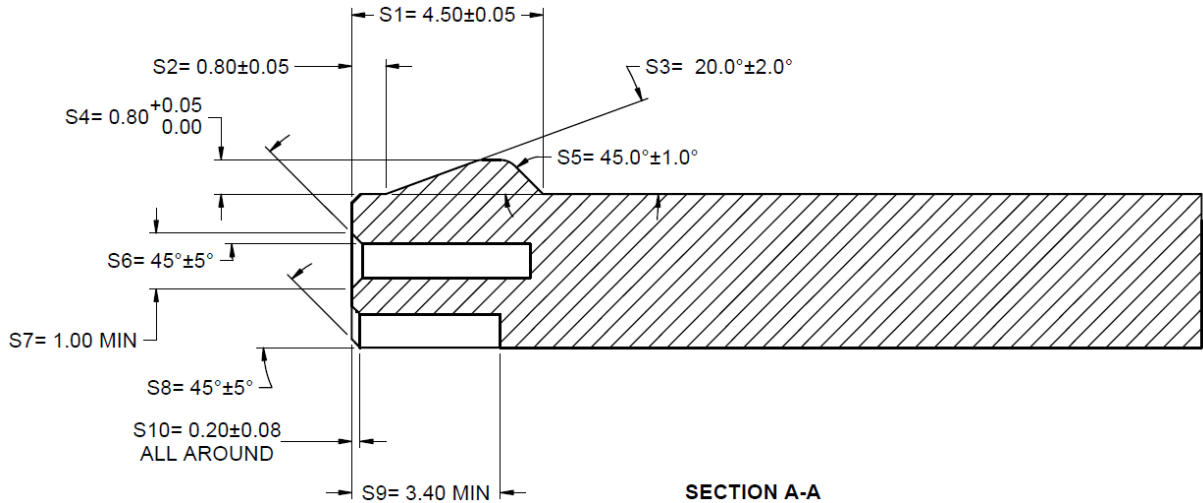


Figure 3-26: Mechanical interface of the mating area of the LEX-LP – cross section A-A.

3.10.3.2 LEX-LP demarcation model

Except for the detent element, the LEX-LP shall not cross the boundaries of the LEX-LP Demarcation as defined in Figure 3-27. The keep-in volume for the LEX-LP is indicated by the green area. At the position of the retention feature the maximum height is restricted to 4.5 mm instead of 3.7 mm.

Note that the keep-in volume does not include the volume that's necessary for the wires. The Luminaire maker should reserve some extra space for this.

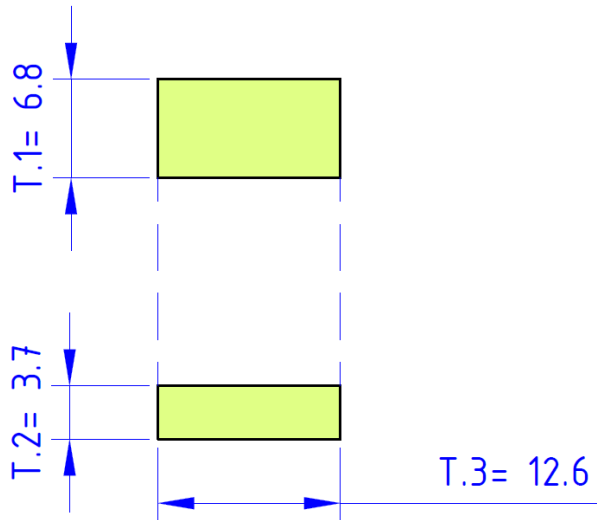


Figure 3-27 Demarcation model of the LEX-LP (top view and side view).

3.10.3.3 LEX-LP additional requirements

Both contacts of the LEX-LP shall be completely tin plated.

4 Electrical & Communication Interface

4.1 Overview (Informative)

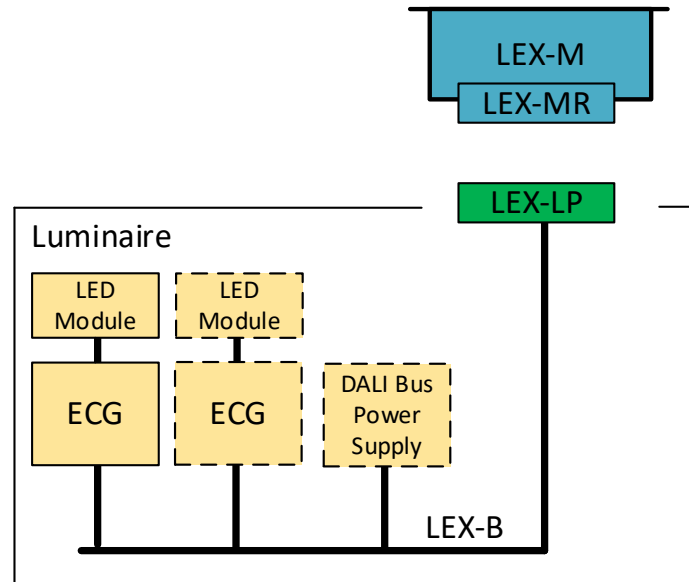


Figure 4-1: Overview of the LEX-M and the Luminaire with LEX-LP.

An overview of a typical Luminaire with LEX-LP and the LEX-M with LEX-MR is depicted in Figure 4-1. The Luminaire holds one to four ECGs driving the LED Modules and one LEX-LP. Additionally, the Luminaire provides DALI bus power supply which may be integrated in the ECG or in a separate bus power supply unit.

The specification in this section 4 aims for plug-and-play. In the context of this specification, plug-and-play means that the total system functions as specified in the datasheets of the Luminaire and the LEX-M. It does not guarantee performance (for example, sensitivity of a presence detector).

In this edition of the specification, the system is restricted to Luminaires without internal DALI application controllers or input devices and to Luminaires that do not provide provisions for connection to an external DALI bus.

