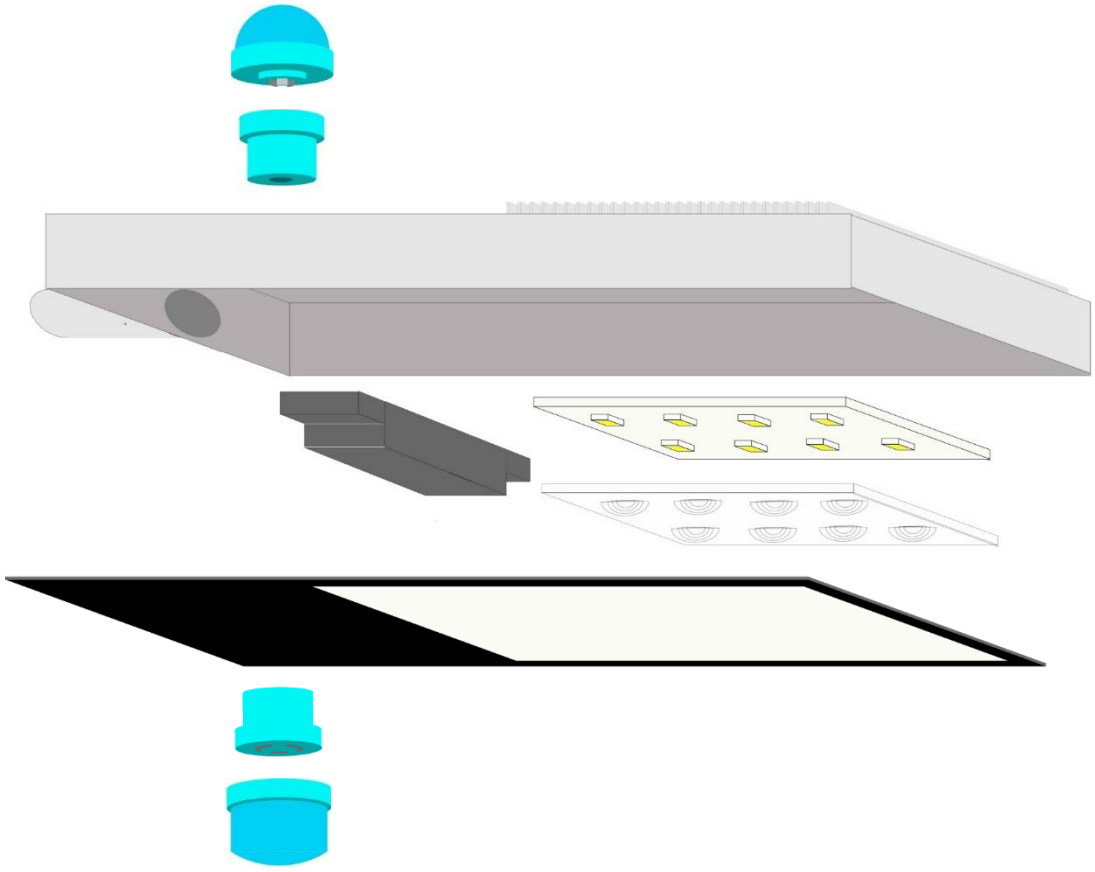
OPENBARE VERLICHTING NEDERLAND

Beoordelingsrichtlijn op basis van NEN-EN 45554

Assessment guideline

Herstelbaarheid van openbare-verlichtingstoestellen

Repairability of public lighting luminaires



English version

Versie 2024

Preface

The Dutch Assessment Guideline for the Repairability of Public Lighting Equipment, has been developed in collaboration with clients/government authorities, contractors, and suppliers. The intention is to make a significant contribution to achieving circularity.

For suppliers, the Assessment Guideline provides guidance for the (re)design of products that meet the circular criteria for lifespan extension. Suppliers can also use the Assessment Guideline to assess to what extent their product aligns with the circular ambitions required set by the client. The Assessment Guideline can be used by clients to request and assess a specific aspect of circularity.

This document contains sections that may exhibit partial or complete similarity to statements found in other standards, such as those established by ISO (International Organization for Standardization) or Zhaga (an industry consortium). Specifically, the portions of text pertaining to definitions, the artwork utilized for “standard tools”, and the design of the “interoperability model” have been adopted from these respective standards or committee documents.

While efforts have been made to ensure consistency and alignment with established industry practices, it is important to acknowledge the influence of existing standards in shaping the content and structure of this document. By incorporating relevant elements from these recognized standards, this document aims to foster compatibility, promote best practices, and enhance interoperability within the given domain.

It should be noted, however, that this document is not a verbatim replication of the standards or committee documents from which it draws inspiration. Instead, it incorporates selected elements while also providing additional context, examples, or modifications tailored to the specific requirements of the intended audience or purpose.

The intention behind borrowing concepts, definitions, artwork, and design elements from established standards is to ensure consistency, facilitate adoption, and leverage the expertise accumulated by the broader industry. Any verbatim usage or direct reproduction of copyrighted material from these standards is done in accordance with applicable laws, permissions, or licenses.

We acknowledge the original sources and provide appropriate credit to the respective standards or committees. This approach ensures transparency and integrity in the development of this document while upholding the principles of intellectual property and collaboration within the standards community.

It is important that readers recognize that true standardization is only possible through collaboration, and acknowledge the contributions of the many organizations and committees that shaped these industry standards.

Content

Introduction

This Assessment Guideline has been carefully prepared to offer an in-depth analysis of the factors that significantly affect the repairability of public lighting luminaires. It focuses on three key aspects: ability to repair, availability of spare parts, and communication/programming. Each of these factors plays a crucial role in determining the overall repairability of a lighting system.

1. Ability to Repair:
This aspect concerns the accessibility of internal components within the luminaire. The ease with which a technician can access and work on these components has a significant influence on the product's repairability. Luminaires that allow easy access to their parts will receive a higher score, while those with limited accessibility will be rated lower in this category.

