

C4/11.3

SPECIFICATIONS FOR LED LUMINAIRES

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1. Introduction

The SYNERGRID C4/11.3 specification sets the requirements for luminaires equipped with LED technology.

These specifications determine the following:

- Specific technical requirements;
- The content of the technical dossier to be submitted with the conformity check request;
- The required tests and corresponding test methods.

The complete procedure for obtaining a certificate of conformity is described in SYNERGRID publication C4/8 “Obtaining a certificate of conformity or approval of an exemption”.¹

Synergrid publishes the list C4/11.3-B of authorised luminaires that comply with the present technical specifications. Every item on this list of homologated luminaires complies with a specific combination of model, LED module, driver, etc.²

¹ [Homologation des luminaires d'éclairage public - Synergrid](#)

² [Liste C4 11 3 B LED luminaires.xlsx](#)

2. Scope

The present technical specification describes the electrical, mechanical and maintenance requirements for public lighting sources equipped with LED technology.

This technical specification **is not applicable** to:

- Ground spots;
- Light beacons;
- Luminaires that are used exclusively for artistic or architectural purposes.

3. Normative references

The latest edition of the regulations, standards, and technical specifications listed below, including any addenda, serve as reference documents and are applicable as long as they do not contradict the criteria formulated in this specification. In case of contradiction, the application of the corresponding part of the standard is revoked in favor of the requirements of this specification (the rest of the standard remains fully applicable).

3.1 Luminaire

Standard number	Title
NBN EN 60598-1	Luminaires - Part 1: General requirements and tests
NBN EN 60598-2-3	Luminaires - Part 2-3: Particular requirements - Luminaries for road and street lighting
NBN EN 60598-2-5	Luminaires – Part 2-5: Particular requirements - Floodlights
IEC 62722-1	Luminaire performance - Part 1: General requirements
IEC 62722-2-1	Luminaire performance - Part 2-1: Particular requirements for LED luminaires
IES TM-28-14	Projecting long-term luminous flux maintenance of LED lamps and luminaires

3.2 LED light source

Standard number	Title
IEC 62504	General lighting - Light emitting diode (LED) products and related equipment - Terms and definitions
NBN EN 62031	LED modules for general lighting - Safety specifications
IEC 62717	LED modules for general lighting - Performance requirements
IEC 63013	LED packages – Long-term luminous and radiant flux maintenance projection
IES TM-21-11	Projecting Long Term Lumen Maintenance of LED Light Sources
NBN EN 60838-2-2	Miscellaneous lamp holders - Part 2-2: Particular requirements - Connectors for LED modules

3.3 LED driver

The normative references for Synergrid C4/10.2 “Requirements for LED light source equipment” are applicable.

3.4 Photometry

Standard number	Title
CIE 13.3	Method of measuring and specifying colour rendering of light sources – New edition (including Disk D008)
CIE 15.3	Colorimetry, 3rd ed.
CIE 63	The Spectroradiometric Measurement of Light Sources
CIE 121	The Photometry and Goniophotometry of Luminaires
CIE 126	Guidelines for Minimizing Sky Glow
CIE 150	Guide on the Limitation of the Effects of Obtrusive Light
CIE S 025	Test Method for LED Lamps, LED Luminaires and LED Modules
NBN EN 13032-2	Light and lighting – Measurement and presentation of photometric data of lamps and luminaires – Part 2: Presentation of data for indoor and outdoor work places
NBN EN 13032-4	Light and lighting – Measurement and presentation of photometric data of lamps and luminaires – Part 4: LED lamps, modules and luminaires
IES LM-79-08	IES LM-79-08 Electrical and Photometric Measurements of Solid-State Lighting Products
IES LM-80-15	Measuring Luminous Flux and Color Maintenance of Led Packages, Arrays and Modules
IES LM-82	Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature
IES LM-84-14	Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires
IEC 62471	Photobiological safety of lamps and lamp systems
IEC 62471-7	Photobiological safety of lamps and lamp systems - Part 7: Light sources and luminaires primarily emitting visible radiation
IEC TR 62778	Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires
IEC TR 62778	Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires

3.5 Materials

Standard number	Title
NBN EN 10088-1	Stainless steels - Part 1: List of stainless steels
NBN EN 10204	Metallic products - Types of inspection documents
NBN EN 515	Aluminium and aluminium alloys - Wrought products - Temper designations
NBN EN 573-1	Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 1: Numerical designation system
NBN EN 573-2	Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 2: Chemical symbol based designation system
NBN EN ISO 1043-1	Plastics - Symbols and abbreviated terms - Part 1: Basic polymers and their special characteristics
NBN EN ISO 3506-1, -2 and -3	Mechanical properties of corrosion-resistant stainless-steel fasteners

3.6 Corrosion

Standard number	Title
NBN EN 515	Aluminium and aluminium alloys - Wrought products - Temper designations
NBN EN ISO 1043-1	Plastics - Symbols and abbreviated terms - Part 1: Basic polymers and their special characteristics (ISO 1043-1:2011)
NBN EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
NBN EN ISO 14713-1	Zinc coatings - Guidelines and recommendations for the protection against corrosion of iron and steel in structures - Part 1: General principles of design and corrosion resistance
NBN EN ISO 14713-2	Zinc coatings - Guidelines and recommendations for the protection against corrosion of iron and steel in structures - Part 2: Hot dip galvanizing
BPR 1197	Quality requirements for the industrial application of organic protective layers on intermittent hot-dip galvanized steel - Duplex system - 3rd revised edition - September 2004 by VOM vzw & PROGALVA vzw
NBN EN ISO 12944-1	Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 1: General introduction
NBN EN ISO 12944-2	Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 2: Classification of environments
NBN EN ISO 12944-5	Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 5: Protective paint systems
NBN EN ISO 12944-6	Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 6: Laboratory performance test methods

NBN EN ISO 12944-7	Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 7: Execution and supervision of paint work
Qualanod specifications	Quality Label for Anodic Oxide Coatings on Wrought Aluminium for Architectural Purposes
Qualanod specifications	Quality Label for Coating on Metal for Architectural Applications
NBN EN ISO 1513	Paints and varnishes - Examination and preparation of test samples
NBN EN ISO 1514	Paints and varnishes - Standard panels for testing
NBN EN ISO 9227	Corrosion tests in artificial atmospheres - Salt spray tests (previously NBN EN ISO 7253)
NBN EN ISO 4628-3	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 3: Assessment of degree of rusting
NBN EN ISO 4628-8	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 8: Assessment of degree of delamination and corrosion around a scribe or other artificial defect
NBN EN ISO 2808	Paints and varnishes - Determination of film thickness
NBN EN ISO 2409	Paints and varnishes - Cross-cut test
NBN EN ISO 2815	Paints and varnishes - Buchholz indentation test
NBN EN ISO 3668	Paints and varnishes - Visual comparison of the colour of paints
NBN EN ISO 4628-2	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 2: Assessment of degree of blistering
NBN EN ISO 2360	Non-conductive coatings on non-magnetic electrically conductive base metals - Measurement of coating thickness - Amplitude-sensitive eddy-current method
NBN EN ISO 2143	Anodizing of aluminium and its alloys - Estimation of loss of absorptive power of anodic oxidation coatings after sealing - Dye-spot test with prior acid treatment
NBN EN ISO 2931	Anodizing of aluminium and its alloys - Assessment of quality of sealed anodic oxidation coatings by measurement of admittance
NBN EN ISO 8251	Anodizing of aluminium and its alloys - Measurement of abrasion resistance of anodic oxidation coatings
NBN EN ISO 8993	Anodizing of aluminium and its alloys - Rating system for the evaluation of pitting corrosion - Chart method
NBN EN ISO 8994	Anodizing of aluminium and its alloys - Rating system for the evaluation of pitting corrosion - Grid method

3.7 Electrical, mechanical, climatic and electromagnetic compatibility tests

Standard number	Title
EN 60068-2-6	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)
NBN C 20-529 (EN 60529)	Degrees of protection provided by enclosures (IP Code)
NBN EN 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK Code)
NBN EN 50294	Measurement method of total input power of ballast-lamp circuits
NBN EN 55015	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
NBN EN 61547	Equipment for general lighting purposes - EMC immunity requirements
NBN EN 61000-3-2	Electromagnetic compatibility (EMC) – Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
NBN EN 61000-3-3	Electromagnetic compatibility (EMC) – Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection
NBN EN 61000-4-1	Electromagnetic compatibility (EMC) – Part 4-1: Testing and measurement techniques - Overview of IEC 61000-4 series
NBN EN 61000-4-4	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test
NBN EN 61000-4-5	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques - Surge immunity test
NBN EN 61000-4-6	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
NBN EN 61000-4-11	Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests

3.8 Quality systems

Standard number	Title
NBN EN ISO 9001	Quality management systems – Requirements
NBN EN ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories

3.9 Others

Standard number	Title
Code	Code on well-being at work
CE marking	In accordance with Royal Decree 23/03/1977 (Belgian Official Gazette dated 31/03/1977) regarding the market launch of electrical equipment and accessories
Directive 2002/95/EC	Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) and its amendments
Directive 2002/96/EC	Directive on waste electrical and electronic equipment (WEEE) and its amendments
NBN EN 13201-2	Road lighting - Part 2: Performance requirements
NBN EN 13201-3	Road lighting - Part 3: Calculation of performance
NBN EN 50160	Voltage characteristics of electricity supplied by public electricity networks
GREI	General Regulations for Electrical Installations
ARAB/RGPT	General Regulation for Protection at Work

4. Definitions

For the purposes of this document, in addition to the terms and definitions of applicable standards, the following definitions apply.