4.2 Multiple LEX-Bs

The Luminaire may hold multiple sections with independent LEX-Bs, each connecting ECGs, Bus Power supply unit and one LEX-LP. In this case, each section of the Luminaire shall comply with all the requirements for Luminaires and LEX-LP in sections 4.3, 4.4, 4.5, 4.6 and 4.7.

4.3 General

The Luminaire shall meet all requirements for Luminaires as defined in section 7 of [D4i Requirements].

ECGs and Bus power supply units shall be in the Luminaire. It is not allowed that these components are attached to the Luminaire.

4.4 Pin assignment at the Luminaire Extension Interface

The contacts of the LEX-LP of the Luminaire shall be connected to the LEX-B according to the assignments as indicated in Table 4-1.

The contact pins of the LEX-MR shall be connected to the rest of the LEX-M system according to the assignments as indicated in Table 4-1.

LEX-MR contact number with reference to Figure 3-21	LEX-LP contact number with reference to Figure 3-25	Assignment
1	1	<ul style="list-style-type: none"> • DA- (Negative pole for the DALI communication and bus power)
2	2	<ul style="list-style-type: none"> • DA+ (Positive pole for the DALI communication and bus power)

Table 4-1: Assignments of contacts in the LEX-MR and in the LEX-LP.

4.5 Contact resistance of the LEX-LP

Each contact of the LEX-LP shall allow for a contact resistance less than 500 mΩ when mated with the contact making gauge as defined in section 5.2.

4.6 Electrical insulation at the Luminaire Extension Interface

Safety requirements for devices are covered by IEC standards and national regulations and compliance with these standards and regulations is the responsibility of the manufacturers.

4.6.1 Insulation requirements for the LEX-LP:

All contacts of the LEX-LP shall be insulated versus mains power according to the requirements for basic insulation as defined in IEC 60598-1.

Note: All contacts of the LEX-LP may in addition be insulated versus mains power according to the requirements as defined in regional standards or regulations, e.g. UL 1310.

The design of the LEX-LP should be such that any conductive part of the LEX-LP cannot be touched with a straight unjointed test finger having the same dimensions as the standard test finger specified in [IEC60529].

When no LEX-M is mounted, a cover should be mounted to the LEX-S to ensure sufficient protection against pollution, damage, and electrical shock.

4.6.2 Insulation requirements for the LEX-M:

The LEX-M should provide supplementary insulation as defined in [IEC 60598-1] between its interface contacts and touchable conductive parts when the LEX-M is attached to the Luminaire.

4.7 DALI communication & DALI bus power at the Luminaire Extension Interface

4.7.1 DALI communication & DALI bus power requirements for the LEX-LP

At the LEX-LP of the Luminaire, the Luminaire shall be capable to provide DALI signals and DALI bus power supply. On top of the requirements for Luminaires as defined in [D4i Requirements], the following requirements shall be met.

- All non-emergency ECGs installed in the Luminaire shall be connected to the LEX-B.
- The (optional) bus power supply unit in the Luminaire shall be connected to the LEX-B.
- The Luminaire excluding the LEX-M shall not comprise DALI application controllers nor DALI input devices as defined in [DALI - Part 103].
- The Luminaire shall not feature provisions for connection to an external DALI bus. However, terminals allowing for connection to segments that enable a modular assembly of a luminaire on site are permitted as long as the following provisions are met:
 - The modular assembly of a luminaire comprises of maximum 4 segments being connected via DALI with each containing one LED driver.
 - Zhaga certification applies only to the segment that provides the LEX-LP.
 - Information should be provided that such terminals should not be used to connect the luminaire to an external DALI network.
- At the LEX-LP interface, the guaranteed supply current provided shall be at least 48 mA and the maximum supply current shall not exceed 250 mA.

4.7.2 DALI communication & DALI bus power requirements for the LEX-M

The LEX-M shall meet the requirements for a Type C control device, or a bus powered Type D control device as defined in [DALI-part 351] (Luminaire mounted control devices).

The LEX-M shall be listed as D4i certified [D4i Requirements] in the DiiA database [DiiA Database].

Part 2: Compliance Tests

5 Compliance test tools

5.1 GO-Gauge for the LEX-MR

5.1.1 Mechanical drawings of the GO-Gauge for LEX-MR

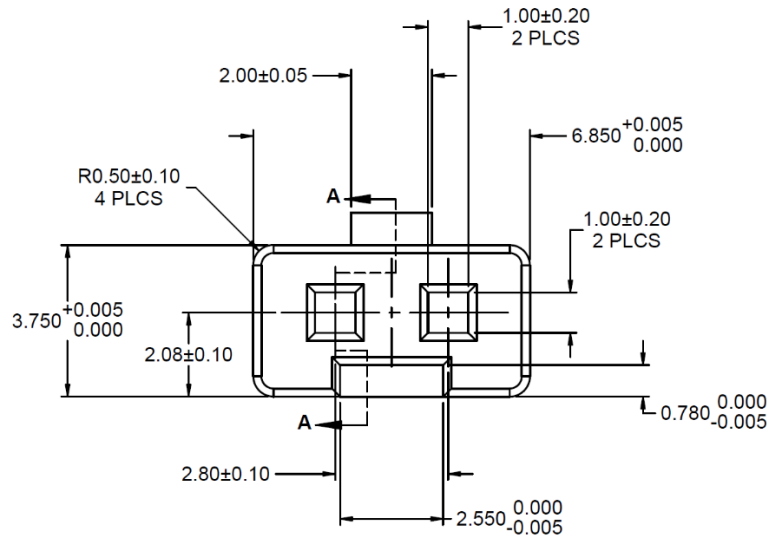


Figure 5-1: Mechanical interface of the mating area of the LEX-MR GO-Gauge.

