



PEP ecopassport® PROGRAM

PSR

SPECIFIC RULES FOR LUMINAIRES

PSR-0014-ed1.0-EN-2018 07 18

According to PSR-model-ed1-EN-2015 03 20

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1. Introduction

This reference document completes and explains the Product Environmental Profile Drafting Rules defined by the PEP ecopassport® program (PEP-PCR ed.3-EN-2015 04 02), available at www.pep-ecopassport.org.

It defines the additional requirements applicable to luminaires. Compliance with these requirements is necessary to:

- Qualify the environmental performance of these products on an objective and consistent basis.
- Publish PEPs compliant with the PEP ecopassport® program and international reference standards.¹

This reference document was drawn up in compliance with the open, transparent rules of the PEP ecopassport® program with the support of stakeholders and professionals in the luminaire market and the interested parties.

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|  | www.pep-ecopassport.org |
| PSR reference | PSR-0014-ed1.0-EN-2018 07 18 |
| Critical review | The third-party Critical review was carried out by B4green consulting™, member of the cooperative society Switzerland neonomia. The declaration of conformity published on 12/06/2018 can be found in the Appendices. |
| Availability | The critical review report is available on request from the P.E.P. Association contact@pep-ecopassport.org |
| Scope of validity | The critical review report and the declaration of conformity remain valid within 5 years or until the PEP Drafting Rules, or the normative reference texts to which they refer, are modified. |

¹ ISO 14025, ISO 14040 and ISO 14044 standards

2. Scope

In accordance with the general instructions of the PEP ecopassport® program (PEP-General instructions-ed4.1-EN-2017 10 17) and additional to the PCR, Product Category Rules of the PEP ecopassport® eco-declaration program (PEP-PCR ed.3-EN-2015 04 02), this document sets out the specific rules for luminaires and defines the product specifications to be adopted by manufacturers in the development of their Product Environmental Profiles (PEPs) particularly with regard to:

- the technology and its type of application,
- the reference lifetime taken into account for the products' Life Cycle Assessment (LCA),
- the conventional use scenarios to be adopted during the product use stage.

Except from the « Self-contained Emergency Electrical Equipment » covered by specific rules presented in « PSR-0007-ed1.1-EN-2015 10 16 », this reference document applies to all "luminaires" intended to be connected to the power grid, regardless of their manufacturing location or destination market.

This document describes the rules for PEPs under the Type III Environmental Declaration Program to be properly developed and communicated with verifiable, comparable and non-misleading information on the environmental aspects of products.

This reference document is primarily intended for:

- environment and/or product managers,
- ICA experts in companies, in charge of PEP development,
- verifiers in charge of PEP conformity assessment in accordance with the defined rules.

2.1. Description of the product families concerned

A luminaire is a device that meets the following definition, with reference to the standard NF EN 60598-1:2015 - Luminaires - Part 1: General requirements and tests.

“Lighting appliance which distributes, filters or transforms the light emitted by one or more lamps and which includes, [...], all the devices necessary for the bracket, fixing and protection of the lamps and, if necessary, the auxiliary circuits and the means for connecting them to the power grid.

A luminaire with non-replaceable integrated lamps is considered as a luminaire, except that tests are not carried out on the integrated lamp or the self-ballasted lamp.”²

² Definition from the standard NF EN 60598-1:2015 Luminaires - Part 1: General requirements and tests.

The devices defined in this paragraph must conform to the entire set of normative and regulatory standards established at the International, European and national levels according to their applications. A non-exhaustive list, defining the main normative and regulatory elements to be respected, is mentioned in chapter 5 "Appendices".

2.2. Consideration of the fonctions and technologies not included in this document

The specific rules for luminaires will take into account all technological advances not included in this document and that will a request to include them in the specific rules for lightings in the PEP ecopassport® Program; the P.E.P. Association will then decide whether the new technology can be included and whether the performance claims are justified.

3. Product life cycle assessment

3.1. Functional unit and reference flow description

These specific rules complete the paragraph "Functional unit and reference flow description" of the product category rules (PCR) of Product Environmental Profiles (PEP) defined by the PEP ecopassport® Program.

3.1.1. Functional unit

The functional unit is defined below:

"Provide lighting that delivers an outgoing artificial luminous flux of 1,000 lumens during a reference lifetime of 35,000 hours"

The life cycle assessment carried out makes it possible to compare different types of luminaires according to usage unit (the emission of a light output of 1,000 lumens) and a reference lifetime (fixed reference lifetime which cannot be assimilated to the actual life of the lighting or its actual running time) common to all luminaires, fixed to 35,000 hours.

It should be noted, however, that the concept of comparability between several products will have to take into account the fundamental technical data of each of them. For reasons of comparability, some basic and representative technical characteristics of the reference product shall be specified in the PEP according to the paragraph 4.1. It should also be noted that, in the context of a project, it is essential to have project data to compare luminaires with each other.

The reference lifetime applicable to the category of "luminaires" was determined consensually by the technical experts of the industry that participated in the development of the PSR by considering the different possible fields of application. This reference lifetime is voluntarily set below the assigned lifetime of most of products range; the assigned lifetime depends on variable factors related to the quality of

implementation of the facilities, the frequency of their maintenance and use conditions of the products. This reference life does not constitute a commercial guarantee commitment from the manufacturer.

3.1.2. Reference product and reference flow description

The reference flow (energy and material flows corresponding to the FU) shall be determined under the conditions of the FU defined in the paragraph 3.1.1 "Functional unit" of this present specific rules and in accordance with the requirements set out in the paragraph 2.1 of product category rules (PCR) of Environmental Product Profiles (PEP) defined by the PEP ecopassport® Program.

A "luminaire" as defined in the paragraph 2.1 "Scope" has the following elements:

- a structure,
- a power supply equipment system,
- a light source (also called a lamp), integrated or not in the luminaire,
- if applicable, a lighting management system which can be integrated into the power supply system.

The luminaire is characterized for an outgoing artificial luminous flux of [V] lumens with a rated lifetime of [H] set in the paragraphs 3.1.2.1 and 3.1.2.2, respectively.