Term/definition	Description
Initial homologation LED luminaire	A homologation of a LED luminaire family that has not been homologated in accordance with the current specification C4/11.3 before.
Upgrade homologation LED luminaire	An upgrade of the homologation of a LED luminaire family which been homologated in the past according to the old specification C4/11.3 and is listed on the old list C4/11.1A. After completion of the upgrade, the luminaire family is considered homologated according to the present version of C4/11.3 and placed on list C4/11.1B.
Extension: new formfactor of LED luminaire	An extension with a new formfactor of LED luminaire can be added to the same product family that is already homologated in accordance with the present version of specification C4/11.3 and published on the new list C4/11.1-B with limited requirements.
Extension: add new LED module	An extension with a new LED module can be added to a product family that is already homologated in accordance with to the present version of specification C4/11.3 and published on the new list C4/11.1-B with limited requirements.
Extension: add new LED control gear	An extension with a new LED control gear can be added to a product family that is already homologated with the present version of specification C4/11.3 and published on the new list C4/11.1-B with limited requirements.
Formfactor	The form factor of a streetlight refers to its physical shape and size within one product family (i.e. mini, medium, maximum, etc.).
LED driver	Element inserted between the power supply (230 VAC) and one or more LED modules, specifically developed to supply the corresponding rated power to the LED modules.
Auxiliary equipment	All electrical or electronic components in the luminaire. (For example, LED driver, fuses, surge protection, etc.)
Protective cover	Part of the luminaire that protects the light source(s) and other components against rain, wind, sun, dust, smoke and corrosive atmospheres.
Auxiliary compartment	Part of the luminaire that houses the main auxiliary equipment.
Optical compartment	Part of the luminaire comprising the light source, diffuser (light cover) and a reflector if applicable.

Term/definition	Description
Body	Structure supporting the luminaire, which allows it to be fixed on a lighting column or attachment. This part remains in place during maintenance and repair tasks. A protective cover and a diffuser (light cover) are fixed on the luminaire body as standard.
Luminous efficacy of the luminaire	The ratio of total luminous flux of the lighting source to the input power. Unit: lm/W
LED luminaire family	Group of luminaires with the same commercial name, same design features and defined by common characteristics for materials, luminaire body shape, components and/or the method of processing and heat management. The various models within the family may differ in terms of: - Number of LEDs; - LED current; - Colour temperature; - Photometry (brightness intensity); - LED control gear; - Dimensions of the luminaire body; - Mounting system.
Sealing	That which seals off the internal section of the luminaire.
Lens	Transparent object used to converge or diverge light rays.
Luminaire	Equipment that distributes, filters or converts light from one or more light sources but does not just include a light source but all elements required to support, protect and secure the light sources and, if required, the auxiliary circuits and the resources to connect these to the power grid. The following elements can form part of the luminaire: - A body; - A mounting element; - An area that contains the complete auxiliary equipment and corresponding cabling; - An easily removable mounting plate with components (optional); - An optical compartment or an optical system; - A reflector (optional); - A protective cover, a diffuser (light cover) and/or lenses; - Protective sealing against dust and water.
LED module	Light source without fitting, incorporating one or more LED package(s) on a printed circuit board, and possibly including one or more of the following: electrical interfaces and equipment, optical, mechanical, and thermal protection devices.

Term/definition	Description
Standard tools	Screwdrivers: - Standard (slot); - Pozidriv; - Phillips; - Torx; - Security Torx. Wrenches and keys: - Hex key set (metric keys) - Metric wrenches
Non-standard tool	Every tool that is not part of the standard tool set as described above.
Mounting element	An essential auxiliary unit to mount the luminaires. The mounting element can be a separate or an integral part of the luminaire.
Mounting plate	A plate including the electric components required for the appropriate operation of the light source.
Projector	Luminaires usually used to light a building, monument, public places or sports areas.
Input power of the luminaire	Electric power consumed from the electricity grid by the luminaire, including all required electric components required to operate the luminaire.
Reflector	This element determines how the light source light is distributed using a mirror.
Refractor	Diffuser (light cover) and structure
Optical system	Light source and mirror, reflector, refractor or lenses.
Temperature t_a of the luminaire	Nominal temperature, indicated by the manufacturer, as the highest ambient temperature to which the luminaire can be subjected during normal operation as defined in standard EN 60598-1.
Temperature t_q of the luminaire	Highest ambient temperature near the luminaire, related to the nominal operation of the luminaire and in relation to the performance thereof, as indicated by the manufacturer or the corresponding supplier. Multiple t_q are possible, depending on the rated lifetime.
Temperature of the t_c LED module	The highest admissible temperature on the exterior of the LED module (at the indicated location, if marked) under normal operating conditions and at the rated voltage/current/power or the maximum value of the rated voltage/current/power range.
Temperature t_p of the LED module	Temperature at location t_p point, related to the LED module performance. The T_p point is the designated location of the point where to measure the performance temperature t_p and $t_{p \text{ rated}}$ at the surface of the LED module. Multiple t_p are possible, depending on the rated lifetime.

Term/definition	Description
Temperature t_c of the LED driver	The highest temperature on the exterior of the LED control gear (at the indicated location, if marked) under normal operating conditions and at the rated voltage or the maximum value of the rated voltage range.
Diffuser (light cover)	Part of the luminaire that allows light through and that may also ensure the protection of the light sources and other components. This term includes the diffusers, optic panels and similar elements that control the light.

5. General requirements

Luminaires must meet the requirements of the following standards:

- NBN EN 60598-1 (safety) (*);
- NBN EN 60598-2-3 (safety) (*);
- NBN EN 60598-2-5 (safety) (*);
- IEC 62722-1 (performance) (**);
- IEC 62722-2-1 (performance) (**).

The following applies alongside the aforementioned requirements.

- The LED modules in the luminaires must meet the requirements of the EN 62384 and EN 62717 standards ;
- A luminaire can only be authorised if it is equipped with a LED driver included in the list C4/10-B of auxiliary equipment authorised by Synergrid.

The luminaires must operate correctly at outside temperatures between -20°C and 25°C. Temperature t_a of the luminaire must be equal to or higher than 25°C.

Damp and/or dusty environments are not considered to be abnormal operating conditions.

Notes:

- (*) : LED luminaires equipped with the ENEC conformity marking and whose issued certificate lists the EN 60598-1, EN 60598-2-3 and EN 60598-2-5 standards, comply with the requirement.
- (**) : LED luminaires equipped with the ENEC+ conformity marking and whose issued certificate lists the IEC 62722-1 and IEC 62711-2-1 standards, comply with the requirement.

If not equipped with the ENEC or ENEC+ conformity marking, see § [17.2](#)

6. Marking requirements

6.1 Normative requirements

The following definitions and requirements about markings is based on the following standards applicable to luminaires:

- NBN EN IEC 60598-1;
- NBN EN IEC 60598-2-3;
- NBN EN IEC 60598-2-5;
- IEC 62722-2-1;
- IEC 62031;
- IEC 62717.

Conformity:

The conformity is verified through a visual inspection.

6.2 Additional requirements

In addition to the marking as required based on the standards indicated in § 6.1, the markings indicated in § 6.2.2 and § 6.2.3 are also required.

The required additional marking can be added by applying an additional label in the luminaire. The label must meet the following specifications:

- Durable (durability in accordance with § 3.4 of the EN 60598-1 standard);
- Clear;
- Hard-wearing;
- Indelible;
- Visible during maintenance tasks.

Conformity:

The conformity is verified through a visual investigation based on the specifications in standard NBN EN 60598-1.

6.2.1 Luminaire

The following additional markings are required on the luminaire:

- CE mark;
- Identification code using alphanumerical characters that allows the tracking of the luminaire;
- Luminous flux in lumen (lm) for the luminaire in the delivered configuration (at ambient temperature 25°C);
- Supply current for the LEDs in the delivered configuration (in mA);
- Correlated colour temperature (in K) and colour rendering index or photometric code (according to IEC 62717);
- Type of optics.

6.2.2 LED module

The LED module(s) must be uniquely and clearly identifiable.

The following additional markings are required on the LED module(s):

- Name of manufacturer;
- Identification code that allows the LED module to be tracked;
- t_c value. If it applies to a specific position on the LED module, this position must be indicated or specified in the documentation provided by the manufacturer;
- If it differs from position t_c , position t_p .