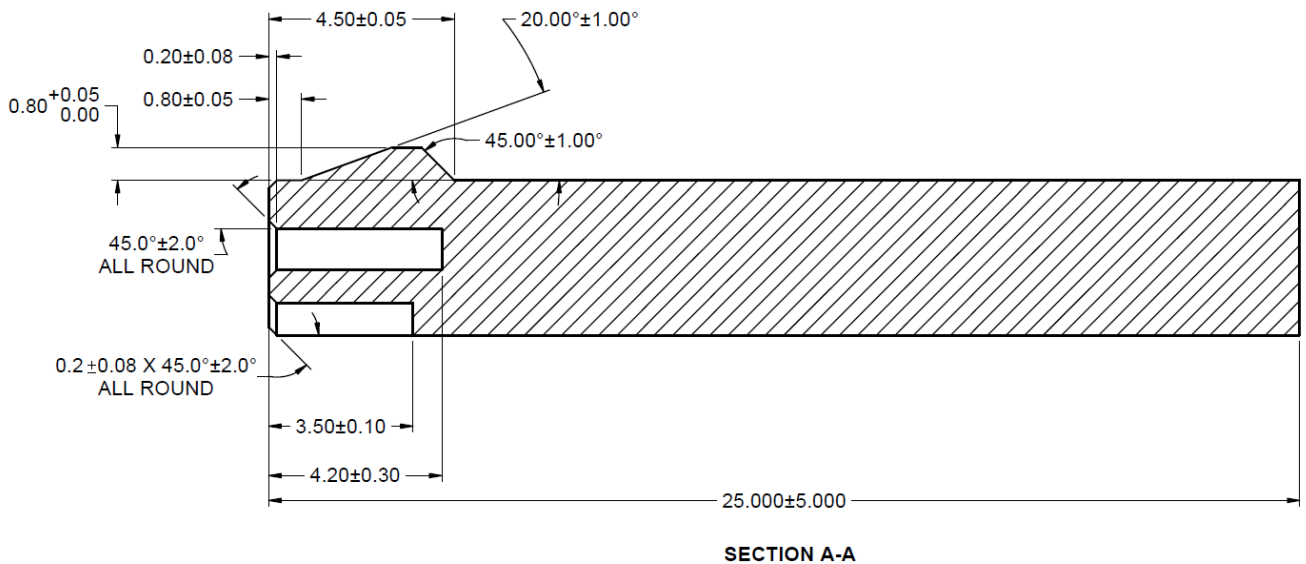


Figure 5-2: Mechanical interface of the mating area of the LEX-MR GO-Gauge – cross section A-A.

5.1.2 Material of the GO-Gauge for the LEX-MR

The GO-Gauge for the LEX-MR shall be made of hardened tool steel.

5.2 Contact making Gauge for the LEX-LP

5.2.1 Mechanical drawings of the Contact making Gauge for the LEX-LP

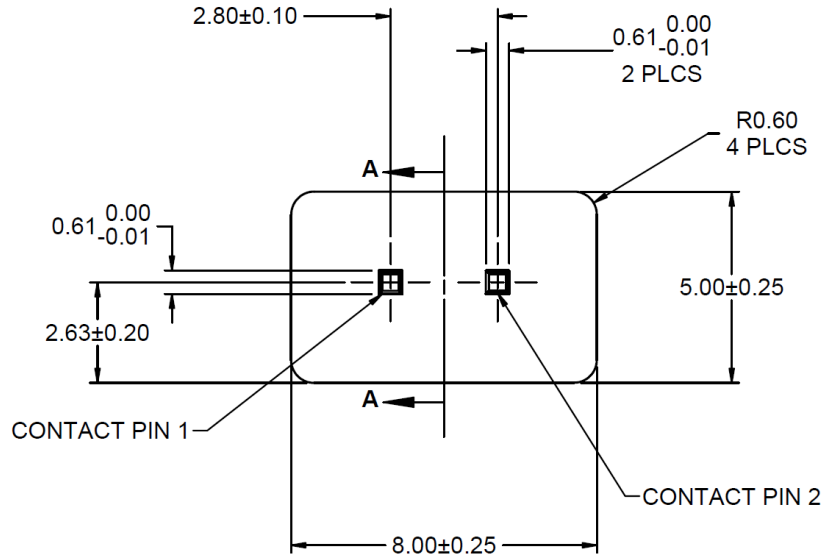


Figure 5-3: Mechanical interface of the mating area of the LEX-LP GO-Gauge.