2. Availability of Spare Parts:
This aspect is divided into two separate categories: mechanical parts and electrical parts. While individual electrical components (such as capacitors, resistors etc) are not included in this evaluation, the overall availability of both mechanical and electrical spare parts plays a decisive role in determining repairability. Luminaires for which spare parts are readily available in both categories will receive higher scores.

3. Communication/Programming:
This aspect assesses the interfaces and software required to operate or configure the luminaire system. Effective communication interfaces and accessible programming options contribute to the repairability of the product. A system that offers intuitive interfaces and adequate programming functionality will score higher in this category.

The scoring system used in this document ranges from A to D or E, where A represents the highest score and D or E the lowest for each specific aspect of repairability.

When presenting the scores of a luminaire based on this Assessment Guideline, a standard evaluation form (Appendix 1) can be used.

1. Scope

This document presents a method for the assessment of the repairability of luminaires intended for use in public spaces.

Products covered by this document are defined in the standards;
- EN 60598-2-1
- EN 60598-2-2
- EN 60598-2-3
- EN 60598-2-5
- EN 60598-2-13

This document applies only to luminaires used to illuminate public spaces such as streets, parks, tunnels, squares, bridges and monuments.

The guideline has been drafted specifically for LED luminaires; products employing conventional light sources are outside the scope of this document.

2 General test requirements and verification

2.1 Type test

Tests according to this document are type tests. For the definition of type test see section 3.1.2 of this document.

The requirements and tolerances permitted by this document are related to testing a type test sample submitted for that purpose. Compliance of the type test sample does not ensure compliance for the whole production of a manufacturer. Compliance of the production is the sole responsibility of the manufacturer and may include routine test and quality assurance in addition to type testing.

2.2 Conditions for testing

Except if otherwise specified, luminaires shall be tested as delivered and installed for normal use, in an ambient temperature of 10 °C to 30 °C, having regard to the manufacturer’s installation instructions.

In general, the tests are made on a single sample luminaire or, where a range of similar luminaires is involved on a representative selection from the range as agreed with the manufacturer. This selection shall be representative for all different combinations of options as defined in the luminaire range by the manufacturer.

2.3 Controlgear

For luminaires used with an external controlgear, but not normally supplied with a controlgear, the manufacturer shall provide a controlgear, typical of the type that may be used with the luminaire. The controlgear itself will not be part of the evaluation.

3. Terms and definitions

Deze sectie geeft de algemene definities die van toepassing zijn op de repareerbaarheid van verlichtingstoestellen.

3.1 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

For the definitions the following sources have been used as far as possible.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:
- IEC Electropedia: available at http://www.electropedia.org
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1 Luminaire

Apparatus which distributes, filters or transforms the light transmitted from one or more light sources and which includes all the parts necessary for supporting, fixing and protecting the light sources, but not the light sources themselves and where necessary, circuit auxiliaries together with the means for connecting them to the supply.

A luminaire with an integral non-replaceable light source is regarded a luminaire for the purpose of this document.

3.1.2 Type test

Test or series of test made on a type test sample, for the purpose of checking compliance of the design of a given product with the requirements of this document.

3.1.3 Type test sample

Sample consisting of one or more similar units submitted by the manufacturer or the responsible vendor for the purpose of a type test.

3.1.4 Part

Hardware, firmware or software constituent of a product.

3.1.5 Disassembly

Process whereby a product is taken apart in such a way that it could subsequently be reassembled and made operational.

3.1.6 Reuse

Process by which a product or its components, after reaching the end of their first use, are used again for the same purpose for which they were originally intended.

3.1.7 Repair

Process of returning a faulty product to a condition in which it can perform its intended function.

Note 1:
This document addresses only the ability to repair a product, not the complete repair process such as fault diagnosis, component replacement, functional testing, and returning the product to operational status.

3.1.8 Upgrade

Process of enhancing the functionality, performance, capacity or aesthetics of a product.

Note 1:
An upgrade to a product may involve changes to its software, firmware and/or hardware

Note 2:
Refer to the “Blue Guide” for conditions under which a product is considered as a new product when placing it on the market after upgrading it.

3.1.9 Light source

Lamp, provided with a lamp-cap, or module (LED) or other light source made in order to produce an optical visible radiation to be used incorporated into the luminaire.

Note 1:
In this document only products with LED light sources are addressed.

3.1.10 Replaceable light source

Lamp, provided with a lamp-cap according to IEC 60061, or light source designed to be connected by terminals, connector or similar devices and designed to be replaced during normal use or maintenance of the luminaire.

3.1.11 Non replaceable light source

Light source which is a non replaceable part of the luminaire either because it cannot be replaced without breaking or destroying the luminaire or because it is enclosed

under a cover fixed by screw or similar fixing means designed to be used only once and which is not possible to opened.

3.1.12 Non-user replaceable light source

Light source which can only be replaced by the manufacturer, his service agent, or similar qualified person.

3.1.13 LED Module

Unit supplied as a light source. In addition to one or more LEDs, it may contain further components, e.g. optical, mechanical, electrical and electronic but excluding controlgear.

3.1.14 Self-ballasted LED module

LED module, designed for connection to the supply voltage.

3.1.15 Controlgear

Controlgear means one or more devices, that may or may not be physically integrated in a light source, intended to prepare the mains for the electric format required by one or more specific light sources.

It may include transforming the supply and starting voltage, limiting operational and preheating current, preventing cold starting, correcting the power factor and/or reducing radio interference.

3.1.16 Commonly available tools

Common available tools are defined in Appendix 2.

3.1.17 Special service tool

Tool that is not available for purchase by the general public or whose applicable patents are not available for licensing under fair, reasonable, and non-discriminatory terms

3.1.18 Spare part

Part or material required to repair or maintain a piece of equipment.