6.2.3 LED driver

The marking of the LED driver(s) must meet the specification C4/10.2.

7. Classification of LED luminaires to facilitate maintenance work

The LED luminaires are classified into 4 different types as indicated below to facilitate maintenance work:

Type 1	Luminaire for which the LED module and LED driver can be replaced on site , without removing the luminaire (at luminaire height).
Type 2	Luminaire for which the LED driver can be changed on site without removing the luminaire (at luminaire height).
Type 3	Luminaire for which the LED module and the LED driver can only be changed after removing the luminaire. The replacement can be done by a technician or in the truck, or in a workplace without using any special equipment under normal working conditions.
Type 4 (Fit & forget)	Luminaire that cannot be repaired and must be permanently replaced in case of malfunction.

7.1 Luminaire type 1

Internal wiring:

- All internal wiring connected to a component must be equipped with a detachable plug including systems that prevent incorrect connections.
- It is not permitted to have loose wiring inside the luminaire.
- When terminal block connectors are used to connect internal wiring, each clamp must be clearly marked using (standard) consistent codes, regardless of the original luminaire components. The codes must consist of symbols, abbreviations or standard names.

LED driver:

The LED drivers can be connected to a removable mounting plate or on the luminaire body. In case of a mounting plate, it should be:

- Detachable;
- Easily removable: secured by clicking it in place, using one or more easily accessible screws using a screwdriver, includes a release mechanism, etc.;
- Easily removable and replaceable, without having to remove the luminaire components;
- Removable and replaceable without having to remove the luminaire from its support;
- Equipped with a detachable terminal block;
- The LED module must not fall when disconnected;
- The mounting plate and the LED driver may not include sharp parts.

LED module:

The LED modules can be connected to a removable mounting plate or on the luminaire body.

The LED module must meet the following specifications:

- Easily accessible and detachable;
- Equipped with a terminal block.
- The LED module must not fall when disconnected.

7.2 Luminaire type 2

Internal wiring:

- All active internal wiring connected to a component, must be equipped with a detachable plug including systems that prevent incorrect connections.
- Passive and unconnected wiring can be integrated in the active internal wiring and also connected to a removable connector or connected to a terminal block connector with spring clamps.
- When terminal block connectors are used to connect internal wiring, each clamp must be clearly marked using (standard) consistent codes, regardless of the original luminaire components. The codes must consist of symbols, abbreviations or standard names.

LED driver:

The LED drivers can be connected to a removable mounting plate or on the luminaire body. In case of a mounting plate, it should be:

- *Detachable;*
- *Easily removable: secured by clicking it in place, using one or more easily accessible screws, using a release mechanism, etc.;*
- *Easily removable and replaceable, without having to remove the luminaire components;*
- *Removable and replaceable without having to remove the luminaire from its support.*

7.3 Luminaire type 3

In case of a defect in the luminaire, it will be removed for the duration of the repair and a temporary luminaire is installed. There are no additional requirements.

7.4 Luminaire type 4

luminaires for which neither the LED module nor the LED driver can be replaced. In case of a defect the luminaire will be replaced. There are no additional requirements.

8. Structural and mechanical requirements

8.1 Luminaire composition

The luminaire is intended for standard operation and mounting on non-combustible surfaces, in accordance with standard NBN EN 60598-1.

The synthetic materials must be appropriate for outdoor environment conditions (rain, sun, etc.).

If applicable the mounting points of the removable components, both interior and exterior, should be such that standard insulated tools (1000 V) can be used.

The various components of the luminaire may not have sharp cutting edges (e.g. clips, metal plate edges or reflectors).

Conformity:

Compliance with these requirements will be verified through a visual inspection.

8.2 Luminaire body

The body consists of all parts that are part of a standard luminaire such as light source holders, optical systems, protective cover mounting elements, auxiliary equipment, cooling systems, etc. The interior of the body may include ribs to mount these elements within the body.

The LED luminaire is developed to ensure that dirt does not accumulate excessively to guarantee the thermal management.

The luminaire is developed to guarantee the thermal management of the luminaire to guarantee the correct operation and the lifespan of the LED light sources. The use of dynamic devices, for example, built-in ventilators is not acceptable.

Conformity:

Compliance with these requirements will be verified through a visual inspection.

8.3 Mounting

The mounting of the luminaire may not cause damage (e.g. by drilling additional openings) to the lighting column, the bracket, the wall support or the luminaire itself.

The mounting element is to be mounted at the end of the lighting column, on the bracket or on the wall support using multiple corrosion-resistant bolts (bolts made of synthetic material are not acceptable) or using a system with a similar safety guarantee.

This mounting element provides at least 3 support areas, which ensure the luminaire does not tilt and the end of the support does not bear the full weight.

This system may not be influenced by external loads such as wind, vibrations caused by traffic and standard maintenance work.

The luminaire support system should be detachable from the support to make sure a damaged luminaire can be easily replaced.

The luminaire can be mounted at the end of the lighting column as described in Synergrid technical specification C4/12 "General technical specification 005 Public lighting equipment. Requirements for the supply of lighting columns".

The specification provides two ways to homologate the mounting system of the luminaire:

A. Standard mounting systems (e.g. functional luminaires):

The mounting system must fit on a bracket with the following slip-over dimensions:

- Outer diameter $d = 60 \text{ mm}$;
- Length $l = 100 \text{ mm}$
- The insertion depth for the sliding piece/mounting of the luminaire must be minimum 80 mm.

B. Non-standard mounting systems (e.g. multi-functional light columns, architectural lighting) :

On request and with the approval of Synergrid different mounting systems can be homologated (e.g. multi-functional light columns, architectural lighting, ...). A vibration test must be performed for each different mounting system.

Note: For some suspended luminaires, an internal or external wire thread is required as described in

Synergrid technical specification C4/12 “General technical specification 005 Public lighting equipment - Requirements for the supply of lighting columns”.

Conformity:

Compliance with these requirements will be verified through a visual inspection and through the Vibration test specified in § 15.3.

8.4 Location of auxiliary equipment and wiring

This location must be large enough to be able to replace the auxiliary equipment.

This location must be easily and directly accessible under all circumstances, without requiring the use of any non-standard tools.

Conformity:

Compliance with these requirements will be verified through a visual inspection.

8.5 Optical compartment (equipped with an optical system which can or cannot be adjusted)

The LED lighting sources, lenses and reflectors are built-in in an optical compartment closed off by a diffuser (light cover) or protective glass.

The use of liquid thermal paste to improve the cooling process is not acceptable.

Placing the light source correctly in the optical compartment has to be assured at all times.

All necessary arrangements need to be implemented to ensure that the light source can be properly secured. Vibrations should not loosen the light source from the support.

If the optical system is adjustable, markings must be added and it must be possible to fix it in each position; this applies to both the light source and the reflector.

Conformity:

Compliance with these requirements will be verified through a visual inspection and through the test specified in § 15.3 Vibration test.

8.6 Reflector

If the luminaire includes a reflector, it should be sturdy enough to exclude any deformation and it should be mounted at the correct location in a reliable manner.

Conformity:

Compliance with these requirements will be verified through a visual inspection.

8.7 Protective cover, diffuser and lenses

If the luminaire includes a protective cover and/or diffuser (light cover) and/or lenses, the following requirements must be met.

8.7.1 Requirements

Protective covers, diffusers and lenses made of thermoplastic material may not be deformed, softened, discoloured or degraded after having been subjected to the endurance test as described in § 12.3 of the NBN EN 60598-1 standard. The luminaire subjected to the test must furthermore be the corresponding light source type with the highest power rating.

The initial optical characteristics of the diffuser may not change over time. The exterior of the diffuser and/or lenses is to be designed in such a way that contamination is limited (dust, spiderwebs, etc.).

If the protective cover or diffuser is to be opened and closed, this is to be done without requiring special tools.

The correct positioning of a refractor and/or lenses must be assured.

Conformity:

Compliance with these requirements will be verified through a visual inspection and through the tests specified in the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards.

8.7.2 Mounting

The mounting system for the protective cover and the diffuser may include a **maximum of 8 closing points** using captive screws or clips. The opening and closing of the protective cover and diffuser may only require the use of a single standard tool.

The protective cover and diffuser are secured to the body in an efficient and enduring manner through an appropriate and sturdy design when open. The covers have to be replaceable. If the connecting parts are made of materials which could conduct an electric current, ensure the connecting parts cannot be in contact with live parts.

Connecting parts made of a synthetic material meet these requirements when:

- The material does not show signs of ageing;
- The parts can resist the high temperature of the LED driver or light source if these accidentally come into contact.

Conformity:

Compliance with these requirements will be verified through a visual inspection.

8.7.3 Closing mechanism

The closing mechanism for the protective cover or diffuser is developed for repeated use.

Closing mechanisms made of synthetic material are excluded. Mounting elements of clips and hinges may be made of synthetic material insofar as these form part of the body, the diffuser and/or the protective cover itself/themselves.

The protective cover and diffuser can be easily and accurately placed on the body when closed.