The reference flow corresponding to the functional unit shall take into account the value of the outgoing artificial luminous flux as well as the rated lifetime of the luminaire determined in accordance with the requirements established respectively in the paragraphs 3.1.3 and 3.1.4 of present specific rules.

3.1.2.1. Determination of the outgoing artificial luminous flux of the luminaire

The outgoing artificial luminous flux [V] of the device is measured according to NF EN 13032-1³. This value must be justified in the LCA report using the photometric report.

In the case where [V] is unavailable, it should be calculated by using the formula below:

$$\text{Artificial light output} = \text{Nominal flow (Source)} \times \eta$$

η is the Light Output Ratio (LOR) of luminaire.

In the case where η is unknown, it is imposed to take the value of $\eta = 30\%$ in the formula above.

³ NF EN 13032-1 + A1: 2012 standard "Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 1: measurement and file format"

If the product is sold without light source (not equipped with lamp), it is mandatory to choose the most impacting compatible light source in terms of power (Watt) by taking into account the indications of CE marking (maximum power allowed) and the most penalizing light efficiency (Delegated Regulation (EU) No 874/2012).

3.1.2.2. Determination of the assigned lifetime of a luminaire

The assigned lifetime of the luminaire is the luminaire life expectancy as estimated by the manufacturers according to the conditions of use provided by them. It is declared in hours of operation.

The assigned lifetime must be justified in the LCA report.

In the case where the assigned lifetime of the luminaire is unknown, it is required to apply an assigned lifetime of 35,000 hours corresponding to the reference lifetime.

3.2. System boundaries

These specific rules completes the paragraph 2.2 "System boundaries" of the product category rules (PCR) of Product Environmental Profiles (PEP) defined by the PEP ecopassport® Program.

The principle of modularity presented in the paragraph 2.2.1. "Presentation of the principle of modularity" of the current PCR ed.3 applies.

3.2.1. Manufacturing stage

All the components delivered with the product to work properly must be included in the scope of the study.

In the case of luminaires the elements to be included are:

- the luminaire,
- as well as all the following items delivered with the product, namely:
 - power supplies detached from the lighting,
 - fixing elements,
 - assembly elements, fittings and other electrical connectors,
 - other possible accessories.

3.2.2. Distribution stage

This PSR does not require any additional requirements to the paragraph 2.2.4. "Distribution stage" of the current PCR ed.3.

3.2.3. Installation stage

The installation of luminaires involves:

- power supplies when these are remote from the lighting and are not supplied with the product.
- the fixing elements in accordance with the manufacturer's instructions :
 - the fixing devices recommended by the manufacturer when they are not delivered with the product :
 - the fixing elements to the frame,
 - the assembly elements, fittings and other electrical connectors.
 - the other possible accessories

The LCA report precises all the elements necessary for the installation of the luminaire.

- the first light source by default when the luminaire is sold without a light source or when the light source is not integrated,
- end-of-life treatment of packaging waste. In fact, the packaging wastes produce during the installation stage are assumed to be eliminated by the installer once the equipment is installed.

The installation is not considering:

- all modification of the frame and/or addition of elements not provided by the manufacturer (eg: electrical network connection, roadworks),

The actual impact of these operations is to be calculated according to the installation elements used during the installation operation by the user of the declaration if he wishes.

- fixing processes that are implemented during the installation.

3.2.4. Use stage

The use phase of luminaires involves:

- an electrical consumption of reference product, measured, justified and dependent on the lighting management functions concerned, if applicable,
- possible replacement of light sources (including the manufacture and distribution of light sources),
- any other consumables and maintenance operations necessary to the proper functioning of the luminaire provided by the manufacturer,
- end-of-life treatment of potential waste (such as replaced light sources or packaging wastes).

The use phase is not considering:

- upgrade operations (modification of the product involving an evolution of its functions and its use).

3.2.5. End of life stage

The end of life stage of luminaires involves:

- the end of life treatment of luminaire.
- the end of life treatment of the last light source presented in the luminaire.

3.2.6. Specific exclusions

This PSR does not require any additional exclusion from paragraph 3.2.8 "Excludes from System Boundaries" of the current PCR ed.3 except for the flow related to the fixation processes described in the paragraph 3.2.3 of this document.

3.3. Cut-off criteria

The requirements specified in the paragraph 2.3 "Cut-off rules" of the product category rules (PCRs) of Product Environmental Profiles (PEP) defined by the PEP ecopassport® Program apply here.

3.4. Co-product allocation rules

The present specific rules complement section 2.4 "Co-product allocation rules" of the product category rules (PCRs) of Environmental Product Profiles (PEP) defined by the PEP ecopassport® Program.

When a process generates several co-products, the weight flow allocation rule must be applied based on the output weight considered in the study.

3.5. Development of scenarios (default scenarios)

Any other scenario than the default scenario described below must be justified in the LCA report and mentioned in the PEP.

3.5.1. Manufacturing stage

The manufacturing stage shall be analyzed in accordance with paragraph 3.2.1 "System boundaries / Manufacturing stage" of this PSR and the default scenarios of the product category rules (PCRs) of the Environmental Product Profiles (PEP) defined by the PEP ecopassport® Program ().

3.5.1.1. Luminaires sold without power supply equipment

If the luminaire is sold without power supply equipment, it is mandatory to choose the power supply equipment recommended by the manufacturer to ensure proper functioning of the luminaire under the conditions of use defined by the manufacturer over the assigned service life of the luminaire.

The choice of the power supply equipment must be justified in the LCA report and specified in the PEP.

3.5.2. Distribution stage

The distribution stage shall be analyzed in accordance with the paragraph 3.2.2 "System boundaries / Distribution stage" of current PSR and default scenarios of the product category rules (PCRs) of Product Environmental Profiles (PEP) defined by the PEP ecopassport® Program.

3.5.3. Installation stage

The installation stage shall be analyzed in accordance with the paragraph 3.2.3 "System boundaries / Installation stage" of this PSR and default scenarios of the product category rules (PCRs) of Product Environmental Profiles (PEP).) defined by the PEP ecopassport® Program.

3.5.4. Use stage

3.5.4.1. Electricity consumption scenario

For the use stage, the default geographic area is Europe and shall be specified in the PEP. Any other geographical area shall be specified in the LCA report and in the PEP.