3.1.19 Layman

Person who does not perform repair activities as part of their profession and has received little or no formal instruction in the repair of luminaires

3.1.20 Generalist

Person competent in the repair of electrical equipment who has received formal instruction in the repair of electrotechnical products and/or luminaires.

3.1.21 Specialist

A person highly skilled in the field of repair of electrical equipment who has received detailed training and instruction specific to the repair of luminaires. In many cases this expertise limited to a certain brand or type of luminaires.

3.1.22 Physical interchangeability

The ability of a system component to physically replace another component while matching its form and fit

See also: Appendix 3, Figure A – Interoperability and interchangeability model

3.1.23 Functional Interchangeability

The ability of a system component to perform in an equivalent manner to another system component

See also: Appendix 3, Figure A – Interoperability and interchangeability model

3.1.24 Interchangeability

The ability of a system component to replace another component while maintaining form and fit compatibility and operating equivalently.

See also: Appendix 3, Figure A – Interoperability and interchangeability model

3.1.25 Interoperability

A system component is considered interoperable with other components if, when combined, they can function as intended.

According to this definition, interoperability requires compatibility of the components across all aspects of all relevant interfaces. These may include mechanical, electrical, photometrical, thermal, and communication interfaces.

See also Appendix 3, Figure A: Interoperability and interchangeability model.

3.1.26 Function as intended

Means that the replacement part is capable of functioning such that the original equipment specifications are met.

This also means that the use of such parts does not prevent compliance with applicable safety or regulatory requirements.

3.1.27 Open standard

An open standard is a standard that is publicly available and usable by anyone, and that meets criteria such as open licensing, non-discriminatory access, and extensibility. Participation in the development of an open standard is typically open to all interested parties.

For example; IEC standards are open and anyone can participate in its development. Also ZHAGA standards, NEN standards, ISO standards etc are considered open standards.

3.1.28 Firmware

Structured set of instructions and data stored in a way that is functionally independent of main memory, usually located in read-only memory.

3.1.29 Software

Set of programs, procedures, rules, documentation and data associated with the operation of a data processing device or system

Note 1:
Software is an intellectual creation that exists independently of the storage medium.

Note 2:
Software requires hardware to execute programs, and to store and transmit data.

3.1.30 Application software

Software designed to solve a specific problem relevant to the end user.

3.1.31 Outdoor Luminaire Controller (OLC)

Functional component of an outdoor lighting system that controls one or more luminaires.

3.1.32 Operating system

Software designed to manage and execute user programs in a computer system.

3.1.33 Refurbish

Activity intended to restore an item to its original, upgraded, or otherwise predetermined form and functionality

3.1.34 Sealed for life

The product cannot be disassembled for repair without causing damage to part of the housing.

3.1.35 Sensor

Device which, when excited by a physical phenomenon, produces an electric signal characterizing the physical phenomenon.

3.1.36 OSI Model

Open Systems Interconnection (OSI) Reference Model

Conceptual model that defines and standardizes the communication functions of a network or computer system, independently of its internal structure and underlying technology.

3.1.37 Subassembly

Subassembly refers to an independent and partially assembled part or module within a luminaire. It is designed to perform a specific function or set of functions and can be integrated with other subassemblies or components to create the final luminaire.

Generally, a subassembly consists of a mechanical structure on which components such as drivers, OLCs, and similar parts are mounted.

This subassembly is then mounted into the luminaire.

Subassemblies can often be easily removed and replaced for repair purposes.

4. Classification

4.1 Identification of parts to be assessed

The following assumptions apply in this document:

A luminaire may consist of the following major parts;
- Main housing (including Spigot)
- Translucent cover
- Light source
- Controlgear (driver)
- Heat sink
- Lenses and/or reflectors
- Sensors and/or OLC’s
- Sealing

Other parts commonly used in luminaires, such as wiring, terminal blocks, etc., are also considered in this document.

Note 1:
OLCs and sensors are considered spare parts only when they are integrated into the luminaire.

4.2 Classification according to ability to be repaired

Luminaires shall be classified according to their ability to be opened, and to have parts removed and replaced.

4.2.1 Sealed for life

Luminaires that cannot be opened for repair without damaging part of the housing shall be classified as sealed for life.

4.2.2 Workshop access

Luminaires that must be returned to the factory or a specialised workshop for repair shall be classified as workshop access luminaires.

Note 1:
In some organisations it is common practice to remove and replace the luminaire and then carry out repairs in a workshop. Only those luminaires for which this return is mandatory fall under this classification; the internal repair practices of organisations are outside the scope of this document.

4.2.3 Specialist access

Luminaires that can be opened only with special service tools shall be classified as specialist access luminaires. The manufacturer or supplier shall either provide such tools for repair purposes or require the luminaire to be returned to the factory or a specialized workshop for repair.

4.2.4 Generalist access

Luminaires that can be opened using commonly available tools shall be classified as generalist access luminaires.

4.2.5 Toolless access

The luminaire can be opened without the use of tools.

4.3 Classification according to the probability of a defect

Parts shall be classified according to their probability of failure: low, medium, or high. Each part must be designed for the specific purpose and conditions in which it is intended to be used.

Subassemblies shall be classified based on the individual parts from which they are composed. The overall classification of the subassembly shall be determined by the part within it that has the lowest score.

Example: If a subassembly consists only of a metal plate with terminals, wiring and LED modules, it shall be classified as having a medium probability of failure. If the same subassembly also includes controlgear (driver), it shall be classified as having a high probability of failure.

4.3.1 Parts with a low probability of failure

Parts that are generally considered to fall into this category include:

- Housing parts
- Translucent cover
- Terminal blocks
- Wiring

Housing parts and translucent covers used in luminaires installed in public spaces and positioned within arm’s reach, with an impact protection rating below IK08, shall be classified as parts with a medium probability of failure.