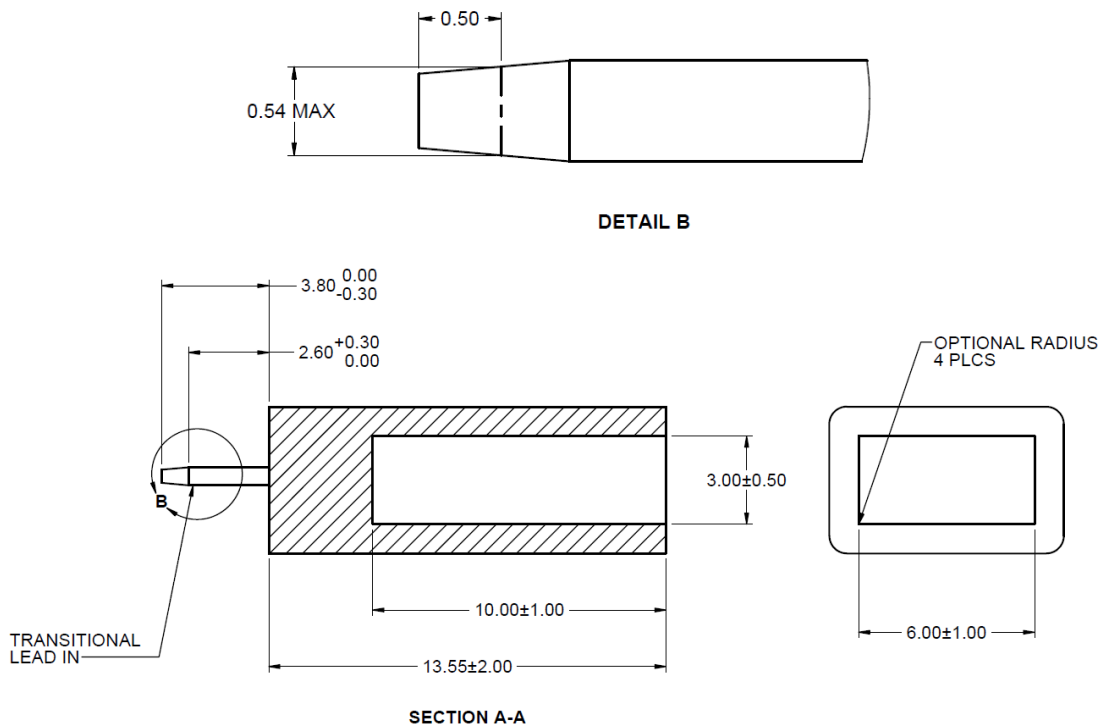


Figure 5-4: Mechanical interface of the mating area of the LEX-LP GO-Gauge - cross section A-A.

5.2.2 Material of the contact making Gauge for the LEX-LP

The contact making Gauge for the LEX-LP shall be made of hard copper alloy with tin over nickel plating.

The Gauge shall meet the requirements in section 7.2.3.

6 LEX Module Receptacle compliance tests

6.1 General

In order to perform the compliance tests listed below, the LEX-MR manufacturer shall provide a letter of confirmation with content and format as defined in [LoC-LEX-MR].

6.2 LEX Module Receptacle mechanical interface tests

6.2.1 Check compliance with section 3.10.2.1 (dimensions of mating area)

The purpose of this test is to check whether the LEX-MR under test meets all requirements as listed in section 3.10.2.1.

6.2.1.1 Test equipment

This test shall be conducted with measuring equipment allowing a measurement accuracy (linear and angular) equal or better than 0.2 x tolerance.

6.2.1.2 Test conditions

This test shall be conducted at 25 ± 5 °C.

6.2.1.3 Test procedure

The test procedure to be conducted depends on the label listed in column 'Verified by' in Table 6-1. In case the cell shows 'MF' the procedure is:

- The manufacturer provides the mechanical drawing of the LEX-MR under test. This drawing shall include for each dimension listed in Table 6-1 with the label 'MF', the typical value, and the production tolerance.
- Check whether for all dimensions listed in Table 6-1 with the label 'MF', nominal value and production tolerances are available in the drawing provided by the manufacturer.
- Check whether for all dimensions listed in Table 6-1 with the label 'MF', the nominal value and production tolerances guarantee products within the tolerance range defined in Table 6-1.

- The manufacturer provides a report of the mechanical measurement of the LEX-MR under test.
- Check whether measurement results for all dimensions listed in Table 6-1 with the label 'MF' are available in the report provided by the manufacturer.
- Check whether for all dimensions listed in Table 6-1 with the label 'MF', the measured value is within the tolerance range.

In case the cell shows 'ATC' the procedure is:

- Measure all dimensions listed in Table 6-1 with the label 'ATC'.

Zhaga Interface Specification

Dimension	Nominal	Description	Number of occurrences to check	Min.	Max.	Verified by
M1	6.90	Cavity length	1	6.85	6.95	ATC
M2	0.66	Pin width	2	0.61	0.71	ATC
M3	2.80	Pin pitch	1	2.70	2.90	MF
M4	0.66	Pin height	2	0.61	0.71	ATC
M5	3.80	Cavity height	1	3.75	3.85	ATC
M6	2.13	Pin position	2	2.03	2.23	MF
M7	0.73	Poke yoke feature height	1	0.68	0.78	ATC
M8	2.50	Poke yoke feature width	1	2.45	2.55	ATC
M9	0.20	Cavity radius	4	-	0.30	ATC
N1	-	Pin length	2	2.60	-	MF
N2	-	Length of transitional lead in.	2	-	3.80	MF
N3	3.30	Poke yoke feature length	1	3.20	3.40	ATC
N4	6.45	Cavity depth	1	6.35	6.55	ATC

Table 6-1: Dimension of the LEX-MR defined in Figure 3-21 and Figure 3-22.

6.2.1.4 Pass criteria

The LEX-MR under test passes if the measured values of all dimensions listed in Table 6-1 are within the specified tolerance range.

6.2.2 Check compliance with section 3.10.2.2 or 3.10.2.3 (demarcation model)

The purpose of this test is to check whether the LEX-MR under test meets the requirements of the demarcation model as defined in section 3.10.2.2 or section 3.10.2.3.

6.2.2.1 Test equipment

Caliper.

6.2.2.2 Test conditions

This test shall be conducted at 25 ± 5 °C.

6.2.2.3 Test procedure

- Check whether the LEX-MR under test is applicable in a wire-to-wire system or a wire-to-board system (see section 3.10.1).
- In case the LEX-MR under test is applicable in a wire-to-wire system, check whether it does not cross the Demarcation as defined in section 3.10.2.2. Guidelines for this test are provided in [Book-1].
- In case the LEX-MR under test is applicable in a wire-to-board system, this test can be skipped.

6.2.2.4 Pass criteria

The LEX-MR under test passes if the result of the demarcation verification is positive.

6.2.3 Test of the LEX-MR un-mating force

The purpose of this test is to check whether after 10 mating cycles with the gauge defined in section 5.1, the force for un-mating is 5 N or more.

6.2.3.1 Test equipment

- Gauge defined in section 5.1.
- Force meter.