3.5.4.1.1. Luminaire without light management function

3.5.4.1.1.1. Reference use scenario

The default use scenario of a luminaire is a continuous use at nominal power during the assigned lifetime of the luminaire.

3.5.4.1.1.2. Energy consumption

The final energy consumption of a **luminaire without light management function** over its assigned lifetime, expressed in kilowatt-hour, is calculated as follows:

$$C = P \times \text{Assigned lifetime}$$

With:

P = declared power of the lighting circuit in operation at nominal power (in kilowatts) including all lamps, power supplies and other components necessary for the proper functioning of the device. In the presence of several components, the power of the lighting equals to the sum of the powers of each component. The power of the lighting must be justified by the manufacturer with a technical manual.

If the product is sold without light source (not equipped with lamp), it is necessary to take into account the power of the lamps (lamps with the most impacts according to paragraph 3.5.4.4) to determine the value of P.

Assigned lifetime= lifetime of the luminaire declared by the manufacturer (in hours).

The lightings without energy management function who behave like switches does not consume energy in the non-active mode.

3.5.4.1.2. Luminaire with light management function

3.5.4.1.2.1. List of light management functions

This paragraph is intended to deal with the most common light management functions of the market. Any other light management function shall be described and justified in the LCA report.

| Light management function nomination | Description |
|---|--|
| Variation or extinction system according to the brightness of day light | System allowing to maintain a constant level of illumination according to the contribution of natural light in the environment. The variation of luminous flux of the luminaire can be continuous or by thresholds, and go to extinction. |
| Variation or extinction system according to the presence and absence | The main function of this type of device is to save energy by lowering the luminosity in case of absence of people. The decline can be continuous or by thresholds, and go to extinction. Most of the time, the lighting turns on automatically once an element enters its scope of detection. Device can be called differently depends on the technologies used (motion detector, passage detector ...). |

| Light management function nomination | Description |
|--|--|
| Combination of presence detection function and luminosity function | Function represented by the combination of the two previous functions to adapt the artificial light input in a given environment, according to natural light and presence detection. |

Table 1 – Different types of light management function

3.5.4.1.2.2. Reference use scenario

The default use scenario for a luminaire with a light management function is to manage the outgoing luminous flux over its assigned lifetime. It is considered that lighting management functions do not influence the assigned lifetime.

Over assigned lifetime, the device will alter from an active mode to a power saving mode according to the light management function. In active mode, the luminaire operates at its nominal power.

Any other use scenario shall be justified in the LCA report and mentioned in the PEP.

3.5.4.1.2.3. Energy consumption

The final energy consumption of a luminaire over its assigned lifetime, expressed in kilowatts, with a light management function is calculated as follows:

$$C = P \times \text{Assigned lifetime} \times \text{Theoretical energy saving coefficient}$$

With:

P = declared power of the lighting circuit in operation at nominal power (in kilowatts) including all lamps, power supplies and other components necessary for the proper functioning of the device. In the presence of several components, the power of the luminaire equals to the sum of the powers of each component. The power of the lighting must be justified by the manufacturer with a technical manual.

If the product is sold without light source (not equipped with lamps), it is necessary to take into account the power of the lamps (lamps with the most impacts according to paragraph 3.5.4.4) to determine the value of P.

When the power supply equipment is not supplied with the reference product and its power is not used to determine P, this must be explicitly mentioned in the PEP.

Assigned lifetime= lifetime of the luminaire declared by the manufacturer (in hours). It is considered that lighting management functions do not influence the assigned lifetime of luminaire.

The energy gain coefficients are associated with the various functions available on the luminaire market⁴. The energy saving coefficients include the power consumption of the luminaire in non-active mode (stand-by).

⁴ Coefficients determined in a consensual way by the technical experts of the sector who participated in the development of the PSR considering the values defined by the ADEME ("Certificats d'économies d'énergie Luminaire d'éclairage générale à modules LED" - December 24, 2014 JORF) and energy saving certificates ("Certificats d'économies d'énergie Lampe ou luminaire à modules LED pour l'éclairage d'accentuation" - 2 August 2015 JORF).

| Light management function nomination | Theoretical reduction of energy consumption | Theoretical coefficient of energy saving |
|---|---|--|
| Variation or extinction system according to the brightness of day light | -25% | 0.75 |
| Variation or extinction system according to the presence and absence | -25% | 0.75 |
| Combination of presence detection function and luminosity function | -45% | 0.55 |

Table 2 – Energy saving coefficients according to light management function

Any other light management function shall be described with its energy saving coefficient justified in the LCA report.

3.5.4.2. Light sources replacement

The replacement of the light sources must be taken into account over the assigned lifetime of the luminaire. The number of alternative light sources will be calculated and rounded up to the next whole number.

The table below summarizes the average lifetime of the most representative light source categories in the market⁵ :

| Light source nomination | Average lifetime (hours) | |
|-------------------------|--------------------------|--------|
| Incandescent | 1,000 | |
| Halogen | 2,000 | |
| Fluocompact lamp | With ballast | 11,000 |
| | Without ballast | 14,000 |
| Fluorescent tube | T5 type | 20,000 |
| | T8 type | 15,000 |
| Discharge lamp | Metal halide | 14,000 |
| | Metal iodide | 12,000 |
| | Sodium | 23,000 |
| | Mercury vapor | 15,000 |
| LED lamp | 17,000 | |
| Integrated LED module | 50,000 | |

Table 3 – Average lifetime of light sources

This table can be used as a reference without additional justifications.

However, it is possible to take into account the assigned lifetime of the light source if justified in the LCA report on the basis of technical reports.

⁵ According to the data provided by the various manufacturers who participated the creation of the PSR

3.5.4.3. End of life treatment of light sources

A transport stage representing the shipment of collected waste to approved treatment centers is to be considered. The default distance is 150 km by truck.

The LCI module of the ELCD database can be used for this scenario:

- Truck: the last available version of the module "Articulated lorry transport; Euro 0, 1, 2, 3, 4 mix; 40 t total weight, 27 t max payload "for geolocation" RER "and not parameterized.