4.3.2 Parts with a medium probability of failure

Parts that are generally considered to fall into this category include:

- Low density and low complexity electronic components
- LED modules
- Seals
- Connectors for sensors and/or OLCs

4.3.3 Parts with a high probability of failure

Parts that are generally considered to fall into this category include:

- High density and complex electronic components
- Controlgear (drivers)
- Integrated sensors
- Surge-protectors
- Integrated OLC’s

5. Luminaire assessment

Luminaires shall be assessed as specified in the following clauses.

5.1 Ability to repair

Luminaires shall be accompanied by appropriate repair documentation. This documentation shall either be supplied with the luminaire or made available via a link to a publicly accessible website. Access may be provided, for example, by means of a QR code affixed to the luminaire. It shall be possible to download the documentation from the website.

The repair documentation shall include a clear step-by-step procedure, supported by illustrations, showing how each replaceable part can be removed and replaced. The documentation shall clearly indicate which tools are required for each step and under what conditions they must be used. Examples include wiring diagrams or specified minimum and maximum torque values for tightening screws. The documentation shall also include a complete bill of materials (parts list).

In addition to written instructions, instructional videos may also be made available on a public website to demonstrate the replacement of specific parts.

The above requirements apply to both luminaires and subassemblies.

Luminaires shall be categorised based on the ease with which they can be opened for repair purposes and the ease with which individual parts can be replaced.

5.1.1 Category A

Luminaires in category A are: classified as toolless access

- or -

for luminaires used in the public areas and expected to be fitted within arm’s reach; classified as generalist access and where only one commonly available tool is required for opening the luminaire.

All parts shall be replaceable without the use of tools.

For parts or subassemblies that are considered low probability for defects as defined in clause 4.3 it is acceptable that commonly available tools are needed for their replacement.

In case of subassemblies, the subassembly can be replaced without the use of a tool. The individual parts mounted on or in the subassembly shall be replaceable using commonly available tools.

5.1.2 Category B

Luminaires classified as toolless access or generalist access and:
- Parts or subassemblies with a high or medium probability of failure can be replaced using commonly available tools.
- A maximum of two commonly available tools is required to open the luminaire and replace high or medium probability of failure parts or subassemblies.
- Parts or subassemblies with a low probability of failure can also be replaced using commonly available tools.

For subassemblies, all parts mounted on or in the subassembly shall be replaceable using commonly available tools.

5.1.3 Category C

Luminaires classified as toolless access or generalist access and replacement of parts or subassemblies can be conducted by means of commonly available tools.

The parts fitted on/in the subassembly shall be replaceable by means of common available tools.

5.1.4 Category D

Luminaires classified as specialist access.

5.1.5 Category E

Luminaires classified as sealed for life.

These luminaires are considered non-repairable.

5.2 Availability of spare parts

The availability of spare parts and subassemblies, both in the short and long term, shall be assured.

Spare parts and subassemblies are typically provided by the original equipment manufacturer (OEM). However, to ensure repairability, the continued availability of these components must be guaranteed, even in cases where the OEM is no longer able to supply them or has ceased operations.

Spare parts and subassemblies shall be assessed based on their availability and whether alternative sourcing from multiple independent suppliers is possible.

To ensure long-term supply of spare parts and subassemblies, the following aspects shall be considered:
– Use of open standards in the design of parts and subassemblies
– Availability of alternative, interoperable parts and subassemblies
– Availability of sufficient information to determine whether alternative parts and subassemblies can be used
– Availability of design specifications, technical drawings, and related documentation

5.2.1 Electrical part classification

The manufacturer/supplier shall provide evidence supporting the selected status and classification of the key electrical components. For the purposes of this clause, only key electrical components are taken into consideration; wiring, terminal blocks, and similar elements are excluded from this classification.

The manufacturer/supplier may choose to create an interchangeable subassembly. This consists of a construction on which one or more key components are mounted. The intention is that this unit, including all electrical components mounted on it, can be replaced as a whole.

The subassembly may be repaired at a later stage.

All individual components used shall be evaluated and classified. The component with the lowest classification shall determine the final category for all components considered under this clause.

Components used in or on the subassembly shall be evaluated in the same manner and shall be treated equally when determining the final classification of the subassembly.

The following criteria apply for classification:
– The component used in the product is designed according to open standards, covering all aspects of interoperability.
– A repair manual is available, providing all necessary information for selecting alternative components in case replacement is needed.
– The repair manual also includes a list of alternative components that may be selected and used.

The manufacturer/supplier shall provide a written and signed declaration pledging to supply the components for at least 20 years after delivery of the product.

5.2.1.1 Category A

- The part used in the luminaire is designed in accordance with open standards that cover all aspects of interoperability.
- A repair manual is available, providing all necessary information for selecting alternative components in case replacement is needed.
- The repair manual also includes a list of alternative components that can be selected and used.

The manufacturer or supplier shall provide a written and signed declaration in which they commit to supplying the components for a minimum of 20 years after delivery of the luminaire.

5.2.1.2 Category B

- The component used in the luminaire is designed in accordance with open standards that cover all aspects of interchangeability.
- A repair manual is available, providing all necessary information for selecting alternative components in case replacement is required.

The manufacturer or supplier shall provide a written and signed declaration in which they commit to supplying the components for at least 10 years after delivery of the luminaire.

5.2.1.3 Category C

- The component used in the luminaire is built in accordance with open standards covering all aspects of functional interchangeability.
- A repair manual is available, providing all necessary information for selecting alternative components in case replacement is required.

The manufacturer or supplier shall provide a written and signed declaration in which they commit to supplying the components for at least 8 years after delivery of the luminaire.

5.2.1.4 Category D

- The component used in the luminaire is built in accordance with open standards covering all aspects of physical interchangeability.
- A repair manual is available, providing all necessary information for selecting alternative components in case replacement is required.

The manufacturer or supplier shall provide a written and signed declaration in which they commit to supplying the components for at least 5 years after delivery of the luminaire.

5.2.1.5 Category E

The part used is built according to proprietary standards.