6.2.3.2 Test conditions

This test shall be conducted at 25 ± 5 °C.

6.2.3.3 Test procedure

- Perform 10 mating/un-mating sequences with the gauge and the LEX-MR under test.
- Measure the force required to detach the gauge from the LEX-MR under test.

6.2.3.4 Pass criteria

The LEX-MR under test passes if the measured force is 5.0 N or more.

6.2.4 Test of the LEX-MR – bending of the latch-on pin housing

The purpose of this test is to check whether the latch-on pin housing of the LEX-MR does not bend up when the gauge defined in section 5.1 is fully inserted.

6.2.4.1 Test equipment

- Gauge defined in section 5.1.

6.2.4.2 Test conditions

This test shall be conducted at 25 ± 5 °C.

6.2.4.3 Test procedure

- Fully insert the gauge in the LEX-MR under test.
- Inspect the latch-on pin housing.

6.2.4.4 Pass criteria

The LEX-MR under test passes if the latch-on pin housing of the LEX-MR does not bend up but snaps into place around the gauge.

6.2.5 Test of the LEX-MR contact plating

The purpose of this test is to verify that the plating to the contact areas of the LEX-MR contains the minimum proportion of tin required by this specification.

6.2.5.1 Test equipment

None.

6.2.5.2 Test conditions

None.

6.2.5.3 Test procedure

Inspect the letter of confirmation provided by the LEX-MR manufacturer.

6.2.5.4 Pass criteria

The LEX-MR under test passes if the letter of confirmation provided LEX-MR manufacturer indicates that the manufacturer guarantees that the plating of the contacts complies with the restrictions in Table 6-2.

Element	% mass
Tin	≥97.5
Copper	≤1.5
Zinc	≤0.7
Total Unnamed Elements	≤0.2
Lead	≤0.1

Table 6-2: Pass criteria for percentage mass of several elements in the contact plating.

6.2.6 Test of the LEX-MR contact pins

The purpose of this test is to verify that both contact pins are coined on all 4 sides of the pins.

6.2.6.1 Test equipment

None.

6.2.6.2 Test conditions

None.

6.2.6.3 Test procedure

Inspect the contact pins of the LEX-MR under test.

6.2.6.4 Pass criteria

The LEX-MR under test passes if both contact pins are coined on all 4 sides of the pins.

7 LEX Luminaire Plug compliance tests

7.1 General

In order to perform the compliance tests listed below, the LEX-LP manufacturer shall provide a letter of confirmation with content and format as defined in [LoC-LEX-LP].

7.2 LEX Luminaire Plug mechanical interface tests

7.2.1 Check compliance with section 3.10.3.1 (dimensions of mating area)

The purpose of this test is to check whether the LEX-LP under test meets all requirements as listed in section 3.10.3.1.

7.2.1.1 Test equipment

This test shall be conducted with measuring equipment allowing a measurement accuracy (linear and angular) equal or better than 0.2 x tolerance.

7.2.1.2 Test conditions

This test shall be conducted at 25 ± 5 °C.

7.2.1.3 Test procedure

The test procedure to be conducted depends on the label listed in column 'Verified by' in Table 7-1. In case the cell shows 'MF' the procedure is:

- The manufacturer provides the mechanical drawing of the LEX-LP under test. This drawing shall include for each dimension listed in Table 7-1 with the label 'MF', the typical value, and the production tolerance.
- Check whether for all dimensions listed in Table 7-1 with the label 'MF', nominal value and production tolerances are available in the drawing provided by the manufacturer.
- Check whether for all dimensions listed in Table 7-1 with the label 'MF', the nominal value and production tolerances guarantee products within the tolerance range defined in Table 7-1.

- The manufacturer provides a report of the mechanical measurement of the LEX-LP under test.
- Check whether measurement results for all dimensions listed in Table 7-1 with the label 'MF' are available in the report provided by the manufacturer.
- Check whether for all dimensions listed in Table 7-1 with the label 'MF', the measured value is within the tolerance range.

In case the cell shows 'ATC' the procedure is:

- Measure all dimensions listed in Table 7-1 with the label 'ATC'.

Zhaga Interface Specification

Dimension	Nominal	Description	Number of occurrences to check	Min.	Max.	Verified by
R1	2.00	Detent element width	1	1.95	2.05	ATC
R2	2.80	Contact hole pitch	1	2.70	2.90	ATC
R3	0.50	Corner radius	4	0.35	-	ATC
R4	6.70	Plug width	1	6.65	6.75	ATC
R5	3.60	Plug height	1	3.55	3.65	ATC
R6	2.03	Contact hole position	2	1.93	2.13	ATC
R7	-	Poke yoke feature width	1	2.65	-	ATC
R8	-	Poke yoke feature height	1	0.78	-	ATC
R9	-	Contact lead in width	2	1.00	-	MF
S1	4.50	Detent element parameter	1	4.45	4.55	MF
S2	0.80	Detent element parameter	1	0.75	0.85	MF
S3	20°	Detent element parameter	1	18°	22°	ATC
S4	0.80	Detent element parameter	1	0.80	0.85	ATC
S5	45°	Detent element parameter	1	44°	46°	ATC
S6	45°	Contact hole lead in	8	40°	50°	MF
S7	-	Contact lead in height	2	1.00	-	MF
S8	45°	Outer Chamfer	4	40°	50°	MF
S9	-	Poke yoke feature length	1	3.40	-	ATC
S10	0.20	Outer Chamfer length	4	0.12	0.28	MF

Table 7-1: Dimension of the LEX-LP defined in Figure 3-25 and Figure 3-26.

7.2.1.4 Pass criteria

The LEX-LP under test passes if the measured values of all dimensions listed in Table 7-1 are within the specified tolerance range.

7.2.2 Check compliance with section 3.10.3.2 (demarcation model)

The purpose of this test is to check whether the LEX-LP under test meets the requirements of the demarcation model as defined in section 3.10.3.2.