Regarding recovery processes, the study will cover all the stages of the sector until temporary storage before recovery.

| Light source nomination | | End of life sector |
|-------------------------|---------------------|--|
| Incandescent | | Scenario 1 |
| Halogen | | Scenario 1 |
| Fluocompact lamp | Compact fluorescent | Scenario 2 |
| | Without ballast | Scenario 2 |
| Fluorescent tube | Fluorescent tube | Scenario 2 |
| | Type T8 | Scenario 2 |
| Discharge lamp | Discharge lamp | Scenario 3 |
| | Iodure metallic | Scenario 3 |
| | Sodium | Scenario 3 |
| | Mercury vapor | Scenario 3 |
| Lampe LED | | Scenario 2 |
| Integrated LED module | | Waste to be considered with the luminaire at the end of life stage |

Table 4 – End of life sector of the light source

| Scenario 1 | Proportion of luminaire | Type of treatment |
|------------|-------------------------|------------------------------|
| Landfill | 100% | Landfill of household wastes |

| Scenario 2 | Proportion of luminaire | Type of treatment |
|------------|-------------------------|---|
| Recycling | 55% | Waste inventory declaration for recycling |
| Landfill | 45% | Landfill of EEE wastes (luminaire type) |

| Scenario 3 | Proportion of luminaire | Type of treatment |
|------------|-------------------------|---|
| Recycling | 80% | Waste inventory for recycling |
| Landfill | 20% | Landfill of EEE wastes (luminaire type) |

3.5.4.4. Luminaire sold without a light source

If the luminaire is sold without a light source (not equipped with lamp), the compatible light source with the most impact must be chosen:

- Maximizing the power (Watt) by considering the CE mark indication (authorized maximum power)
- Minimizing the luminous efficacy (EU Delegated Regulation No 874/2012).

If the manufacturer recommends the use of a specific light source, it may be considered.

The choice of the light source must be justified in the LCA report and specified in the PEP.

3.5.5. Maintenance stage

The requirements specified in the paragraphs 2.2.6 "Use stage" and 2.5.5 "Maintenance stage" of the product category rules (PCRs) of Product Environmental Profiles (PEP) defined by the PEP ecopassport® Program apply.

3.5.6. End of life stage

When the light source is not integrated into the luminaire, the treatment of the last light source in operation is included in the luminaire end of life treatment.

When the light source is integrated into the luminaire, the treatment of the integrated light source is included in the luminaire end of life treatment.

The treatment of the light source applied at its end of life stage is identical to the requirements described in the paragraph 3.5.4.3 of current specific rules.

Regarding recovery processes, the study will cover all the stages until the temporary storage step before recovery.

The **professional and household luminaires** are subject to specific end-of-life treatment obligations regulated by Directive 2012/19 / EU on waste electrical and electronic equipment and Decree No. 2005-829 of 20 July 2005, for which minimum recovery constraints are applicable:

- Minimum 75% of waste must be recovered,
- And minimum 55% of the waste is prepared for recycling or reuse.

Evidence of affiliation to a third party organization will be attached to the LCA report by providing the attestation of membership in an eco-organization authorized by the public authorities.

1st case: Minimum compliance with regulatory requirements in a collective system

If the producer can justify his membership of an authorized third party eco-organization, this situation will be modeled at the end-of-life phase by considering processes repartition as presented in Table 5 (Note: when luminaire is treated outside France for end-of-life treatment, the treatment repartition must be justified in the LCA report).

A transport step representing the shipment of collected waste to approved treatment centers is to be considered. The default distance is 150 km by truck.

The LCI module of the ELCD database can be used for this scenario:

- Truck: the last available version of the module "Articulated lorry transport; Euro 0, 1, 2, 3, 4 mix; 40 t total weight, 27 t max payload "for geolocation" RER "and not parameterized.

| | Proportion of luminaire | Type de treatment |
|--------------------------------------|-------------------------|---|
| Recycling | 77% | Waste inventory declaration for recycling |
| Incineration with energy recovery | 6% | Waste inventory declaration for incineration with energy recovery |
| Incineration without energy recovery | 8.5% | Incineration without energy recovery of EEE wastes (luminaire type) |
| Landfill | 8.5% | Landfill of EEE wastes (luminaire type) |

Table 5 – Scenarios of luminaires end of life treatment (respect the minimum regulatory requirements in France)

2nd case: Compliance with minimum regulatory requirements for individual systems

If the producer can justify the way his waste is recycled in his individual system and that he respects the regulatory requirements, this situation will be modeled at the end-of-life phase by considering processes repartition as presented in Table 5 (Note: when luminaire is treated outside France for its end-of-life treatment, the treatment repartition must be justified in the LCA report).

A transport step representing the shipment of collected waste to approved treatment centers is to be considered. The default distance is 1,000 km by truck.

The LCI module of the ELCD database can be used for this scenario:

- Truck: the last available version of the module "Articulated lorry transport; Euro 0, 1, 2, 3, 4 mix; 40 t total weight, 27 t max payload "for geolocation" RER "and not parameterized.

3rd Case: No proof of recovery

If the producer can not justify his membership of an authorized third party eco-organization or that he respects the regulatory requirements related to end of life phase, he is not allow to create a PEP on this product.

Any other product end-of-life treatment repartition used must be justified in the LCA report and mentioned in the PEP.

3.6. Rules applying to joint environmental declarations

The rules specified in the paragraph 2.7 "Rules applying to joint environmental declarations" of the product category rules (PCR) of Product Environmental Profiles (PEP) defined by the PEP ecopassport® Program apply.

3.7. Requirements concerning the collection of primary and secondary data

The rules specified in the paragraphs 2.9 "Requirements for the collection of primary data" and 2.10 "Requirements for the collection of secondary data" of the product category rules (PCR) of Product Environmental Profiles (PEP) defined by the PEP ecopassport® Program apply.

3.8. Data quality evaluation

The rules specified in the paragraphs 2.11 "Data quality evaluation" of the product category rules (PCR) of Product Environmental Profiles (PEP) defined by the PEP ecopassport® Program apply.

3.9. Calculation of environmental impact

3.9.1. Calculation of environmental impact at the product level (declared unity)

The results of environmental impacts generated by the life cycle of reference product correspond to the environmental impacts at the declared unity level.