Conformity:

Compliance with these requirements will be verified through a visual inspection.

8.7.4 Replacement of protective covers

Damaged protective covers are to be replaced using standard tools without having to disassemble the luminaire completely.

Conformity:

Compliance with these requirements will be verified through a visual inspection.

8.8 Protective sealing joints against dust and water

The quality of sealing joints such as the IP rating (International Protection Rating) over time is to be guaranteed.

The sealing joints must be made of synthetic material, resistant to ageing and thermal and mechanical influences (permanent deformations are not acceptable), as well as external influences to which the luminaire is exposed.

Natural rubber and non-synthetic felt are excluded.

The structure of the luminaire must protect the sealing joints to ensure these do not degrade due to maintenance work on the luminaire. Their original positioning must always be assured, no degradation of any kind is acceptable, regardless of the actions performed on the luminaire (opening, closing, cleaning, etc.).

Conformity:

Compliance with these requirements will be verified through a visual inspection.

8.9 Protection against mechanical stress concentrations

All necessary arrangements need to be implemented to avoid mechanical stress or Charpy impact, e.g. due to sudden section changes.

Conformity:

Compliance with these requirements will be verified through a visual inspection.

8.10 Mechanical protection - IK testing

8.10.1 Degree of protection against external mechanical impact (IK) of the luminaire

The luminaire must have at least **IK08** impact protection according to standard NBN EN 62262.

The minimum impact protection requirement for **glass light covers** is **IK06**.

Conformity:

Compliance with those requirements will be verified through the tests specified in the NBN EN 62262 standard.

8.10.2 Protection against glass breakage

The tests and requirements indicated in the following standards are required in order to decrease the risk of injury caused by glass breakage:

- NBN EN 60598-2-3
- NBN EN 60598-2-5.

Conformity:

Compliance with these requirements will be verified through a visual inspection and through the test specified in the NBN EN 60598-2-3 and NBN EN 60598-2-5 standards.

8.11 Protection against dust and moisture

The minimum International Protection Marking is IP65.

Conformity:

Compliance with these requirements will be verified through a visual inspection and through the tests specified in the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards.

8.12 Resistance to wind load

If any part of the luminaire, with the exception of the light cover, includes synthetic material (e.g. closing cover) the luminaire must be subjected to the “Resistance to wind load test” as specified in § 15.2.

In case of incidents on site caused by wind with luminaires that do not have parts in synthetic material, the luminaires will be removed from the Synergrid list C4/11.3-A. The concerned luminaire must subsequently undergo a wind tunnel test and if the results are positive, it will again be included in the Synergrid list C4/11.3-A.

Conformity:

See § 15.2 Resistance to wind load test.

8.13 Resistance to vibrations

The resistance to vibrations is verified by performing the test indicated in § 15.3 Vibration test.

Conformity:

See § 15.3 Vibration test

8.14 Weight of the luminaire

The weight of the luminaire (including auxiliary equipment) may not exceed 25 kg.

8.15 Ageing and thermal tests

Luminaires must meet the requirements of the following standards:

- NBN EN 60598-1
- NBN EN 60598-2-3 or NBN EN 60598-2-5

The temperature of the unprotected parts of the luminaire which people can touch may not be exceed 80°C for glass parts and 65°C for metal parts.

Conformity:

Compliance with these requirements will be verified through the tests specified in the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards.

8.16 Resistance to heat, fire and tracking

The provisions of the NBN EN 60598-1 and NBN EN 60598-2-3 standards apply.

Conformity:

Compliance with these requirements will be verified through a visual inspection and through the tests specified in the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards.

8.17 Synthetic materials for the exterior of the luminaire

The applicant must provide a test report demonstrating that the luminaire has been protected against UV(A) radiation and weathering of luminaire materials.

Conformity:

Compliance with these requirements will be verified based on the submitted technical documentation.

9. Requirements regarding protection against corrosion

The tests must be performed on every type of luminaire for each of the anti-corrosion treatments applied by the manufacturer.

Climatic conditions of the luminaire:

External climatic conditions of the luminaire	Internal climatic conditions of the luminaire
C3	C2
C4	C2

9.1 External parts

The luminaire must be protected against corrosion taking the specific corrosion-resistance requirements included in NBN EN 60598-1 § 4.18 and the requirements below into account.

The aluminium or metal alloy elements meet the following requirements:

- Made of a compound material that ensures the parts are practically immune to corrosion;
- Protected against corrosion, either by applying paint or a powder coating, or through anodizing.

All bolts, screws, nuts, clips and hinges are made of corrosion-resistant metal.

The assembly takes the various material combinations and compounds into account and where necessary, appropriate protection against corrosion (passivation, galvanisation, etc.) is applied. Necessary precautions are also implemented to ensure galvanic isolation for all types of metal combinations.

A coating is applied on aluminium in accordance with specifications which are equivalent to Qualicoat (Quality Label for Liquid and Powder Organic Coatings on Aluminium for Architectural Applications).

9.1.1 Protection of the body of the luminaire by applying a coating

The requirements for the protection of coatings are included in Table 1 below.

	Standard coating	Double coating
Atmospheric corrosivity category in accordance with standard NBN EN 12944-2	C3 (medium risk)	C4 (high risk)
	Urban and industrial atmospheres, moderate sulphur dioxide pollution; coastal area with low salinity	Industrial areas and coastal areas with moderate salinity
Resistance of the top coating in accordance with standard NBN EN 12944-1	High	Medium
	Maintenance after 15 years	Maintenance between 5 and 15 years
Exterior requirements	No surface irregularities such as: wrinkles, sagging, runners, inclusion, porosity, etc.	
Thickness requirement of powder coating with epoxy resin, regardless of location	Thickness: Average coating thickness at least 60 µm Local coating thickness at least 48 µm	Thickness: Average coating thickness at least 100 µm Local coating thickness at least 96 µm

Table 1 Requirements for the protection of external parts of luminaires using coatings

Conformity:

Compliance with these requirements will be verified through an examination and through tests specified in § 15.4.2.

9.1.2 Aluminium components without coating

Aluminium components on the exterior that have no coating must be anodized.

Anodizing should take place in accordance with equivalent Qualanod specifications (Quality Label for Anodic Oxide Coatings on Wrought Aluminium for Architectural Purposes).

Conformity:

A Qualanod certification shall be required.

9.1.3 Protection of the other components

Clips and hinges must be made of corrosion resistant metal.

Bolts, screws and nuts shall be made of passivated stainless steel (NBN EN ISO 2516) resistant to salty environments in accordance with NBN EN ISO 3506-1, -2 and -3.

Closing mechanisms shall be made of a combination (to prevent contact corrosion or cold welding) of hot-dip galvanized steel and passivated stainless steel (NBN EN ISO 2516) resistant to saline environments in accordance with NBN EN ISO 10088-1.

Plastic components must be suitable for outdoor use (rain, sunshine, etc.).

Conformity:

Compliance with these requirements will be verified through a visual inspection.

9.2 Internal parts

All the luminaire's internal elements, such as reflector, mounting plate, driver enclosures, terminals, etc. shall be protected against corrosion. The reflector's adjusting screws can be made of nylon or any other equivalent synthetic material.

Where anodization of aluminium in accordance with the Qualanod guideline is concerned, the minimum layer thickness is 5 µm.

With fully closed luminaires the internal protective layer of the source is classified under atmospheric corrosivity category C3 (medium risk) in accordance with NBN EN 12944-2 (urban and industrial atmospheres, moderate sulphur dioxide pollution and low salinity coastal zones).

The luminaire's internal parts, therefore, are classified under atmospheric corrosiveness category C2.

Conformity:

Compliance with these requirements will be verified through a visual inspection.

10. Electrical requirements

10.1 Protection against electric shock

The provisions of the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards apply.

Protection (IP2X) against electric shocks from all auxiliary equipment and all normally live parts, including the connection terminals, shall be provided by construction. This protection cannot be provided by the luminaire casing and cannot be degraded after opening or removing the protective diffusers that is necessary for ordinary luminaire maintenance.

Conformity:

Compliance with these requirements will be verified through the tests specified in the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards.

10.2 Insulation resistance and dielectric strength

The provisions of the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards apply.

Conformity:

Compliance with this requirement will be verified through a visual inspection and through the tests specified in the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards.

10.3 Creepage distances and clearances

The provisions of the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards apply.

Conformity:

Compliance with this requirement will be verified through a visual inspection and through the tests specified in the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards.

10.4 Internal wiring of the luminaire

The provisions of the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards apply.

The following also applies:

- The wiring shall be appropriate to the usual operating voltage and current and shall resist external direct effects (specific mechanical and thermal loads, UV radiation, etc.).
- It must be impossible for the wiring to get jammed between moving components.

The connections must be made using terminal blocks with screw or pressure contacts or be fitted with safety plugs.

The electric connections must also guarantee unimpeded and permanent contact under any condition.

The supply cable shall be fixed to the luminaire by means of a tension stop system or a compression gland with incorporated tension stop.