7.2.2.1 Test equipment

Caliper.

7.2.2.2 Test conditions

This test shall be conducted at 25 ± 5 °C.

7.2.2.3 Test procedure

- Check whether LEX-LP under test does not cross the Demarcation as defined in section 3.10.3.2. Guidelines for this test are provided in [Book-1].

7.2.2.4 Pass criteria

The LEX-LP under test passes if the result of the demarcation verification is positive.

7.2.3 Test of the LEX-LP contact plating

The purpose of this test is to verify that the plating to the contact areas of the LEX-LP contains the minimum proportion of tin required by this specification.

7.2.3.1 Test equipment

None.

7.2.3.2 Test conditions

None.

7.2.3.3 Test procedure

Inspect the letter of confirmation provided by the LEX-LP manufacturer.

7.2.3.4 Pass criteria

The LEX-LP under test passes if the letter of confirmation provided LEX-LP manufacturer indicates that the manufacturer guarantees that the plating of the contacts complies with the restrictions in Table 6-2.

Element	% mass
Tin	≥97.5
Copper	≤1.5
Zinc	≤0.7
Total Unnamed Elements	≤0.2
Lead	≤0.1

Table 7-2: Pass criteria for percentage mass of several elements in the contact plating.

7.3 LEX Luminaire Plug electrical interface tests

7.3.1 Test contact resistance

The purpose of this test is to check whether the contact resistance of the LEX-LP under test meets the requirements in section 4.5.

7.3.1.1 Test equipment

- Gauge defined in section 5.2.

7.3.1.2 Test conditions

None.

7.3.1.3 Test procedure

Fully insert the LEX-LP under test in the gauge and measure the resistance between the gauge and each of the two contacts of the LEX-LP.

7.3.1.4 Pass criteria

The LEX-LP under test passes if both measured resistance values are less than 500mΩ.

8 LEX-M compliance tests

8.1 General

In order to perform the compliance tests listed below, the LEX-M manufacturer shall provide an instruction on how to mount the LEX-M to a Luminaire and a letter of confirmation with content and format as defined in [LoC-LEX-M].

8.2 LEX-M mechanical interface tests

8.2.1 Test of the LEX-M demarcation

The purpose of this test is to verify that LEX-M under test is compliant with the applicable demarcation model as defined in section 3.

8.2.1.1 Test equipment

Caliper

8.2.1.2 Test conditions

This test shall be conducted at 25 ± 5 °C.

8.2.1.3 Test procedure

- Determine the category of the LEX-M under test from its Product Data Set.
- Find the corresponding LEX-M Demarcation model in section 3.
- Verify that the total set of LEX-M under test + (optional) wire to LEX-MR + LEX-MR + maximum LEX-LP (as defined in section 3.10.3.2) is within the keep-in volume of the LEX-M Demarcation model. Additional guidelines for this test are provided in [Book 1] – Annex B.

8.2.1.4 Pass criteria

The LEX-M under test passes if the total set of LEX-M under test + (optional) wire to LEX-MR + LEX-MR + maximum LEX-LP (as defined in section 3.10.3.2) is within the keep-in volume of the Demarcation model.

8.2.2 Test of the LEX-M fixation, detachment, and dependency on mounting plate thickness

The purpose of this test is to verify that the means of fixation implemented in the LEX-M under test is such that:

- The fixation does not depend on specific features in the Luminaire other than the LEX-S as defined in section 3.5.3.3.
- The LEX-M can be detached from the Luminaire without damaging the LEX-M nor the Luminaire.
- Fixation works for all thicknesses of the mounting plate within in the allowed range as defined in section 3.5.3.3.

8.2.2.1 Test equipment

- Aluminum mounting plate with a LEX-S in the same category as the LEX-M under test, with minimum dimensions and a thickness equal to the minimum thickness as defined in section 3.5.3.3.
- Aluminum mounting plate with a LEX-S in the same category as the LEX-M under test, with minimum dimensions and a thickness equal to the maximum thickness as defined in section 3.5.3.3.

8.2.2.2 Test conditions

This test shall be conducted at 25 ± 5 °C.

8.2.2.3 Test procedure

- Mount the LEX-M under test to the mounting plate with minimum thickness and verify that the fixation is proper.
- Detach the LEX-M under test from the mounting plate and verify that the LEX-M can be detached from the mounting plate without damaging the LEX-M nor the mounting plate.
- Mount the LEX-M under test to the mounting plate with maximum thickness and verify that the fixation is proper.
- Detach the LEX-M under test from the mounting plate and verify that the LEX-M can be detached from the mounting plate without damaging the LEX-M nor the mounting plate.

8.2.2.4 Pass criteria

The LEX-M under test passes if:

- mounting the LEX-M under test to a mounting plate with minimum thickness as well as to a mounting plate with maximum thickness results in a proper fixation.
- the LEX-M can be detached from the mounting plate with minimum thickness as well as from a mounting plate with maximum thickness without damaging the LEX-M nor the mounting plate.

8.2.3 Test of the LEX-MR of the LEX-M under test

The purpose of this test is to verify the mechanical interface of the LEX-MR of the LEX-M under test. This compliance test is not required in case the LEX-M under test features a Zhaga certified LEX-MR.

In case the LEX-M under test does not feature a Zhaga certified LEX-MR, all tests in section 6 shall be conducted.

8.3 LEX-M electrical interface tests

8.3.1 General

In order to perform the compliance tests listed below, the LEX-M manufacturer shall provide a letter of confirmation with content and format as defined in [LoC-LEX-M].

8.3.2 Test of the LEX-M pin assignment

The purpose of this test is to verify whether pin assignment of the LEX-M complies with Table 4-1.

8.3.2.1 Test equipment

None

8.3.2.2 Test conditions

None

8.3.2.3 Test procedure

Inspect the letter of confirmation provided by the LEX-M manufacturer.