5.2.2 Mechanical part classification

The manufacturer shall provide evidence to support the selected status and category of mechanical components. For this clause, key components such as the housing and the translucent cover are taken into consideration.

The mechanical component with the lowest classification shall determine the overall category for all components considered under this clause.

5.2.2.1 Category A

The construction drawings, design specifications, and material properties are publicly available, or will be made available by the supplier when they are no longer able or willing to produce the parts. This may involve a third party for secure storage in order to prevent the loss of information once the supplier ceases operations.

The manufacturer/supplier shall provide a written and signed declaration in which they commit to supplying the parts for at least 20 years after delivery of the luminaire.

5.2.2.2 Category B

The manufacturer/supplier provides a written and signed declaration in which they commit to supplying the parts for a minimum of 10 years after delivery of the final of the luminaire.

5.2.2.3 Category C

The manufacturer/supplier provides a written and signed declaration in which they commit to supplying the parts for a minimum of 8 years after delivery of the luminaire.

5.2.2.4 Category D

The manufacturer/supplier provides a written and signed declaration in which they commit to supplying the parts for a minimum of 5 years after delivery of the luminaire.

5.2.2.5 Category E

The manufacturer/supplier does not provide the spare parts.

The manufacturer/supplier is also not willing to provide the technical specifications required for manufacturing the part at an alternative location.

5.3 Firmware, software and applications

Parts may be equipped with firmware, software, and application software.

In most cases, firmware and/or software is used in drivers and Outdoor Luminaire Controllers (OLCs).

To enable the repair of a luminaire containing such parts, the functionality must be replaceable by alternatives. This primarily means that the communication interfaces must communicate in the same manner.

To ensure the availability of spare parts, the following points shall be considered:

- Parts designed based on open standards;
- Alternative interoperable parts are available;
- Sufficient information is available to assess whether an alternative part can be used;
- Availability of design specifications, configuration data, etc.

The model in Appendix 3, Figure B is used to determine which interfaces are to be considered.

In this chapter, the term “interface” refers to OSI layers 1 to 7, excluding the mechanical aspects which are covered in other parts of this assessment guideline.

Note 1:
OLCs (Outdoor Luminaire Controllers), such as those connected to a Zhaga socket, shall not be considered part of the evaluation. These separate OLCs, when disconnected from the luminaire, do not constitute an integral or fixed part of the overall lighting system.

5.3.1 Category A

All interfaces (IF1 – IF4) used in the system are designed according to open standards.

Configuration of the driver can be performed without voltage and via a manufacturer-neutral software tool. The configuration tool must be available from multiple manufacturers.

A manual is available containing all necessary information for applying the correct configuration settings and describing the required options to achieve interoperability.

If applicable, configuration files are available or will be made available by the supplier as soon as they are no longer able to supply the parts.

This may involve a third party for secure storage to prevent loss of information once the supplier is no longer active.

5.3.2 Category B

Interfaces (IF2 – IF4) used in the system are designed according to open standards.

Configuration of the driver can be performed without voltage and via a manufacturer-neutral software tool. The configuration tool must be available from multiple manufacturers.

A manual is available containing all necessary information for applying the correct configuration settings and describing the required options to create interoperability.

5.3.3 Category C

Interfaces (IF3 – IF4) used in the system are designed according to open standards.

The driver can only be configured using a manufacturer-specific protocol / programming tool.

5.3.4 Category D

Not all interfaces are designed according to open standards.

Configuration is only possible by the manufacturer or by a representative designated by the manufacturer.

6. Assessment result evaluation

This clause contains the criteria for assessing the ability of a luminaire to be repaired.

The luminaire repairability score is determined by the lowest score among the categories.

6.1 Determining the score of the lighting device

The repairability of the luminaire is determined in this guideline by the score on three aspects:

1. The possibility of repair

2. The availability of:
a. mechanical components
b. electrical components

3. Communication/interfaces

The scoring system for each aspect ranges from A to D or E, with A representing the highest score and D or E the lowest score.

6.2 Clear communication about the score

It is important that the score of a Luminaire based on this Assessment Guideline is communicated clearly and unambiguously. After all, the aim of this guideline is to provide an objective framework, allowing different types of Luminaires to be compared with each other. This is only possible if the assessment results are displayed clearly and accompanied by appropriate background information.

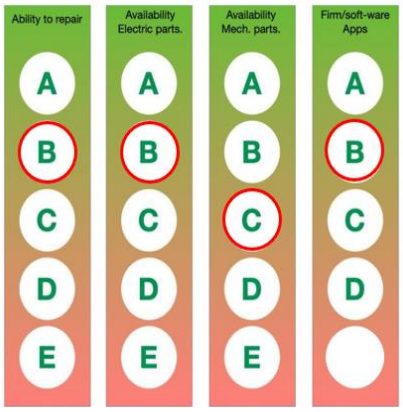
When displaying the scores of a Luminaire based on this Assessment Guideline, the form in Appendix 1 is therefore used as standard.

This appendix consists of three pages, namely:
1. Cover page with information about the product, manufacturer and any verification
2. Scores achieved
3. Explanation of the scores achieved

Displaying the results achieved in any other way is not in accordance with this guideline.

Below is a completed example of the score table included in the standard form (Appendix 1). The red circles in the input fields are examples of possible results of an assessment.

Example:


Ability to repair
A
B
C
D
E
Availability Electric parts.
A
B
C
D
E
Availability Mech. parts.
A
B
C
D
E
Firm/soft-ware Apps
A
B
C
D

Appendices

Appendix 1: Standard form for presentation of assessment results
Appendix 2: Commonly available tools
Appendix 3: Models
Appendix 4: Required skills for carrying out repair activities
Appendix 5: Considerations
Appendix 6: Bibliography

Appendix 1: Standard form for presentation of assessment results

When displaying the scores of a luminaire based on this Assessment Guideline, a standard form shall be used.
Presenting the score in any other way is not in accordance with this guideline.
The standard form consists of three pages.