Conformity:

Compliance with these requirements will be verified through a visual inspection and through the tests specified in the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards.

10.5 Terminal blocks and plugs

The provisions of the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards apply.

At an ambient temperature of 25°C and at the rated voltage, the temperature of the insulating parts of all the terminal blocks or plugs of the luminaire shall not exceed 100°C. If this is exceeded, the manufacturer shall provide proof of the greater thermal resistance of the materials used.

Conformity:

Compliance with these requirements will be verified through a visual inspection and through the tests specified in the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards.

10.6 Connection to the power supply

The connection to the power supply must be effected by means of a

- Either pluggable terminal block;
- Or a switch interrupting the supply network when the luminaire is opened.

The terminal block's connection must be designed in such a way that pole reversal due to an incorrect connection is prevented.

The connection to the network must meet the following specifications:

- Equipped with an identification of the phase conductors, neutral and ground;
- Designed so that the earthing connection can be made before connecting the live parts and is disconnected last when unplugged;
- Designed for a current of 16 A and voltage of 250 V.

Conformity:

Compliance with these requirements will be verified through a visual inspection.

10.7 Electrical classes

The provisions of the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards apply.

Furthermore, LED luminaires must belong to one of the following electrical classes:

- Class I;
- Class II.

Metal parts of class I luminaires which may become active in the case of an insulation fault in the power wiring can be connected permanently and reliably to an earth terminal.

Conformity:

Compliance with these requirements will be verified through the tests specified in the NBN EN 60598-1, NBN EN 60598-2-3 and NBN EN 60598-2-5 standards.

10.8 Supply voltage

The performance and requirements described in this document must be guaranteed for input voltages in accordance with the NBN EN 50160 standard, included in Table 2.

		Minimum	Nominal	Maximum
Supply voltage	VAC	207	230	253

Table 2 Input voltage for performance testing

10.9 Electromagnetic compatibility (EMC)

All the different configurations in a product family of a LED luminaire must comply with the requirements of § 10.9.1, § 10.9.2 and § 10.9.3.

Conformity:

At least one test report in which the most critical configuration (responsibility of manufacturers) has been tested shall be provided to demonstrate compliance with the EMC requirements of § 10.9.1, § 10.9.2 and § 10.9.3. These test report(s) have to mention the luminaire model (and form factor), luminaire power, driver manufacturer, driver model, applied EMC standard, test conditions and test results.

10.9.1 Emissions

The radiated emission level between 9 kHz and 30 MHz must comply with the requirements of the NBN EN 55015 standard. If the LED luminaire is dimmable, the test must be carried out at the most unfavourable position (LED current). The radiated emission level between 30 MHz and 300 MHz (alternative method) must comply with the requirements of the NBN EN 55015 standard. If the LED luminaire is dimmable, the test must be carried out at the most unfavourable position (LED current). The harmonic power level must comply with the requirements of the NBN EN 61000-3-2 standard. When the LED luminaire is dimmable, the test must be performed at maximum power and the most unfavourable position (LED current).

10.9.2 Immunity

The following immunity tests are to be carried out in accordance with the NBN EN 61547 standard:

- IEC / EN 61000–4-2: Electrostatic Discharges;
- IEC / EN 61000–4-3: Radiated Fields;
- IEC / EN 61000–4-4: Electrical Fast Transients;
- IEC / EN 61000–4-6: Conducted Fields;
- IEC / EN 61000–4-8: Magnetic Fields (if applicable);
- IEC / EN 61000–4-11: Voltage Dips and Interruptions

When the LED luminaire is dimmable, the above tests shall be performed at the rated LED load for a lighting level dimmed to $50\% \pm 10\%$ in accordance with § 7 of the NBN EN 61547 standard.

10.9.3 Surge protection

The luminaire must withstand surges that may occur on the 230 V_{AC} network.

The luminaire must comply to the surge test performed according to the EN 61000-4-5 standard for the following levels and conditions:

- 6 kV between L/N and GND;
- 4 kV between L and N;

Lower levels must also be tested. Pulses are to be applied as follows: five positive pulses (90° phase), 5 negative pulses (270° phase). The luminaire may display different functioning during the tests (e.g. flicker), but after the tests should return to normal functioning without external intervention.

To meet these requirements, the luminaire can be fitted with an additional component for surge protection. In that case the component must comply with the following:

- All the luminaire's connections to the 230 V_{AC} supply network are protected
- The component is placed in the auxiliary compartment;
- The component is wired in accordance with the manufacturer's recommendations (cables between the surge protection and the LED driver as short as possible).

10.10 Input power of the luminaire

The luminaire's input power must be measured at the supply terminals of the complete luminaire (including LED driver) in accordance with the conditions in § 15.1.

Conformity:

The input power may not exceed the power specified by the manufacturer by more than 10%.

11. Initial photometric requirements

11.1 Luminous flux of the luminaire

The initial luminous flux of the luminaire must be measured in accordance with the circumstances specified in § 15.1.

Conformity:

The initial luminous flux of the luminaire may not be less than 90% of the value specified by the manufacturer.

11.2 Distribution of light intensity

The luminaire's distribution of the light intensity must be measured in accordance with the circumstances specified in § 15.1.

Conformity:

The distribution of the light intensity must be in accordance with the intensity specified by the manufacturer. The comparison method specified in the normative Annex D of the IEC 62722-1 standard shall be used to assess this compliance.

11.3 Luminous efficacy of the luminaire

The luminaire's initial luminous efficacy (in lm/W) must be calculated based on the measured initial luminous flux of the LED lighting source (§ 11.1) divided by the measured initial input power of the luminaire (§ 10.10).

Conformity:

The initial luminous efficacy of the luminaire may not be less than 90% of the value specified by the manufacturer.

12. Initial colometric requirements

12.1 Correlated colour temperature (CCT)

The luminaire's temperature corresponding to the initial correlated colour temperature (CCT) must be measured in accordance with the circumstances specified in § 15.1.

Conformity:

The measured initial correlated colour temperature of the luminaire may not deviate by more than 10% from the original value specified by the manufacturer.

12.2 Colour rendering index (CRI)

The luminaire's initial colour rendering index (CRI) must be at least 70 and be measured in accordance with the circumstances specified in § 15.1.

Conformity:

The measured initial colour rendering index of the luminaire must be higher than or equal to the colour rendering index specified by the manufacturer, minus 3 points.

(Example: when the manufacturer specifies a colour rendering index of 70, the measured colour rendering index must be higher than or equal to 67.)

13. Requirement regarding photobiological safety

The retinal blue light hazard must be assessed in accordance with standard IEC/TR 62778 or IEC 62471-7.

Note : Assessment in accordance with standard IEC/TR 62778 is accepted until 31/12/2025. After this date, only the assessment in accordance with standard IEC 62471-7 will be accepted.

13.1 Option 1a: Assessment according to IEC/TR 62778 of the complete luminaire

The retinal blue light hazard of the complete luminaire with the most critical configuration in the product family shall be measured according to the conditions specified in IEC/TR 62778 at a distance of 200 mm from the luminaire in the direction of the highest blue light luminance. Less critical configurations shall be automatically approved.

The most critical configuration of the luminaire is defined as:

- Highest Correlated Color Temperature CCT (lower CCT is automatically approved)
- Maximum LED current (lower LED currents are automatically approved)
- Most critical optics (less critical lenses are automatically approved)

Conformity:

The luminaire with the most critical configuration must be classified in Risk Group 0 or 1 (RG0 or RG1) for retinal blue light hazard measured at a distance of 200 mm according to IEC 62471 or IEC/TR 62778 standard. The test report must include the LED package manufacturer and model, optics reference, testing distance, LED test current and CCT.

13.2 Option 1b: Assessment according to IEC/TR 62778 of the LED module

The retinal blue light hazard of the LED module with optics in its most critical configuration in the product family shall be measured according to the conditions specified in IEC/TR 62778 at a distance of 200 mm from the LED module in the direction of the highest blue light luminance. Less critical configurations shall be automatically approved.

The most critical configuration of the LED module is defined as:

- Highest Correlated Color Temperature CCT (lower CCT is automatically approved)
- Maximum LED current (lower LED currents are automatically approved)
- Most critical optics (less critical lenses are automatically approved)

Conformity:

The LED module with the most critical configuration must be classified in Risk Group 0 or 1 (RG0 or

RG1) for retinal blue light hazard measured at a distance of 200 mm according to IEC 62471 or IEC/TR 62778 standard. The test report must include the LED package manufacturer and model, optics reference, testing distance, LED test current and CCT.

13.3 Option 2a: Assessment according to IEC 62471-7 of the complete luminaire

The retinal blue light hazard of the complete luminaire with the most critical configuration in the product family shall be measured according to the §7.3 of IEC 62471-7 with a field of view of 11 mrad at a distance of 1000 mm from the luminaire in the direction of the highest blue light luminance. Less critical configurations shall be automatically approved.