8.3.2.4 Pass criteria

The LEX-M under test passes if the letter of confirmation provided LEX-M manufacturer indicates that:

- Pin 1 is used for DA- (Negative pole for the DALI communication and bus power) and not used for other purposes.
- Pin 2 is used for DA+ (Positive pole for the DALI communication and bus power) and not used for other purposes.

8.3.3 Test of the LEX-M DALI communication & DALI bus power requirements

The purpose of this test is to verify whether the LEX-M meets the DALI communication & DALI bus power requirements as listed in section 4.7.2.

8.3.3.1 Test equipment

None.

8.3.3.2 Test conditions

None.

8.3.3.3 Test procedure

- Check whether the LEX-M under test is listed in [DiiA Database] and whether this listing indicates that the LEX-M is compliant with [DALI - Part 351] (*Luminaire mounted control devices*)
- Check letter of confirmation provided by the LEX-M manufacturer.

8.3.3.4 Pass criteria

The LEX-M under test passes if

- the LEX-M meets the condition listed in section 8.3.3.3. and
- the letter of confirmation provided LEX-M manufacturer indicates that the LEX-M is a Type C control device, or a bus powered Type D control device as defined in [DALI-part 351] (*Luminaire mounted control devices*).

9 Luminaire compliance tests

9.1 General

In order to perform the compliance tests listed below, the Luminaire manufacturer shall provide a circuit diagram and a letter of confirmation with content and format as defined in [LoC-Luminaire].

9.2 Luminaire mechanical interface tests

In case the Luminaire under test holds multiple independent LEX-Bs, each section of the Luminaire containing a single LEX-B shall pass the tests as defined in sections 9.3.1, 9.3.2, 9.3.3 and 9.3.4.

9.2.1 Test of the number of LEX-Ss

The purpose of this test is to verify that the Luminaire under test features at least one LEX-S.

9.2.1.1 Test equipment

None

9.2.1.2 Test conditions

None

9.2.1.3 Test procedure

Inspect the Luminaire under test and count the number of LEX-Ss.

9.2.1.4 Pass criteria

The Luminaire under test passes if it features at least one LEX-S.

9.2.2 Test of the number of LEX-LPs

The purpose of this test is to verify that the Luminaire under test features exactly one LEX-LP.

9.2.2.1 Test equipment

None

9.2.2.2 Test conditions

None

9.2.2.3 Test procedure

Inspect the Luminaire under test and count the number of LEX-LPs.

9.2.2.4 Pass criteria

The Luminaire under test passes if it features exactly one LEX-LP.

9.2.3 Test of the LEX-S

The purpose of this test is to verify that the LEX-S of the Luminaire under test is compliant with the applicable mechanical specifications as defined in section 3.

9.2.3.1 Test equipment

This test shall be conducted with measuring equipment allowing a measurement accuracy (linear and angular) equal or better than 0.2 x tolerance.

9.2.3.2 Test conditions

This test shall be conducted at 25 ± 5 °C.

9.2.3.3 Test procedure

- Determine the category of the Luminaire under test from its Product Data Set.
- In case the category of the Luminaire under test is R44x17, measure all dimensions listed in Table 9-1.

Dimension	Nominal	Description	Number of occurrences to check	Min.	Max.
B1	17.2	LEX-S width	1	17.1	17.3
B2	44.2	LEX-S length	1	44.1	44.3
B3	2.3	Curvature of corners	4	2.2	2.4
C1	-	Border length	1	61	-
C2	-	Border width	1	23	-

Table 9-1: Dimensions of the LEX-S for category R44x17 defined in Figure 3-4 and Figure 3-5.

- In case the category of the Luminaire under test is R60x22, measure all dimensions listed in Table 9 2.

Dimension	Nominal	Description	Number of occurrences to check	Min.	Max.
E1	22.0	LEX-S width	1	21.8	22.2
E2	60.0	LEX-S length	1	59.8	60.2
E3	-	Curvature of corners	4	-	0.5
F1	-	Border length	1	69	-
F2	-	Border width	1	28	-

Table 9-2: Dimensions of the LEX-S for category R60x22 defined in Figure 3-7 and Figure 3-8.

- In case the category of the Luminaire under test is C22-T1A, measure all dimensions listed in Table 9-3.

Dimension	Nominal	Description	Number of occurrences to check	Min.	Max.
H1	22.23	LEX-S diameter	1	21.82	23.01
J1	-	Border diameter	1	36.0	-

Table 9-3: Dimensions of the LEX-S for category C22-T1A defined in Figure 3-10 and Figure 3-11.

- In case the category of the Luminaire under test is C22-T1B, measure all dimensions listed in Table 9-4.

Dimension	Nominal	Description	Number of occurrences to check	Min.	Max.
H1	22.23	LEX-S diameter	1	21.82	23.01
J1	-	Border diameter	1	38.0	-

Table 9-4: Dimensions of the LEX-S for category C22-T1B defined in Figure 3-13 and Figure 3-14.

- In case the category of the Luminaire under test is C22-T2, measure all dimensions listed in Table 9-5.

Dimension	Nominal	Description	Number of occurrences to check	Min.	Max.
H1	22.23	LEX-S diameter	1	21.82	23.01
J1	-	Border diameter	1	36.0	-
L1	-	Internal border width	1	36.0	-
L2	-	Internal border length I	1	35.5	-
L3	-	Internal border length II	1	60.5	-

Table 9-5: Dimensions of the LEX-S for cat. C22-T2 defined in Figure 3-16, Figure 3-17 and Figure 3-18.

9.2.3.4 Pass criteria

The Luminaire under test passes if the measured values of all dimensions listed in the appropriate table are within the specified range.

9.2.4 Test of the Luminaire demarcation

The purpose of this test is to verify that the Luminaire under test is compliant with the applicable demarcation model as defined in section 3.