REPAIRABILITY ASSESSMENT OF LUMINAIRE IN ACCORDANCE WITH ASSESSMENT GUIDELINE

Compiled by:

Product type:

Trademark:

Type/Model:

Manufactured by:

Date :

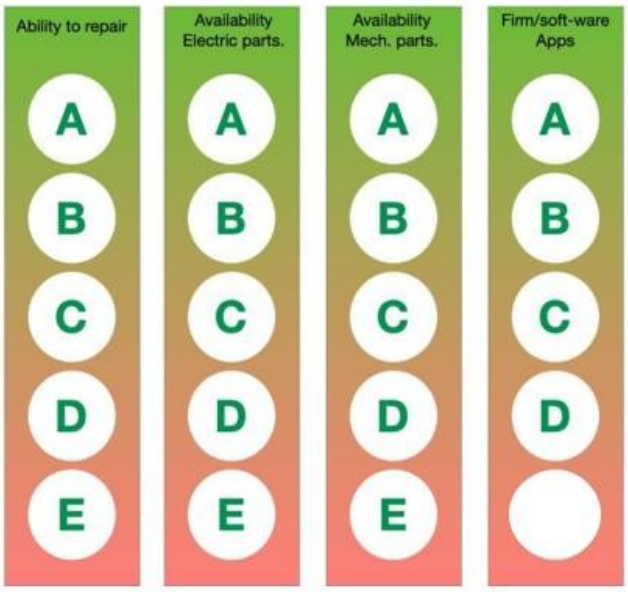
Verification by CI: Yes/no, (when yes, include declaration)

Standard:
Assessment guideline Repairability of public lighting luminaires/ Beoordelingsrichtlijn Herstelbaarheid van openbare-verlichtingstoestellen based on NEN-EN 45554

The assessment of the luminaire based on the "Assessment Guideline for the Repairability of Public Lighting Luminaires" results in the following outcome:

	Assessment result evaluation	Score
I	Abillity to repair	
II (a)	Availability of electrical parts	
II (b)	Availability of mechanical parts	
III	Firm-/Software	

Visual representation of the above assessment result
(The achieved scores are circled)



Subassemblies
Is a subassembly used in this luminaire?* Yes / No (Indicate as applicable.)

**A subassembly refers to an independent and partially assembled part or module within a luminaire. It is designed to perform a specific function or set of functions and can be integrated with other subassemblies or components to form the final luminaire. In general, a subassembly consists of a mechanical structure on which components such as drivers, OLCs, etc., are mounted. This subassembly is then installed in the luminaire.*

Below is a simplified description of the possible scores per component.
For the full description, refer to the "Assessment Guideline for the Repairability of Public Lighting Luminaires."

I Abillity to repair

Category	Explanation
A	The luminaire can be opened without the use of tools.
B	The luminaire can be opened using a maximum of 2 different types of commonly available tools.
C	The luminaire can be opened using commonly available tools.
D	The luminaire can only be opened using specialist tools.
E	The luminaire cannot be opened without causing irreversible damage.

II (a) Availability of electrical parts

Category	Explanation
A	The luminaire is developed according to publicly accessible standards that cover all requirements for interoperability. The repair manual includes details for selecting alternative components. The repair manual includes a list of alternative components. Parts will remain available for at least 20 years.
B	The luminaire is developed according to publicly accessible standards that cover all requirements for interchangeability. The repair manual includes details for selecting alternative components. Parts will remain available for at least 10 years.
C	The luminaire is developed according to publicly accessible standards that cover all requirements for functional interchangeability. The repair manual includes details for selecting alternative components. Parts will remain available for at least 8 years.
D	The luminaire is developed according to open standards that cover all aspects of physical interchangeability. The repair manual includes details for selecting alternative components. Parts will remain available for at least 5 years.
E	The luminaire is developed according to proprietary standards.

II (b) Availability of mechanical parts

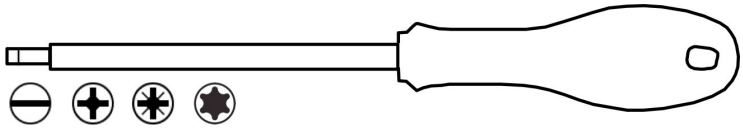
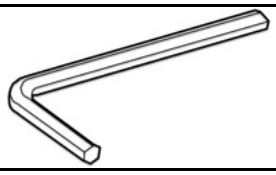
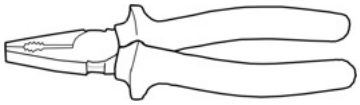
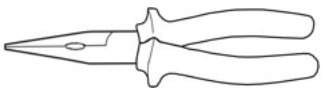
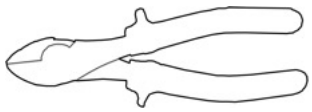
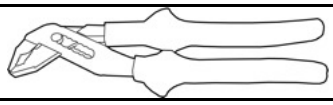
Category	Explanation
A	Material specifications are available from the manufacturer or accessible through a third party. Parts will remain available for at least 20 years.
B	Parts will remain available for at least 10 years.
C	Parts will remain available for at least 8 years.
D	Parts will remain available for at least 5 years.
E	The manufacturer does not meet categories A through D.