The most critical configuration of the luminaire is defined as:

- Highest Correlated Color Temperature CCT (lower CCT is automatically approved)
- Maximum LED current (lower LED currents are automatically approved)
- Most critical optics (less critical lenses are automatically approved)

Conformity:

The luminaire with the most critical configuration must have a Blue light hazard Radiance (L_B) lower than $3000 \text{ W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$ measured with a field of view of 11 mrad at a distance of 1000 mm. The test report must include the LED package manufacturer and model, optics reference, testing distance, field of view, LED test current and CCT

13.4 Option 2b: Assessment according to IEC 62471-7 of the LED module without optics

If the LED module used in the luminaire is measured without optics according to the §7.2 of IEC 62471-7 at its maximum LED current, with a field of view of 1,7 mrad and at a distance of 200 mm, the data can be transferred to the luminaire without any additional test on the luminaire.

Conformity:

The LED module must have a Blue light hazard Radiance (L_B) lower than $30000 \text{ W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$ measured with a field of view of 1.7 mrad at a distance of 200 mm. The test report must include the LED package manufacturer and model, testing distance, field of view, LED test current and CCT

14. Lifespan requirements

14.1 General

The lifespan of a LED lighting source is the combination of gradual and abrupt deterioration of various components. The quality of these components can be assessed based on the following tests:

- The luminous flux retention test assessed the progressive deterioration of the embedded LEDs;
- The durability tests assess the abrupt deterioration of the LED module's components;
- The thermal test of the LED driver assesses the latter's deterioration.

14.2 Luminous flux maintenance

Maintenance of the luminous flux of the LEDs used in the luminaire must be assessed using the following procedure:

- The temperature T_s (LED soldering point temperature) must be measured on the LED with the highest temperature in the luminaire when it is operating at an ambient temperature of 25°C. When the same LED module is used in various luminaires the test is performed on the luminaire with the highest T_s temperature. This measurement must be included in a test report.
- The data of the IES LM-80 report for the LED package in the luminaire must be used. This IES LM-80 report must specify the data regarding the luminous flux maintenance for:
 - a minimal duration of 10000 hours;
 - a LED current higher than or equal to the maximum LED current in the luminaire;
 - a temperature T_s higher than or equal to the temperature T_s measured in the luminaire.
- The luminous flux maintenance (Lumen Maintenance) of the LEDs in the luminaire, measured at maximal temperature T_s must be calculated based on at least 60000 hours in accordance with the IES TM-21 standard and the corresponding IES LM-80 report.

Conformity:

The luminous flux maintenance (Lumen Maintenance) at 60000 hours must be higher than or equal to 90%, meaning that after 60000 hours of operation the LEDs must have at least 90% of their initial luminous flux.

Furthermore, the applicant must provide the following values:

- The time in hours when $L_{90}B_{50}$ is attained;
- The time in hours when $L_{90}B_{10}$ is attained;
- The luminous flux retention at 100000 hours ($L_{xx}B_{50} = 100kh$).

14.3 Durability tests

The following tests must be performed as permitted by the IEC 62722-2-1 standard:

- Either on the LED module (luminaires of type A using LED modules that have been demonstrated to comply with the IEC 62717 standard);
- Or on the complete luminaire (luminaires of type B using LED modules that have not been demonstrated to comply with the IEC 62717 standard).

14.3.1 Determining temperature t_p or t_q

When the durability tests are performed on the LED module, the temperature at point t_p of the LED module must be measured when the LED module has been normally fitted in the complete luminaire and it functions at an ambient temperature of 25°C and at maximum power (rated LED current). The below durability tests must be performed for a temperature t_p higher than or equal to the temperature measured in the luminaire.

When the durability tests are performed on the complete luminaire, the t_q value to be considered is 25°C. This means, for example, that the ambient temperature that must be applied during the accelerated operation time must be at least 35°C.

14.3.2 Temperature cycling test

The test will be performed in accordance with § 10.3.2 of the IEC 62717 standard.

Conformity:

Compliance will be verified in accordance with the criteria of the IEC 62717 standard.

14.3.3 Supply switching test

The test will be performed in accordance with § 10.3.3 of the IEC 62717 standard. At least 30000 cycles must be performed.

Conformity:

Compliance will be verified in accordance with the criteria of the IEC 62717 standard.

14.3.4 Accelerated operation life test

The test will be performed in accordance with § 10.3.4 of the IEC 62717 standard.

Conformity:

Compliance will be verified in accordance with the criteria of the IEC 62717 standard.

14.4 Thermal tests of the LED driver

The temperature at point t_c of the LED driver must be measured when it has been normally fitted in the complete luminaire and it functions at an ambient temperature of 25°C, at the rated power (rated LED current).

Conformity:

The most critical combination (housing, driver and LED module) must be tested. The temperature measured at point t_c of the most critical LED driver must be lower than or equal to the temperature that corresponds to a life span of 60000 hours as specified by the manufacturer of the LED driver (see § 14.2).

15. Measurement methods and specific tests

15.1 Method for measuring the characteristics of the LED luminaires

15.1.1 General

The measurements shall be performed according to the specifications of one of the following documents:

- EN 13032-4;
- CIE S 025;
- IES LM-79.

The measurements shall be performed at an ambient temperature of $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ using an input voltage of $230.0 \text{ VAC} \pm 0.2\%$ and frequency of $50 \text{ Hz} \pm 0.2\%$.

During the measurements the luminaire must be placed in its normal operating position.

The measurements must be performed after thermal stabilisation of the LEDs (refer to the stability conditions specified in EN 13032-4, CIE S 025 or IES LM-79).

No ageing is required prior to the measurements.

Unless otherwise specified, the measurements shall be performed at the rated power of the luminaire, i.e. without current reduction of the LEDs or dimming.

15.1.2 Distribution of light intensity

The coherence of the photometric distribution data largely depends on the C planes and gamma angles used for the measurement. The light intensity must at least be measured for the following C half planes and gamma angles:

- C half planes specified in CIE 34 (0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 75, 90, 105, 120, 130, 135, 140, 145, 150, 155, 160, 165, 170, 175, 180, 185, 190, 195, 200, 205, 210, 215, 220, 225, 230, 240, 255, 270, 285, 300, 310, 315, 320, 325, 330, 335, 340, 345, 350, 355);
- Gamma angles from 0° to 100° in steps of 1° .

The light intensities can be expressed in cd or cd/klm. When the light intensities are expressed in cd or cd/klm, these must be expressed per 1000 lm luminous flux exiting the luminaire. In all cases the units and the total luminous flux of the luminaire must be clearly specified in the report.

The photometric data regarding the distribution of the light intensity must be specified in the EULUMDAT electronic format (.ldt).

15.1.3 Colorimetry

The spectral characteristics of a LED lighting source may depend on the beam angle. The spatial average colorimetric characteristics (colour temperature and colour rendering index) must be measured using one of the following methods:

- a) For a minimum of 5 directions defined by their C plane and gamma angle (C0° G60°, C20° G60°, C0° G45°, C90° G30°, C0° G0°);
- b) As a directional distribution, determined by means of a goniospectroradiometer;
- c) Determined by means of an integrating sphere.

For methods a and b, the colour temperature and colour rendering index of the luminaire shall be obtained by the arithmetic mean weighted by the light intensity in the directions of the various measurements. The manufacturer shall clarify the method used.

The correlated colour temperature (CCT) shall be measured in accordance with the CIE 015 technical report, and the colour rendering index in accordance with the CIE 013.3 publication.

15.1.4 Photobiological safety - retinal blue light hazard

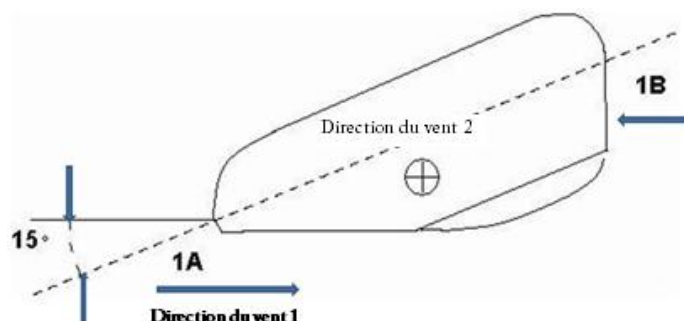
The tests performed in accordance with the IEC 62471 standard at a distance of 200 mm from the luminaire in the direction of the highest blue light luminance. As this document only relates to LED lighting sources, only the retinal blue light hazard shall be measured.

Note: the distance of 200 mm was determined based on a risk analysis of operators performing maintenance on the luminaires and who are at a distance of 200 mm from the LED lighting sources.

15.2 Resistance to wind load test

The luminaire, fully equipped and placed under normal operating conditions, must be able to withstand the stresses exerted by a wind at a wind speed of 150 km/h (41.67 m/s).

The tests shall be performed in a wind tunnel, where the luminaire shall be positioned in the wind directions indicated in the figure below.



Wind direction 1: two test directions (1A and 1B).