3.9.2. Calculation of environmental impact at the level of functional unit (FU)

In order to evaluate the results of environmental impacts at the level of functional unit declared in the PEP (reminder: Provide lighting that delivers an outgoing artificial luminous flux of 1,000 lumens during a reference lifetime of 35,000 hours), the environmental impacts generated by the life cycle of the reference product must be brought back to the functional unit.

Calculations of environmental impacts of the manufacturing, distribution, installation, use and end-of-life stages are carried out as follows for each life cycle stage:

$$\text{Environmental impact of PEP (for 1,000 lumens over 35,000 hours) =} \\ \text{Environmental impact of the reference product} \times (1,000 / \text{Outgoing luminous flux of the reference} \\ \text{product in lumens}) \times (35,000 / \text{Assigned product lifetime of the reference product in hours})$$

Examples:

In the case of a luminaire providing an outgoing artificial luminous flux of 2,500 lumens during a lifetime of 50,000 hours, the coefficient to be applied is the following:

$$\text{Environmental impact of PEP (for 1,000 lumens over 35,000 hours) =} \\ \text{Environmental impact of the reference product} \times (1,000 / 2,500) \times (35,000 / 50,000) = \\ \text{Reference product environmental impact} \times 0.28$$

In the case of a luminaire providing an outgoing artificial luminous flux of 500 lumens during a lifetime of 25,000 hours, the coefficient to be applied is the following:

$$\text{Environmental impact of PEP (for 1,000 lumens over 35,000 hours) =} \\ \text{Environmental impact of the reference product} \times (1,000 / 500) \times (35,000 / 25,000) = \\ \text{Reference product environmental impact} \times 2.8$$

3.10. Rules for extrapolation to a homogeneous environmental family

The current rules complete the paragraph "Rule(s) for extrapolation to a homogeneous environmental family" of the product category rules (PCR) of the Product Environmental Profiles (PEP) defined by the PEP ecopassport® Program.

The following paragraphs detail the extrapolation rules applicable to each stage of the life cycle and the conditions of belonging to a homogeneous environmental family. To use these extrapolation rules, the manufacturer must justify in the LCA report that the range of products fulfill all these conditions.

These extrapolation rules are not intended to cover all the product lines on the market. The use of any other extrapolation rule and / or definition of environmental homogeneous family shall be justified in the LCA report.

3.10.1. Definition of a homogenous environmental family

For luminaires, to be belonging to an environmental homogeneous family, the product group must have, in addition to the requirements established by the PCR, the following characteristics:

- be in the same range of products of the manufacturer,

- be subject to the same product standards,
- has the same assigned lifetime (for luminaire and its light source - if applicable).

In particular, to belong to a homogeneous environmental family, the product group must have the following characteristics:

- the materials and manufacturing processes of luminaires are identical, namely:
 - the same type of materials and manufacturing process for the luminaire structure,
 - the same type of power supply equipment (which means power supply devices have the same technology and, in the case of printed circuits, the same types of components),
 - the same type of light source (which means the light sources have the same technology),
 - the same type of lighting management system (which means lighting management systems have the same technology and, in the case of printed circuits, the same types of components).
- the packaging materials and manufacturing processes are identical,
- the packaging is optimized within the product line, with means:
 - the total mass of the packaging varies proportionally to the mass of the luminaire,
 - the packaging material repartition is the same.
- the product group must use the same logistics circuit (the same transport type, distance and transport conditions),
- the conditions of installation and use are the same,
- the technology of the light source is identical,
- luminaires have the same energy saving functions,
- luminaires are recycled according to the same regulatory requirements.

Any other definition of homogeneous environmental family shall be justified in the LCA report.

3.10.2. Application of extrapolation rules

If the conditions to belong to a homogeneous environmental family as defined in the paragraph 3.10.1 are met, the extrapolation rules to be applied for each stage of the life cycle are those given in the paragraphs from 3.10.3 to 3.10.7. These rules are applicable at the product level (or declared unit). The extrapolation coefficients calculation at the functional unit level shall take into account the instructions of the paragraph 3.9.2 by using the following formula:

$$\text{Extrapolation coefficient at the product level} \times \left(\frac{\text{Lighting output of reference product (lumens)}}{\text{Lighting output of product concerned (lumens)}} \right)$$

When the extrapolation rules of a life cycle stage is based on the combination of several coefficients, the declarant of the PEP may apply one of the two following methods:

- Method 1: the declarant specifies in the LCA report the results of environmental impacts obtained for the entire product line by applying the different coefficients. The final choice of the coefficient has to be indicated in the PEP and calculated based on the results of extrapolation rules.

- Method 2: The declarant keeps the maximum value among the set of coefficients calculated.

Note: Method 2 is based on a conservative approach that maximizes environmental impacts compared to Method 1.

All the extrapolation rules must be justified in the LCA report.

3.10.3. Rules of extrapolation applied to fabrication stage

In the context of a range of products that respect the characteristics of a homogeneous environmental family as defined in the paragraph 3.10.1 :

- the environmental impacts generated by the production of the luminaire structure and its packaging are mainly correlated to the weight of the luminaire structure,
- the environmental impacts generated by the production of the supply equipment are mainly correlated to the weight of the supply equipment,
- the environmental impacts generated by the production of the light source are mainly correlated to the weight of the light source,
- the environmental impacts generated by the production of the lighting management system are mainly correlated to the weight of the lighting management system.

For the manufacturing stage, the extrapolation rule to be developed from collection data at the product level (or declared unit) for any other luminaire in the same product range is:

| | |
|--|--|
| <p>Coefficient at the declared unit level</p> | <p>Coefficient to be determined on the base of combination of 4 rules indicated below :</p> <p>Rule applicable to the production of luminaire structure and its packaging :</p> $\left(\frac{\text{Structure weight of concerned product (kg)}}{\text{Structure weight of reference product (kg)}} \right)$ <p>Rule applicable to the production of power equipment :</p> $\left(\frac{\text{Weight of power equipment of concerned product (kg)}}{\text{Weight of power equipment of reference product (kg)}} \right)$ <p>Rule applicable to the production of light source:</p> $\left(\frac{\text{Weight of light source of concerned product (kg)}}{\text{Weight of light source of reference product (kg)}} \right)$ <p>Rule applicable to the production of lighting management system :</p> $\left(\frac{\text{Weight of lighting management system of concerned product (kg)}}{\text{Weight of lighting management system of reference product (kg)}} \right)$ |
| | <ul style="list-style-type: none"> • The rules are applicable at the collection data level and from its reference product • The manufacturer must establish the overall extrapolation coefficient at the life cycle stage to be reported on the PEP • The manufacturer must provide the justification for the establishment of these parameters and document them in the LCA report |

3.10.4. Rules of extrapolation applied to distribution stage

In the context of a range of products that respect the characteristics of a homogeneous environmental family as defined in the paragraph 3.10.1, the environmental impacts generated during the distribution stage are mainly correlated to the total weight of the luminaire including its packaging.