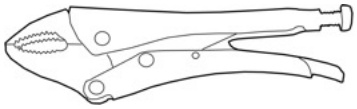
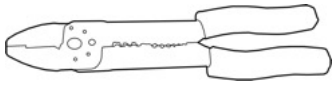
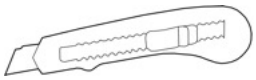
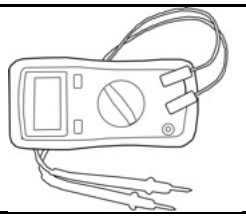
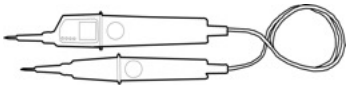
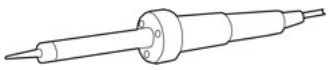
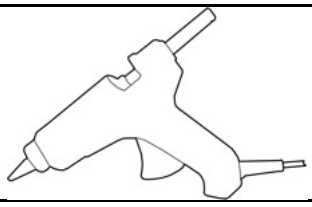
III Firm-/Software

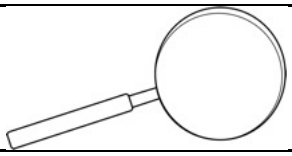
Category	Explanation
A	IF1–IF4 interfaces are based on open standards. Voltage-free (re)programming of the driver is possible. The configuration tool must be provided by multiple manufacturers using neutral software. A configuration manual is available. Configuration files are available from the manufacturer or accessible through a third party.
B	IF3–IF4 interfaces are based on open standards. A configuration manual is available describing the options for achieving interoperability.
C	IF3–IF4 interfaces are based on open standards.
D	Interfaces are not designed according to open standards.

Appendix 2: Commonly Available Tools

This table contains a selection of hand tools that can be used to perform repair activities.
The table is adopted from NEN-EN 45554.

Tool type	Illustration (informative example)	Reference
Schroevendraaier voor sleufkopschroeven, kruiskopschroeven of zeshoekige schroeven met stervormige uitsparing. Screwdriver for slotted heads, cross recess or for hexalobular recess heads		ISO 2380, ISO 8764, ISO 10664
Inbussleutel Hexagon socket key		ISO 2936
Combinatie sleutel Combination wrench		SO 7738
Combinatietang Combination pliers		ISO 5746
Platte ronde neustang Half round nose pliers		ISO 5745
Zijkniptang Diagonal cutters		ISO 5749
Waterpomptang		ISO 8976

Multigrip pliers (multiple slip joint pliers)		
Grijptang Locking pliers		
Combinatietang voor draadstrippen en kabelklemmen Combination pliers for wire stripping and terminal crimping		
Koevoet Prying lever		
Pincet Tweezers		
Werkbankhamer Hammer, steel head		ISO 15601
Afbreekmes Utility knife (cutter) with snap-off blades		
Multimeter Multimeter		
Spanningstester Voltage tester		
Soldeerbout Soldering iron		
Lijm pistool Hot glue gun		

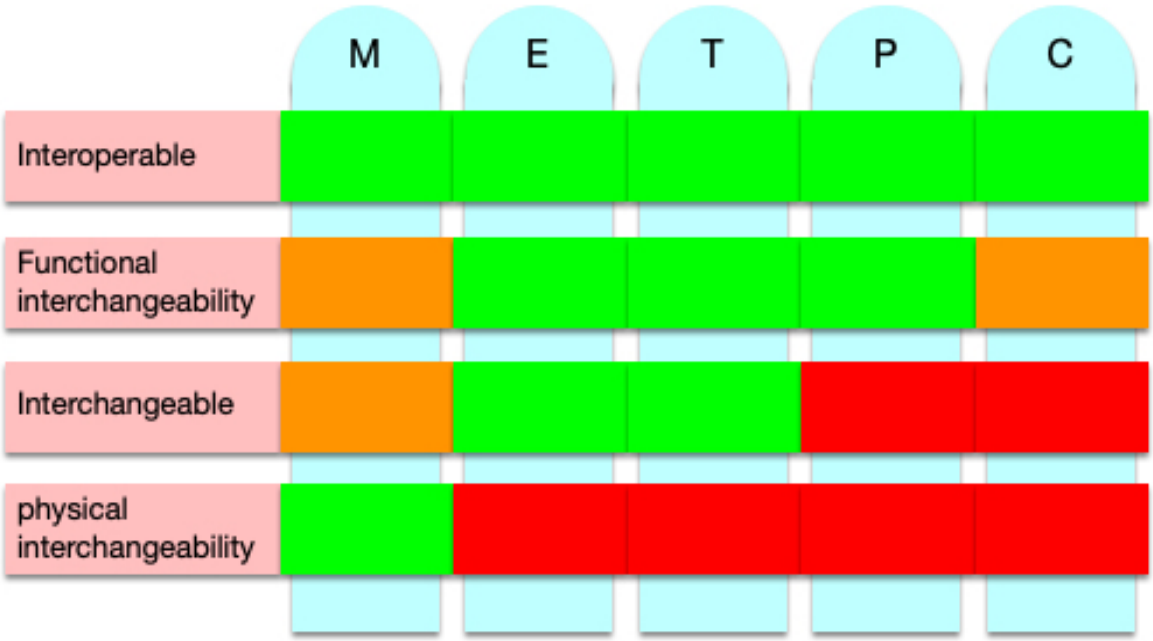
Vergrootglas Magnifying glass		

Opmerking 1:
De meeste gereedschappen zijn verkrijgbaar in verschillende maten. Deze lijst verwijst alleen naar het type gereedschap. Hoewel sommige maten vaker voorkomen dan andere, wordt voor praktische doeleinden elke maat van de vermelde gereedschappen beschouwd als basisgereedschap.

NOTE 1:
Most tools come in different sizes. This list only refers to the tool type. Although some sizes are more common than others, for practical purposes, any size of the listed tools is considered to be a basic tool.