Wind direction 2: one test direction if the luminaire is positioned geometrically symmetrical relative to a vertical plane passing through axis AB (including hinge and closing devices), two test directions when these conditions are not complied with.

This wind speed must be achieved after two minutes and must then be maintained for two minutes.

Under this stress the luminaire may not show any breakage or permanent deformation and no movement of the appliance relative to its support may occur. In addition, the correct operation of the equipment in the luminaires, such as light source, auxiliary equipment, etc. must continue to be provided, as must the luminaire's tightness.

The protective diffuser closure device shall always ensure perfect closure, whatever the vibrations to which the luminaire may be subjected.

Furthermore, the applicant is required to determine during the wind tunnel test the three or four drag coefficients for the luminaire according to the wind directions indicated by the arrows in the above diagram, and to specify these in the final wind tunnel test report.

15.3 Vibration test

The luminaire shall be placed on the test equipment as for normal use. The fixing bolts for assembly

to a straight lighting column, a jib or a wall support shall be tightened to the torque indicated in the manufacturer's assembly instructions.

For luminaires intended for mounting on a straight lighting column, jib or wall support a single vibration resistance test is sufficient, whatever the mounting mode.

The origin of the orthogonal axis system XYZ corresponds to the appliance's mounting point. The X and Y axes are horizontal. The Z axis is situated in the luminaire's longitudinal plane.

The following vibration tests shall be performed in accordance with the NBN EN 60068-2-6 standard along the three principal axes XYZ.

15.3.1 Test 1: Determination of mechanical resonance frequency

Search for the resonance frequencies of the mechanical safety critical components. To do this a constant acceleration of 0.5 G shall be applied in the frequency range between 5 and 25 Hz. The sweep rate is 1 octave per minute.

This test determines the resonance frequency/frequencies with corresponding quality factors (Q). In the event of detection of multiple resonances for the mechanical safety critical components, such as the body, the mounting element, the diffusers and protective covers, the highest quality factor (Q) shall be selected for the second part of the test.

15.3.2 Test 2: Test around the mechanical resonance frequency

The luminaire shall be vibrated for 30 minutes and with a constant acceleration of 0.5 g in a 10 Hz frequency range around the resonance frequency with the highest quality factor (Q).

In the absence of resonance ($Q < 2$), vibrations shall be applied for 1 hour between 5 and 25 Hz with a sweep rate of 1 octave per minute.

After each period of 30 minutes the luminaire shall be subjected to a visual inspection to detect any deterioration of the critical components: rupture or cracking of the mounting element, body, diffusers or protective covers and loosening of the fixing bolts.

None of the above deteriorations may have occurred at the end of the tests performed on the 3 principal axes.

15.4 Corrosion tests

The tests must be performed on every type of luminaire for each of the anti-corrosion treatments applied by the manufacturer.

15.4.1 Internal parts

The salt spray resistance test shall be executed in accordance with the NBN EN ISO 9227 and NBN EN ISO 2143 standards, with the test duration being equal to:

- 100 hours for anodised aluminium reflectors and vacuum metallized reflectors;
- 480 hours for painted reflectors.

15.4.2 External parts

Aluminium elements must be protected against corrosion by either the application of paint or a powder coating, or by anodization.

Tests on the housing of the luminaire or on test plates manufactured in accordance with the NBN EN ISO 1513 and NBN EN ISO 1514 standards are accepted.

The following tests according to the Qualicoat specifications apply to aluminium luminaires covered with a coating:

- External (visual inspection at 3 m), no surface irregularities such as wrinkles, sags, runs, inclusions, porosity, etc.;
- Layer thickness measured in accordance with the NBN EN ISO 2360 standard at 5 different locations (see § 7.6 Corrosion resistance (NBN EN 60598-1 § 4.18) for the requirements);
- Minimum adhesion class 2 (not class 0 like Qualicoat) according to the NBN EN ISO 2409 standard (cross hatching test);
- Salt spray corrosion resistance test according to the NBN EN ISO 9227 standard and assessment of the degree of blistering (3 scratch-free plates) according to the NBN EN ISO 4628-2 standard:
 - Density Q1 (negligible) and dimensions: S4 (0.5-5 mm);
 - Single coating: 1.000 hours;
 - Double coating: 1.000 hours.

16. Different homologation procedures for LED luminaires

In the following paragraphs an overview is given for the different homologation procedures that can be requested for public lighting LED luminaires.

16.1 Initial homologation LED luminaire

An initial homologation is a homologation of a LED luminaire product family that has not been homologated in accordance with the present version of specification C4/11.3 before.

To start the initial homologation of a LED luminaire product family to the present technical specification, the applicant must:

- Submit a request to the secretariat of Synergrid in accordance with document C4/8 “Technical specifications 005 - Public lighting equipment. Obtaining Certificate of compliance.”;
- Complete and deliver the document “Descriptive form for luminaires equipped with LED technology”, C4/11.3-1;
- Provide Synergrid with a technical file in accordance with § 17 of document “Technical file for initial homologation of the present technical specification”;
- Complete and deliver the C4/11.3-2 checklist “Checklist for the technical dossier of the drivers” in soft copy (.xls);
- Provide the required samples.

16.2 Upgrade homologation LED luminaire

An upgrade of the homologation of a LED luminaire family can be carried out if the LED luminaire family has already been listed on the old list C4/11.1-A. This means that the LED luminaire family has been homologated in the past in accordance with the old specification C4/11.3. After completion of the upgrade, the luminaire family is considered homologated according to the present version of C4/11.3 and placed on list C4/11.1B.

To initiate the upgrade of the homologation of a LED luminaire family to the present technical specification, the applicant must:

- Submit a request to the secretariat of Synergrid in accordance with document C4/8 “Technical specifications 005 - Public lighting equipment. Obtaining Certificate of compliance.”;
- Complete and deliver document C4/11.3-1 “Descriptive form for luminaires equipped with LED technology”
- Provide Synergrid with a complete technical file in accordance with § 17 “Technical file for initial homologation of the present technical specification” that includes the new requirements of the present specification compared to the old C4/11.3 specification. The new requirements are listed hereunder:
 - §5 Requirements for LED luminaires : Performance standard Luminaire IEC 62722-1 & LED Luminaire IEC 62722-2-1 or EPRS003
 - §5 Requirements for LED luminaires : Safety standard LED Module IEC 62031
 - §5 Requirements for LED luminaires : Performance standard LED Module IEC 62717 or EPRS001
 - §6.2.1 Marking Requirements: Additional Luminaire Marking: type of optic
 - §6.2.2 Marking Requirements: : Additional Luminaire Marking: Tc point LED module
 - §9.1.1 Protection of the body of the luminaire by applying a coating: salt spray test of 1000h
 - §10.9.1 Electrical requirements: EMC - conducted emission level between 9 kHz and 30 MHz complies with NBN EN 55015
 - §10.9.1 Electrical requirements: EMC - current harmonic level complies with NBN EN 61000-3-2.
 - §10.9.2 Electrical requirements: EMC - immunity tests according to NBN EN 61547 standard
 - §10.9.3 Electrical requirements: EMC - Surge protection test according to IEC 61000-4-5 standard
 - §14.2 Lifespan requirements Lifespan: Luminous flux retention
 - §14.3 Lifespan requirements Lifespan: Endurance : Endurance tests according to IEC 62722-2-1
 - §14.4 Lifespan requirements Lifespan: Thermal tests of the LED driver
- Complete and deliver the C4/11.3-2 checklist “Checklist for the technical dossier of the drivers” in soft copy (.xls);
- Provide samples (only needed if the LED luminaire has been changed from the initial homologation.)

16.3 Extension: new formfactor of LED luminaire

An extension with a new formfactor of a LED luminaire can be added to the same LED luminaire product family that is already homologated in accordance with the present version of specification C4/11.3 and published on the new list C4/11.1-B with limited requirements.

To initiate the new LED luminaire formfactor homologation as extension to the present technical specification, the applicant must:

- Submit a request to the secretariat of Synergrid in accordance with document C4/8 “Technical specifications 005 - Public lighting equipment. Obtaining Certificate of compliance.”;
- Complete and deliver the document C4/11.3-1 “Descriptive form for luminaires equipped with LED technology”;
- Provide Synergrid with a limited technical file in accordance with § 17 of document “Technical file for initial homologation of the present technical specification”, including following test reports:
 - ENEC+ EPRS003, CB IEC 62722 or equivalent test report C4/11.3 §5
 - Test report of the manufacturer that proves the conformity C4/11.3 §14.2, requirements lumen maintenance
 - Test report of the manufacturer that proves the conformity to C4/11.3 §14.4, requirements lifetime LED control gear
 - Test report of the manufacturer that proves the conformity to C4/11.3 §15.3, vibration requirements
- Complete and deliver the C4/11.3-2 checklist “Checklist for the technical dossier of the drivers” in soft copy (.xls);
- Provide samples.

16.4 Extension: add new LED module

An extension with a new LED module can be added to a LED luminaire product family that is already homologated according to the present version of specification C4/11.3 and published on the new list C4/11.1-B with limited requirements.