For the distribution stage, the extrapolation rule to be developed from collection data at the product level (or declared unit) for any other luminaire in the same product range is:

| | |
|---|--|
| Coefficient at the declared unit level | $\left(\frac{\text{Weight of concerned product} + \text{Packaging weight of concerned product (kg)}}{\text{Weight of reference product} + \text{Packaging weight of reference product (kg)}} \right)$ |
|---|--|

With:

Packaging weight = packaging weight of the luminaire as defined in the paragraph **Erreur ! Source du renvoi introuvable.**, in kg.

3.10.5. Rules of extrapolation applied to installation stage

In the context of a range of products that respect the characteristics of a homogeneous environmental family as defined in the paragraph 3.10.1, the environmental impacts generated during the installation stage are mainly correlated to the total weight of its packaging.

For the installation stage, the extrapolation rule to be developed from collection data at the product level (or declared unit) for any other luminaire in the same product range is:

| | |
|---|--|
| Coefficient at the declared unit level | $\left(\frac{\text{Packaging weight of concerned product (kg)}}{\text{Packaging weight of reference product (kg)}} \right)$ |
|---|--|

With:

Packaging weight = packaging weight of the luminaire as defined in the paragraph 3.2.1, in kg

3.10.6. Rules of extrapolation applied to use stage

In the context of a range of products that respect the characteristics of a homogeneous environmental family as defined in the paragraph 3.10.1 :

- The environmental impacts generated by electricity consumption are mainly correlated to the total electrical power of the luminaire.
- The environmental impacts generated by the production of replacing light sources and the treatment of used light sources are mainly correlated to the weight of the light source.

For the use stage, the extrapolation rule to be developed from collection data at the product level (or declared unit) for any other luminaire in the same product range is:

| | |
|---|--|
| Coefficient at the declared unit level | <p style="text-align: center;">Coefficient to be determined on the base of combination of 2 rules indicated below :</p> <p style="text-align: center;">Rule applicable to the electricity consumption :</p> $\left(\frac{\text{Power of concerned product (W)}}{\text{Power of reference product (W)}} \right)$ <p style="text-align: center;">Rule applicable to the production of replacing light sources and the treatment of used light source :</p> $\left(\frac{\text{Weight of concerned product light source (kg)}}{\text{Weight of reference product light source (kg)}} \right)$ |
| | <ul style="list-style-type: none"> • The rules are applicable at the collection data level and from its reference product • The manufacturer must establish the overall extrapolation coefficient at the life cycle stage to be reported on the PEP • The manufacturer must provide the justification for the establishment of these parameters and document them in the LCA report |

With:

Power = electrical power of the luminaire as defined in the paragraph 3.5.4.3.2.1., in watt

3.10.7. Rules of extrapolation applied to end of life stage

In the context of a range of products that respect the characteristics of a homogeneous environmental family as defined in the paragraph 3.10.1, the environmental impacts generated during the distribution stage are mainly correlated to the total weight of the luminaire including its lamps (if applicable).

For the use stage, the extrapolation rule to be developed from collection data at the product level (or declared unit) for any other lighting in the same product range is:

| | |
|---|--|
| Coefficient at the declared unit level | $\left(\frac{\text{Weight of concerned product including its light source (kg)}}{\text{Weight of reference product including its light source (kg)}} \right)$ |
|---|--|

With:

Packaging weight = packaging weight of the lighting as defined in the the paragraph 3.2.1, in kg

4. Drafting of the Product Environmental Profile

4.1. General information

The current rules complete the paragraph 4.1 "General information" of the product category rules (PCR) of the Product Environmental Profiles (PEP) defined by the PEP ecopassport® Program.

The PEP shall include:

- the description of the components and accessories supplied with the luminaire,
- if a light source is supplied with the luminaire,
- if a power supply is delivered with the product,
- if the power supply is not integrated with the product, the description of the power supply equipment used to produce the PEP,
- if the luminaire is sold equipped with light sources, the value of the outgoing artificial luminous flux shall be measured according to standard NF EN 13032-1 + A1: 2012 in lumens or calculated using the LOR (3.1.3) by specifying the light sources used in all different cases,
- the nominal operating voltage in Volt,
- the light source color temperature in Kelvin,
- the protection index for water and dust (IP),
- the impact resistance index (IK) measured according to standard NF EN 62262: 2004,
- the luminous efficiency expressed in lm / W according to the following formula:
"Luminous efficiency = Outgoing luminous flux / Total product electrical power"
- the electrical power of the luminaire in watt,
- assigned lifetime in hours,
- the description of the reference use scenario,
- when using extrapolation rules, the outgoing artificial luminous flux of each product covered by the PEP intended for the product range,
- the lifetime of the luminaire in years by taking into account average annual operating hours by building type, according to EN 15193-1:2017 for indoor applications and EN 13201-5:2016 for outdoor applications. When the luminaire can be used in different types of building, the annual service lifetime announced in the PEP - and which must be reported in the PEP ecopassport® data base - is the smallest duration. The other annual service lifetimes can be indicated in the PEP form by specifying the type of building.

| | Type of building | Annual operationg hours by default |
|--------------------|--------------------------|---|
| Indoor application | Residential building | 3,500 |
| | Office | 2,500 |
| | Educational institutions | 2,000 |
| | Hospital | 5,000 |
| | Hotel | 5,000 |
| | Catering | 2,500 |
| | Sports establishments | 4,000 |
| | Type of building | Annual operationg hours by default |

| | | |
|---------------------|--|-------|
| | Retail (wholesale and retail services) | 5,000 |
| | Industry (manufacturing plants) | 4,000 |
| Outdoor application | Urban | 4,000 |
| | Tunnel (entrance) | 4,000 |
| | Tunnel (inside) | 8,760 |
| | Sport (recreational) | 2,500 |
| | Zone, open space | 4,000 |

