# Eurovent Recommendation on complementary Product Category Rules for heat pump and air conditioning equipment

First Edition

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# Preface

## In a nutshell

**This document outlines Eurovent's recommendations for Product Category Rules complementary to EN 15804 or EN 50693 for the development of EPD's for heat pump and air conditioning equipment. It is intended as input for the development of a future harmonised cPCR standard for heat pump and air conditioning equipment, and to serve as a useful reference until the publication of said standard. The focus of this Recommendation is on aspects specific to heat pump and air conditioning equipment, including:**

- **Product description, scope and performance characteristics**
- **Functional unit and declared unit**
- **Reference Service Life**
- **Aspects, rules and assumptions in the product stage (A1-A3), construction process stage (A4-A5), use stage (B1-B7), and end of life stage C1-C4**

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## Abbreviations and definitions

**AC**: Air conditioner

**CEN**: European Committee for Standardization

**EPD**: Environmental Product Declaration

**EOL**: End-of-life

**HP**: Heat pumps

**LCA**: Life Cycle Assessment

**PEF**: Product Environmental Footprint

**PEFCR**: Product Environmental Footprint Category Rules

**cPCR**: Complementary Product Category Rules according to EN 15804 or EN 50693 – Product group specific or horizontal PCR, which provide additional compliant and non-contradictory requirements to EN 15804 or EN 50693. cPCR shall be used together with the core PCR or standard.

**PCR**: Product Category Rules according to ISO14025 – set of specific rules, requirements and guidelines for developing Type III environmental declarations for one or more product categories

**RSL**: Reference Service Life

**VRF**: Variable refrigerant flow

# 1. Introduction

This document outlines Eurovent's recommendations for complementary Product Category Rules for heat pump and air conditioning equipment. Such complementary rules facilitate the development of EPD's, which can be carried out in accordance with the core rules specified in the following standards:

- EN 50693:2019 "Product category rules for life cycle assessment of electronic and electrical products and systems".
- EN 15804+A2:2019 "Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products"

This document is intended to serve as input to, and support for, the work to develop a harmonised cPCR standard for heat pump and air conditioning equipment. A harmonised cPCR is needed to complement core rules, reduce room for creative interpretation, simplify the production of EPDs, and level the playing field. It should enable the selection sustainable solutions considered over the life cycle of the building, according to a unified approach, with minimal burdens, complexity, costs, and other barriers to scalability.

The focus of this Recommendation is on LCA aspects specific to heat pump and air conditioning equipment. More general aspects common across product categories, and issues in the overarching standards and general programme rules, are not considered. These issues are important and may also result in differences and inconsistencies related to the products in scope, but it is not likely that a cPCR can solve such inconsistences, which should be addressed at a more overall level, such as for example, within the work carried out by ECO Platform, various standardisation organisations, and by the European Commission. All this said, the creation of a harmonised cPCR for heat pump and air conditioning equipment, applied uniformly, would already be a helpful step in the right direction.

# 2. Scope

## 2.1. Product scope

This Recommendation applies to heat pump and air conditioning equipment covered by CEN/TC 113 - Heat pumps and air conditioning units. According to EN 14511-1, the following definitions are applicable:

- Air conditioner: device capable of cooling or heating, or both, indoor air, using a vapour compression cycle driven by an electric compressor, including air conditioners that provide additional functionalities such as dehumidification, air purification, ventilation or supplemental air heating by means of electric resistance heating, as well as appliances that are using water (either condensate water that is formed on the evaporator side or externally added water) for evaporation on the condenser, provided that the device is also able to function without the use of additional water, using air only
- Comfort chiller: liquid chilling package whose indoor heat exchanger extracts heat from a water-based cooling system designed to operate at leaving chilled water temperatures greater than or equal to 2° C
- Heat pump: encased assembly or assemblies designed as a unit, using a vapour compression cycle driven by an electric compressor, to provide delivery of heat
  Note 1 to entry: It can have means for cleaning and dehumidifying the air, circulating and cooling. The cooling is by means of reversing the refrigerating cycle.

- Liquid chilling package: factory-made unit designed to cool liquid, using an evaporator, a refrigerant compressor, an integral or remote condenser and appropriate controls
  Note 1 to entry: It can have means for heating which can be reversing the thermodynamic cycle such as a heat pump.
- Process chiller: factory-made product integrating at least one compressor and one evaporator, capable of cooling down and continuously maintaining the temperature of a liquid in order to provide cooling to a refrigerated appliance or to a process cooling system
  Note 1 to entry: It may or may not integrate the condenser, the coolant circuit hardware and other ancillary equipment.