9.2.4.1 Test equipment

Caliper

9.2.4.2 Test conditions

This test shall be conducted at 25 ± 5 °C.

9.2.4.3 Test procedure

- Determine the category of the Luminaire under test from its Product Data Set.
- Find the corresponding LEX-M Demarcation model in section 3.
- Verify that the Luminaire provides the keep-out volume of the LEX-M Demarcation model. Additional guidelines for this test are provided in [Book 1] – Annex B.

9.2.4.4 Pass criteria

The Luminaire under test passes if the Luminaire provides the keep-out volume of the LEX-M Demarcation model.

9.2.5 Test of the LEX-LP of the Luminaire under test

The purpose of this test is to verify the mechanical interface of the LEX-LP of the Luminaire under test. This compliance test is not required in case the Luminaire under test features a Zhaga certified LEX-LP.

In case the Luminaire under test does not feature a Zhaga certified LEX-LP, all test in section 7.2 shall be conducted.

9.2.6 Test of the thickness of the mounting plate

The purpose of this test is to verify that the thickness of the mounting plate of the Luminaire under test is in the range $0.4 \leq D \leq 1.5$ mm.

9.2.6.1 Test equipment

Caliper

9.2.6.2 Test conditions

This test shall be conducted at 25 ± 5 °C.

9.2.6.3 Test procedure

Measure the thickness of the mounting plate in the region of the LEX-S border as defined in section 3.

9.2.6.4 Pass criteria

The Luminaire under test passes if the thickness of its mounting plate in the range $0.4 \leq D \leq 1.5$ mm.

9.3 Luminaire electrical interface tests

In case the Luminaire under test holds multiple independent LEX-Bs, each section of the Luminaire containing a single LEX-B shall pass the tests as defined in sections 9.3.1, 9.3.2, 9.3.3 and 9.3.4.

9.3.1 Test compliance with [D4i Requirements]

The purpose of this test is to verify that the Luminaire meets all requirements for Luminaires as defined in section 7 of [D4i Requirements].

9.3.1.1 Test equipment

None.

9.3.1.2 Test conditions

None.

9.3.1.3 Test procedure

Inspect the letter of confirmation provided by the Luminaire manufacturer.

9.3.1.4 Pass criteria

The Luminaire under test passes if the letter of confirmation provided by the Luminaire manufacturer indicates that the Luminaire meets all requirements for Luminaires as defined in section 7 of [D4i Requirements].

9.3.2 Test of the Luminaire pin assignment

The purpose of this test is to verify whether the pin assignment of the LEX-LP of the Luminaire under test complies with Table 4-1.

9.3.2.1 Test equipment

None

9.3.2.2 Test conditions

None

9.3.2.3 Test procedure

Inspect the circuit diagram of the Luminaire under test and check whether for the LEX-LP the following conditions are met:

- Pin 1 is connected to the LEX-B line for DA- (Negative pole for the DALI communication and bus power) and not used for other purposes.
- Pin 2 is connected to the LEX-B line for DA+ (Positive pole for the DALI communication and bus power) and not used for other purposes.

9.3.2.4 Pass criteria

The Luminaire under test passes if all conditions listed in section 9.3.2.3 are met.

9.3.3 Test of the Luminaire electrical insulation

The purpose of this test is to verify whether the Luminaire complies at its LEX-LP with the requirements on electrical insulation as listed in section 4.6.1.

9.3.3.1 Test equipment

None.

9.3.3.2 Test conditions

None.

9.3.3.3 Test procedure

Inspect the letter of confirmation provided by the Luminaire manufacturer.

9.3.3.4 Pass criteria

The Luminaire under test passes if the letter of confirmation provided by the Luminaire manufacturer indicates that all contacts of each LEX-LP of the Luminaire under test are insulated versus mains power according to the requirements for basic insulation as defined in IEC 60598-1.

9.3.4 Test of the Luminaire DALI communication & DALI bus power requirements

The purpose of this test is to verify whether the Luminaire meets the DALI communication & DALI bus power requirements as listed in section 4.7.1.

9.3.4.1 Test equipment

None.

9.3.4.2 Test conditions

None.

9.3.4.3 Test procedure

- Inspect the circuit diagram of the Luminaire under test and check whether the following conditions are met:
 - All non-emergency ECGs are installed in the Luminaire under test and are connected to the LEX-B.

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- The Luminaire under test does not feature provisions for connection to an external DALI bus.
- The (optional) bus power supply unit is installed in the Luminaire and is connected to the LEX-B.
- Inspect the letter of confirmation provided by the Luminaire manufacturer.

9.3.4.4 Pass criteria

The Luminaire under test passes if:

- all conditions as listed in section 9.3.4.3 are met and
- the letter of confirmation provided by the Luminaire manufacturer indicates that the Luminaire under test does not contain a DALI application controller nor DALI input devices as defined in [DALI - Part 103].

Annexes

Annex A Product Data Set requirements

In this section the requirements with respect to the Product Data Sets of Zhaga products defined in this Book 20 are listed.

A.1 LEX-M Product Data Set

The LEX-M Product Data Sets shall contain the following information:

- The mechanical category (R44x17, R60x22, C22-T1A, C22-T1B, or C22-T2)

A.2 Luminaire Product Data Set

The LEX-M Product Data Sets shall contain the following information:

- The mechanical category (R44x17, R60x22, C22-T1A, C22-T1B, or C22-T2), for each LEX-S

Annex B History of Changes

Location	Change
Section 3.6.1	Demarcation model updated
Section 3.7.1	Demarcation model updated
Section 3.8	Definition of new category C22-T1B added
Section 3.10.2.3	Demarcation model updated
Section 4.7.1	Requirements for DALI updated

Table F-1: Changes from Edition 1.0 to Edition 1.1.