Table 6 – Luminaire annual operating times according to the area of application and the type of building

Example:

For a luminaire with a assigned lifetime of 70,000 hours that can be installed in indoor applications such as "residential buildings", "offices", "hotels" and "catering", we have the following annual service time :

| | Type of building | Annual operationg hours by defaut | Operational lifetime |
|--|----------------------|-----------------------------------|----------------------|
| Luminaire with a assigned lifetime of 70,000 hours | Residential building | 3,500 h | 20 years |
| | Office | 2,500 h | 28 years |
| | Hotel | 5,000 h | 14 years |
| | Catering | 2,500 h | 28 years |

The operational lifetime announced in the PEP is 14 years and must be reported in the PEP ecopassport® data base. The other annual service lifetimes can be indicated in the PEP by specifying the type of building.

4.2. Constituent materials

The rules specified in the paragraph 4.2 "Constituent materials" of the current PCR apply.

4.3. Additional environmental information

The current specific rules completes the paragraph 4.3 "Additional environmental information" of the product category rules (PCR) of the Product Environmental Profiles (PEP) defined by the PEP ecopassport® Program.

The PEP can include:

- The types of application and use of the luminaire
- The assigned lifetime of the luminaire in years by building type, according to EN 15193-1:2017 for indoor applications and EN 13201-5:2016 for outdoor applications (operating hours available in Table 3 of paragraphe 3.5.4.2)

4.4. Environmental impacts

The current specific rules completes the paragraph 4.4 "Environmental impact" of the PCR in force.

The table of environmental impacts represents the environmental impact of the functional unit (which means providing an outgoing artificial luminous flux equivalent to 1,000 lumens during a reference lifetime of 35,000 hours) as defined in the paragraph 3.9.2 of current specific rules.

The following details shall be completed and included in the PEP to ensure clarity and transparency for the user:

This environmental declaration has been developed by considering an outgoing artificial luminous flux of 1,000 lumens over a reference lifetime of 35,000 hours.

When using the extrapolation rules, the following detail shall be mentioned:

The extrapolation coefficients are given for the environmental impact of the functional unit, which is the emission of an outgoing artificial luminous flux of 1,000 lumens over 35,000 hours. For each life cycle stage, the environmental impacts of the product are calculated by multiplying the reference product impacts of the declaration with the extrapolation coefficient. The "Total" column is to be calculated by adding the environmental impacts of each life cycle stage.

In the context of the making a life cycle assessment of a building:

- the environmental impacts of the equipment related to the energy consumption must be taken into account separately.

Thus, in order to facilitate the use of the PEP for carrying out building LCA, the PEP can include the results of the environmental impacts during the use phase according to a decomposition of the module B (B1 to B7) in coherence with the standards EN 15978:2012 and EN 15804:2014,

- the environmental impacts of equipment must be considered at the product level. In addition, industry experts judge the product-level impacts as a complementary vision to the impact of functional unit for optimal comparability. Thus, to facilitate the use of the PEP and to ensure optimal comparability, the PEP must include:
 - the table of the environmental impacts of the reference product expressed on the product (or declared product) scale in addition to the table on the functional unit scale. The values must then be indicated in numerical values, expressed in the appropriate units to three significant figures (and, optionally, as a percentage) for each stage of the life cycle, and the total for each indicator of the complete life cycle analysis.

The following details must be included in the PEP, to ensure clarity and transparency for the user:

- for environmental impacts expressed per functional unit, the following wording must be included: « for 1,000 lumens during 35,000 hours »,
- for environmental impacts expressed per declared product, the following wording must be included: « for 1 luminaire of XX lumens during H hours » with XX the luminous power of the light expressed in lumens and H the assigned lifetime of the light in hours.
- the extrapolation rules at the declared product level, where applicable.

5. Appendices

5.1. Terms and definitions

| | |
|-----|---|
| LCA | Life Cycle Assessment |
| EU | European Union |
| IEC | International Electrotechnical Commission |
| EN | European Standards |
| EEE | Electrical and Electronic Equipment |
| EU | European Union |
| LCI | Life cycle inventory |
| NF | Norme française |
| PCR | Product category rules |
| PEP | Product Environmental Profile |
| PSR | Product specific rules |
| EPR | Extended producer responsibility |
| FU | Functionnal unit |

5.2. Glossary

NOMINAL OUTGOING LUMINOUS FLUX OF A SOURCE (LUMEN)

Luminous flux value declared by the source manufacturer for a given source type and operating under specific conditions. (Source AFE – French Lighting Association)

OUTGOING LUMINOUS FLUX OF A LUMINAIRE (LUMEN)

Total luminous flux measured at the output of the luminaire.

The outgoing luminous flux is therefore lower than the nominal flux of the light source of a luminaire since its components (optical glass, reflector, etc.) will absorb a portion (as small as it is) of the nominal flux of the light source.

η

Theoretical efficiency of an optical system expressed by the ratio between the luminaire outgoing flux divided by the nominal flux of the light sources. It can not be greater than 1.

Also called L.O.R (LIGHT OUTPUT RATIO).

LIGHT

Light source equipped with a base designed to produce optical radiation in the visible range.

(Source AFE – French Lighting Association)

REFERENCE LIFETIME

Lifetime that can be expected for equipment according to a particular set (reference set) of conditions of use and which can serve as a baseline for estimating service life under other conditions of use.

NOTICE: The reference lifetime is also called typical. This is a theoretical service lifetime chosen for the purposes of the calculations. It can not be assimilated to the minimum, average or actual life of the products. (Source PCR edition 3 2015 04 02 – P.E.P. Association)

LIFETIME OF A SOURCE

The lifetime of a source represent the time during which a source worked before being out of use, or considered as such according to specified criteria.

(Source AFE – French Lighting Association)

ASSIGNED LIFETIME (OF A LUMINAIRE OR A SOURCE)

Service lifetime declared by the manufacturer during which a luminaire (or light source) may work before it is out of use, or considered as such according to the criteria specified by the manufacturer.