Appendix 3: Models

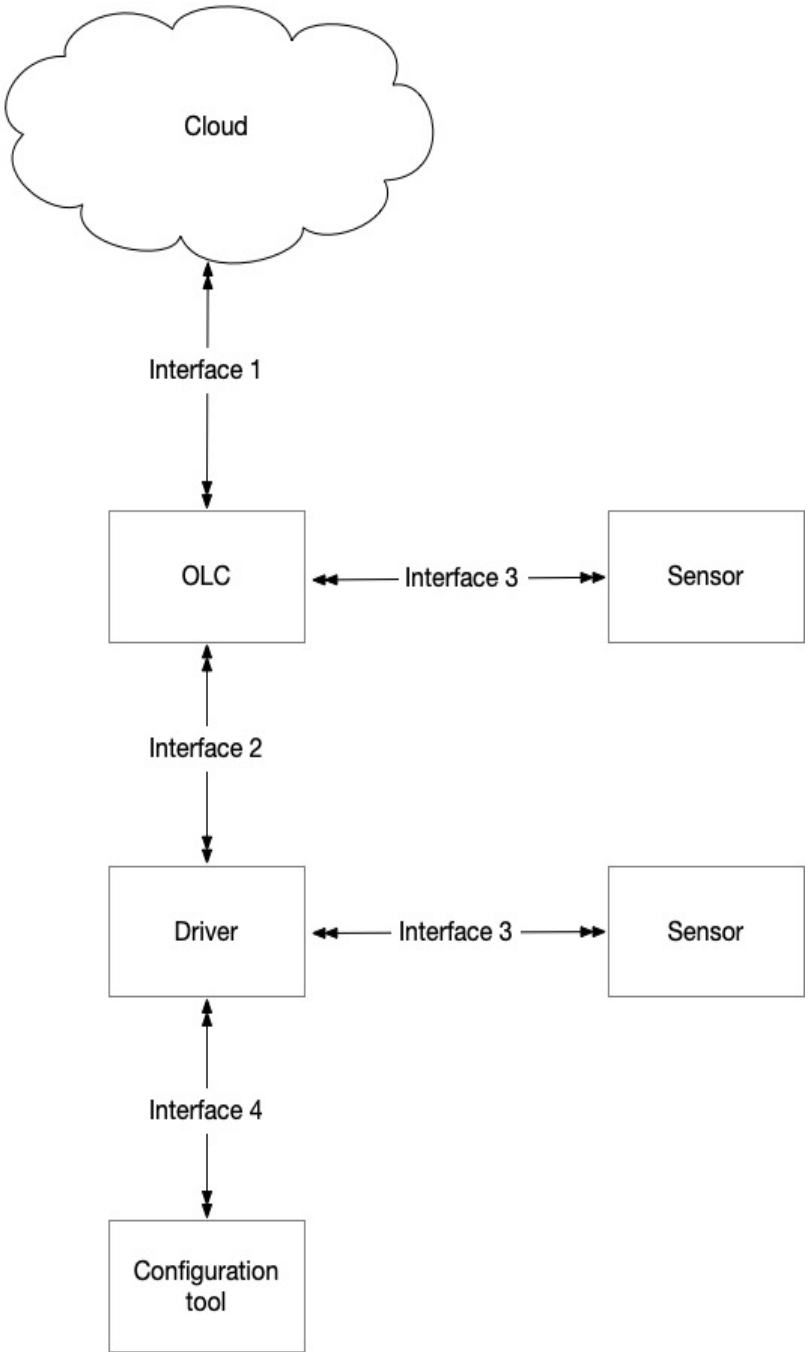
Figure A: Interoperability and interchangeability model



M Mechnical
E Electrical
T Thermal
P Photometric
C Communication

Green => Is be fully implemented
Orange => Partially required
Red => Not completed

Figure B: Interface model



Appendix 4: Considerations

How a subassembly affects the score of a luminaire

Subassemblies play a crucial role in reducing the complexity of final luminaire assembly and facilitate repair activities. This standard recognises the benefits of easier and faster repairs, but also acknowledges the potential challenges related to replacement. It is important that subassemblies, which are replaced during repair operations, are themselves designed to be repairable. Although repairing a subassembly may be more complex than replacing an individual component, this standard recognises the feasibility of such repairs. Specialised repair centres may be capable of repairing subassemblies, allowing them to be reused after refurbishment.

However, there is some uncertainty regarding the extent to which this practice will be implemented. It is also possible that such subassemblies will be considered e-waste and recycled, even if they still contain functioning components that are suitable for reuse.

Ultimately, it is the responsibility of the end user and the manufacturer to collaborate and determine the most appropriate approach to achieve sustainability goals.

Does every open standard meet the requirements of this standard?

There are many open standards available. However, compliance with an open standard does not necessarily mean that the component meets the intended purpose of this specific standard.

For example, if a driver complies with EN 61347-2-13, it fulfils safety requirements. However, compliance with this open standard does not automatically imply standardised dimensions. Therefore, it does not guarantee mechanical compatibility with alternative drivers.

To determine whether an open standard aligns sufficiently with the requirements of this standard, the open standard itself must be evaluated to determine to what extent it covers the necessary interfaces for repairability.

Examples include:

Driver compliance with Zhaga standards may fulfil requirements related to dimensions and programmability.

Driver compliance with DALI standards provides a standardised communication interface.

However, additional information is required to ensure that alternative drivers can be selected. This includes details such as permissible ambient temperature, maximum Tc point temperature, operating window, insulation properties, etc.

Appendix 5: Bibliography

The following documents have been used as references for this document.

EN 45554: 2020, General methods for the assessment of the ability to repair, reuse and upgrade energy-related products
EN 45552, General method for the assessment of the durability of energy-related products;
EN 45559, Methods for providing information relating to material efficiency aspects of energy-related products
EN 60598-1, Luminaires - Part 1: General requirements and tests
EN 60598-2-1, Luminaires - Part 2-1: Particular requirements - Fixed general purpose luminaires
EN 60598-2-2, Luminaires - Part 2-2: Particular requirements - Recessed luminaires
EN 60598-2-3, Luminaires - Part 2-3: Particular requirements - Luminaires for road and street lighting
EN 60598-2-5, Luminaires - Part 2-5: Particular requirements - Floodlights
EN 60598-2-13, Luminaires - Part 2-13: Particular requirements - Ground recessed luminaires
EN 62262, Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)

“Blue Guide on the implementation of the product rules 2022” https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:C:2022:247:TOC

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