If the manufacturer replaces the current LED package with a new generation of the same type, he needs to provide the request form, ENEC+ conformity letter, photobiological safety report. A link to the previous ISTM report and TM-21 can be used if complying.

To initiate the new LED module homologation as extension to the present technical specification, the applicant must:

- Submit a request to the secretariat of Synergrid in accordance with document C4/8 “Technical specifications 005 - Public lighting equipment. Obtaining Certificate of compliance.”;
- Complete and deliver the document C4/11.3-1 “Descriptive form for luminaires equipped with LED technology”;
- Provide Synergrid with a limited technical file in accordance with § [17](#) of document “Technical file for initial homologation of the present technical specification”, including following test reports:
 - ENEC+ EPRS003, CB IEC 62722 or equivalent test report C4/11.3 §5
 - Photobiological safety test report C4/11.3 §13
 - Test report of the manufacturer that proves the conformity to C4/11.3 §14.2, requirements lumen maintenance
- Complete and deliver the C4/11.3-2 checklist “Checklist for the technical dossier of the drivers” in soft copy (.xls);

16.5 Extension: add new LED control gear

An extension with a new LED control gear can be added to a LED luminaire product family that is already homologated with the present version of specification C4/11.3 and published on the new list C4/11.1-B with limited requirements.

To initiate the new LED control gear homologation as extension to the present technical specification, the applicant must:

- Submit a request to the secretariat of Synergrid in accordance with document C4/8 “Technical specifications 005 - Public lighting equipment. Obtaining Certificate of compliance.”;

- Complete and deliver the document C4/11.3-1 “Descriptive form for luminaires equipped with LED technology”;
- Provide Synergrid with a limited technical file in accordance with § 17 of document “Technical file for initial homologation of the present technical specification”, including following test reports: Test report of the manufacturer that proves the conformity C4/11.3 §14.4, requirements lifetime LED control gear (only requested if the new LED control gear has an higher power then the current most critical combination (housing, LED control gear and LED module)
- Complete and deliver the C4/11.3-2 checklist “Checklist for the technical dossier of the drivers” in soft copy (.xls);

17. Technical file for initial homologation

17.1 General

Compliance with the requirements specified in this document shall be demonstrated through (depending on the requirement):

- A. A statement of document from the applicant; or
- B. A CB Certificate of compliance; or
- C. A test report submitted by an accredited laboratory in accordance with the EN ISO/IEC 17025 standard in the relevant discipline; or
- D. A test report of a customer testing facility (CTF) that performs tests under the supervision of a certification body in the relevant discipline. The CTF shall comply with the relevant aspects of ISO/IEC 17025 and the applicable CB Scheme requirements.
- E. A test report of a laboratory with relevant competences in the discipline.

Synergrid can always ask for clarification or re-testing if it has no confidence in the provided test report.

Execution of the tests and measurements shall in all cases be the subject of a properly detailed report, unambiguously specifying the brand, model and configuration of the tested luminaire. All the tested values must be recorded, as well as the measurement devices that were used, the calibration date and the measurement uncertainty.

17.2 LED luminaire without ENEC marking

When the LED luminaire does not have the ENEC marking, a detailed report must be submitted, demonstrating that the applicable safety and performance standards are fully complied with. This report must be provided by a laboratory with one of the following accreditations:

- ISO 17025 accreditation;
- EA accreditation (European cooperation for Accreditation);
- CCA accreditation (CENELEC Certification Agreement).

Furthermore, the applicant must demonstrate that the manufacturer has implemented an ISO 9001:2015 quality system for monitoring the production line.

17.3 Contents of the technical file

The technical file must contain the information, statements, documents and reports specified below.

<u>Folder</u>	<u>Documents to deliver / Requirement</u>	<u>Proof of conformity/documents to be provided (§15.1)</u>
00	Fill in request for family form found in folder 00	Completed request for family form
01	Fill in declaration (Synergrid template C4-11-3.3)	Completed declaration (Synergrid template C4-11-3.3)
02	Brochure & Technical datasheets	Manufacturer Brochure & Technical datasheets
03	Information manufacturererr luminaire identification code	Information manufacturer luminaire identification code
04	Assembly-maintenance documents	Manufacturer assembly-maintenance documents

05	Mounting instructions documents	Manufacturer mounting instructions documents
06	Declaration CE marking	Manufacturer declaration CE marking
07	C4/11.3 §5; Safety of the luminaire: - NBN EN 60598-1 - NBN EN 60598-2-3 - NBN EN 60598-2-5 The following tests must be included in the test report: -Mechanical impedance - IK testing -Protection against glass breakage -Protection against dust and moisture	ENEC certificate or ISO 17025 test report or CTF test report confirming compliance with: - NBN EN 60598-1 - NBN EN 60598-2-3 - NBN EN 60598-2-5
08	C4/11.3 §5; Performance of the luminaire: - IEC 62722-1 - IEC 62722-2-1	ENEC+ certificate or ISO 17025 test report or CTF test report confirming compliance with: - IEC 62722-1 - IEC 62722-2-1
09	C4/11.3 §5; Safety of the LED module: IEC 62031	ENEC certificate or ISO 17025 test report or CTF test report confirming compliance with ENEC / IEC 62031 standard (§15.1 C or D)
10	C4/11.3 §5; Performance of the LED module: IEC 62717	ENEC+ certificate or ISO 17025 test report or CTF test report confirming compliance with ENEC+ / IEC 62717 standard (§15.1 C or D)

11	C4/11.3 §14.2; LED Package IES LM80 (min. 10000h)	IES LM-80 test reports of the LED packages used in the luminaire product family with a minimum duration of 10,000 hours.
12	C4/11.3 §14.2: In-Situ Temperature Measurement (ISTM) report of the most critical LED luminaire in the product family	Manufacturer or ISO 17025 test report that includes In-Situ Temperature Measurement (ISTM)
13	C4/11.3 §14.2: Luminaire lumen maintenance (IES TM-21 min. 60000h) - xx kh L90 B50 - xx kh L90 B10 - 100 kh Lxx B50	Manufacturer or ISO 17025 test report that includes the IES TM-21 calculation for: - xx kh L90 B50 - xx kh L90 B10 - 100 kh Lxx B50
14	C4/11.3 §14.4: Thermal tests of LED driver at 25°C + lifetime (min 60000h)	Manufacturer or ISO 17025 test report that proves the compliance with C4/11.3 §14.4(Datasheet of the LED driver used for thermal tests)
15	C4/11.3 §10.9.1: Electromagnetic compatibility: emission report (EN 55015)	ISO 17025 test report or CTF test report confirming compliance for the most critical configuration in the product family
16	C4/11.3 §10.9.2: Electromagnetic compatibility: Immunity report (EN 61547)	ISO 17025 test report or CTF test report confirming compliance for the most critical configuration in the product family
17	C4/11.3 §10.9.3: Electromagnetic compatibility: Surge report (6kV L-N & GND, 4kV L & N))	ISO 17025 test report or CTF test report confirming compliance for the most critical configuration in the product family

18	C4/11.3 §8.13: Vibration test	Test report that proves the compliance with C4/11.3 §8.13: Vibration test
19	Only required if any part of the luminaire, other than the light cover, is made of plastic (e.g. closure). C4/11.3 §8.12: Wind tunnel test	Test report that proves the compliance with C4/11.3 §8.12: Wind tunnel test
20	Only required if there is synthetic material on the outside of the luminaire C4/11.3 §8.17: Tests of the synthetic material:	Official documents issued by the manufacturer or report regarding the resistance of the used material to UV radiation
21	C4/11.3 §13: Photobiological safety at 200mm	ISO 17025 test report or CTF test report confirming compliance
22	C4/11.3 §9.1: Corrosion of external parts of the luminaire	ISO 17025 test report or CTF test report confirming compliance
23	Files LDT & photometric reports (IES LM-79 or EN 13032-4)	Optional reports IES LM-79 or EN 13032-4
24	Divers	This folder is for interesting documents or reports that don't belong in any of the other folders.

17.4 Electronic files

All photometric data regarding the distribution of light intensity for every type of luminaire and all applicable light sources are submitted in the following data file format:

- EULUMDAT

The measurements in these files are acquired in accordance with the NBN EN 13032-1 and NBN EN 13032-2 standards.

If the submitted photometric matrix has not been measured in an accredited calibration laboratory in accordance with EN ISO/IEC 17025, a photometric test is performed to be paid for by the applicant, as described in the corresponding Synergrid procedure.

17.5 Luminaire sample

The applicant submits representative luminaire samples to Synergrid with their application.

These luminaire samples must be taken from a standard production run (not a prototype) and become property of Synergrid.

18. Notification obligation

The luminaire construction is such that the lifespan is at least 15 years. No abnormal deterioration of the mechanical, electric and photometric characteristics of the luminaire may occur during this period: at the end of the period the luminaire must still meet the requirements of the present technical specification.

The manufacturer must notify Synergrid in writing when the manufacture of a specific luminaire is discontinued.