INCANDESCENT LAMP

Lamp in which the emission of light is produced by a body brought to incandescence by the passage of an electric current.

(Source AFE – French Lighting Association)

HALOGEN LAMP

Incandescent gas-filled tungsten filament lamp containing a certain proportion of halogens or halogenated compounds.

(Source AFE – French Lighting Association)

DISCHARGE LAMP

Lamp in which light is produced (directly or indirectly) by electric discharge in a gas, a metal vapor or a mixture of several gases and vapors.

(Source AFE – French Lighting Association)

MERCURY STEAM LAMP

A mercury vapor discharge lamp, coated or not with a photoluminescent substance, in which the pressure within the container is depending on the model.

(Source AFE – French Lighting Association)

SODIUM STEAM LAMP

Discharge lamp in which light is produced by the radiation of sodium vapor, the pressure of which in the container is depending on the model.

(Source AFE – French Lighting Association)

METAL HALID LAMP

Discharge lamp in which most of the light is produced by the radiation of a mixture of a metal vapor and halide dissociation products.

(Source AFE – Association Française de l'Eclairage)

FLUORESCENT TUBE LAMP

Low-pressure mercury vapor lamp in which most of the light is emitted by one or more layers of photoluminescent substances excited by the ultraviolet radiation of the discharge.

Compact fluorescent lamps are fluorescent lamps whose smaller discharge diameter tube has been shaped to fit in a small volume.

(Source AFE – Association Française de l'Eclairage)

LIGHT SOURCE

Concept defining a surface or object designed to emit primarily visible optical radiation produced by energy transformation. The term "visible" corresponds to a wavelength between 380nm and 780nm.

(Source: JOUE Directive 2009/125/CE)

LUMINAIRE STRUCTURE

Set of luminaire elements excluding power supply equipment, light source and packaging.

LED - ELECTROLUMINESCENT DIODE

Concept which defines a light source consisting of a solid-state device having a p-n junction of inorganic material which emits optical radiation when excited by an electric current.

(Source: JOUE Directive 2009/125/CE)

LED MODULE

Non-base assembly with one or more LED housings mounted on a printed circuit board and, where appropriate, electrical, optical, mechanical and thermal components, interfaces and lamp control device.

(Source: JOUE Directive 2009/125/CE)

LED LAMP

Lamp containing one or more LED modules and which can be equipped with a base.

(Source: JOUE Directive 2009/125/CE)

POWER SUPPLY OR SUPPLY EQUIPMENT

Devices used to ensure the operation of lamps and luminaires, for example: ballast, transformer and step-down converter). (Source: IEC 60598-1:2015)

COLOR TEMPERATURE (KELVIN)

Color temperature is used to determine the color of a light source. The color of a light source is compared to the color of a theoretical blackbody, which would have in the field of visible light, a spectrum of emission similar to the color considered.

5.3. References

5.3.1. European directives

European Directives below are to be considered in their latest version in force:

- Directive 2014/35/EU and its amendments – on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits
- Directive 2014/30/EU and its amendments – on the harmonisation of the laws of the Member States relating to electromagnetic compatibility
- Directive 2012/19/EU and its amendments – on waste electrical and electronic equipment (WEEE)
- Directive 2011/65/EU and its amendments – on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
- Directive 2009/125/EU and its amendments – establishing a framework for the setting of ecodesign requirements for energy-related products (ErP)
- Directive 2014/53/EU and its amendments – relating to the making available on the market of radio equipment
- Directive 94/9/EU and its amendments – concerning equipment and protective systems intended for use in potentially explosive atmospheres

5.3.2. Harmonized standards

The standards related and applicable to luminaires, as specified by AFNOR, member of CENELEC (European Committee for Electrotechnical Standardization) and IEC (International Electrotechnical Commission) must be complied with in their latest version in force:

- IEC 61000-3-2:2014 Electromagnetic compatibility (EMC) – Part 3-2: Limits - Limits on harmonic current emissions (current used by equipment not more than 16A per stage)
- IEC 61000-3-3:2013 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 stage and not subject to conditional connection
- IEC 60598-1:2015 - Luminaires - Part 1: General requirements and tests
- IEC 60598-2-X* Luminaires - Part 2-2: Particular requirements
*: The « X » allows defining the category of luminaire concerned through specific standards
- NF EN 40-1:1992 - Lighting columns. Part 1: definitions and terms.
- NF EN 40-X - Lighting columns – Part X Particular specifications
- NF EN 55015:2017 - Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
- IEC 61547:2009 - Equipment for general lighting purposes - EMC immunity requirements
- IEC 62471:2006 - Photobiological safety of lamps and lamp systems
- IEC 62031:2008 (First Edition) LED modules for general lighting – Safety specifications
- NF EN 13032-1+A1:2012 Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 1 : measurement and file format

5.4. Declaration of conformity



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IMPULSION FOR PRODUCT SUSTAINABILITY

Critical review certificate of PEP ecopassport® program technical rules

Document title: PSR 0014 – SPECIFIC RULES TO LUMINAIRES
Version: PSR-0014-ed1-EN-2018 07 18
Coordinated by: Syndicat du Luminaire – GIL et Syndicat de l'Eclairage
Critical Review period: from April 5 to June 12 2018

I. REFERENCES

The purpose of the critical review is to verify the document's compliance with the following references:

- ISO 14025:2006 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
- ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework
- ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
- PCR-ed3-EN-2015 04 02 Product Category Rules for Electrical, Electronic and HVAC-R Products of the PEP ecopassport® program ®

This critical review was conducted in accordance with the recommendations of the following references:

- ISO/TS 14071:2014 Environmental management - Life cycle assessment - Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006
- PEP-AP0017-ed2-EN-2015 02 13 Procedure for the development and adoption of PSRs – Product Specific Rules of the PEP ecopassport® program

II. CONCLUSIONS

The document on which the critical review was conducted does not contain any non-compliance with the references. Therefore, the technical rules of the PEP ecopassport® program established under reference PSR-0014-ed1-EN-2018 07 18 SPECIFIC RULES TO LUMINAIRES are deemed to comply.

Maud JACQUOT,
Founder and Director, Critical Reviewer.

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