In addition, FprEN 17625 provides the definition for rooftop unit: Air conditioning unit whose function is space cooling or heating, or both, using a vapour compression cycle driven by electric compressor(s) and in which the evaporator, compressor, condenser and supplementary heaters are integrated into a single package, that can be provided on one or two separate frames.
Note 1 to entry: Rooftop units use recycled air or a mixture of recycled air and outdoor air on the indoor heat exchanger, and outdoor air or a mixture of outdoor air and extracted air on the outdoor heat exchanger, with capability of free cooling and may be equipped with a heat recovery system to benefit from the extracted air.
Note 2 to entry: Air mixtures ratio can vary from 0 % to 100 %.
Note 3 to entry: It can have means for cleaning and/or dehumidifying the air.

Additional relevant standards that characterise the products in scope include the following:

- EN 14511 series
- EN 14825
- FprEN 17625
- EN 16147

## 2.2. Modules

The Recommendation addresses the whole life cycle from cradle to grave, which includes all modules shown in Figure 1 below.

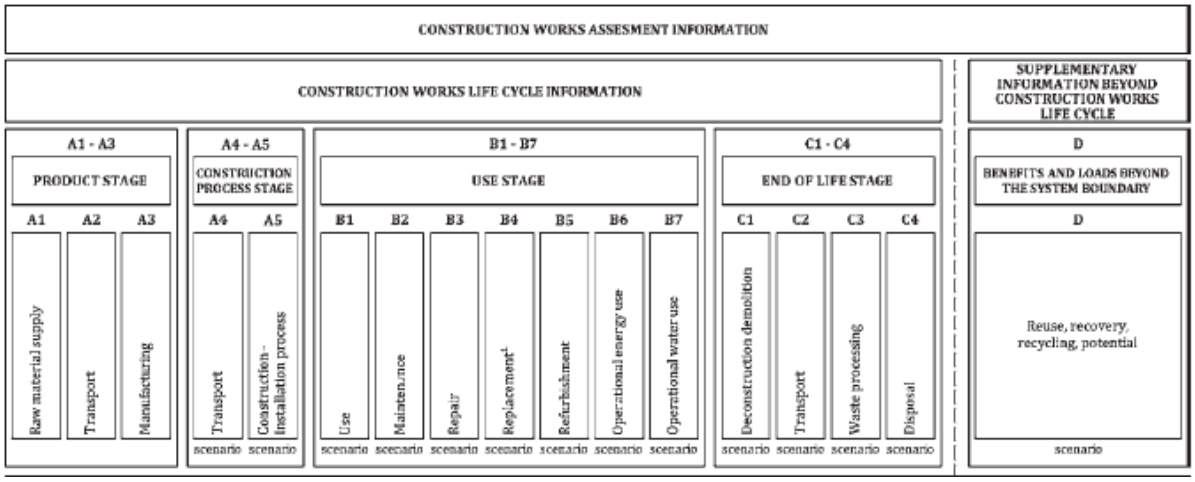


*Figure 1: Modular structure in EN 15804 for construction products*

It is noted that LCA studies based on this Recommendation may not apply the above modular structure. For a correlation with the terms used in EN 50693, refer to Annex D of said standard.

## 3. Development process

All Eurovent members were invited to participate in the development of this Recommendation in a dedicated technical working group, and to provide inputs throughout the development process. More than 40 organisations participated, as did several independent experts and knowledge partners. The European Heating Industry was also involved in the development of the Recommendation, providing input and review. The full list of participating organisations can be found in Appendix A.

A recorded training seminar was made available to the members of the working group, to ensure a sufficient level of knowledge about PCR's.

The first step was a mapping of existing (c)PCR's, LCA's and EPD's for heat pump and air conditioning equipment and similar product categories. For an overview of these, see Table 1 below. The findings were structured in a mapping report. The purpose of this exercise was to:

- Identify inconsistencies across cPCR's, EPD's and LCA practices for the products in scope
- Identify aspects in need of clarification and guidance to ensure a harmonised, fair and cost-efficient LCA practice for the products in scope

During the development process, the issues, inconsistencies and recommendations were discussed in several meetings, while participants also shared relevant information and feedback with the project leaders in between meetings.

This Recommendation is a product of the discussions and consensus achieved in the working group.

The Recommendation was tested, updated and validated based on a pilot study on an AquaEdge® 19DV water-cooled centrifugal chiller charged with R-1233zd(E) from Carrier.

## 4. Existing (c)PCR

In accordance with ISO 14025, existing (c)PCR's for relevant product categories were mapped and the content was considered in this recommendation. The (c)PCR's considered are shown in Table 1 below:

| Source | cPCR | Scope |
|---|---|---|
| IBU | Part B: Requirements on the EPD for Air conditioners | Mains-operated air conditioners with a rated output of ≤ 12 kW cooling capacity or heating capacity (EU Directive No. 626/2011) |
| IBU | Part B: Requirements on the EPD for heat generators | Room heaters and combination heating appliances with a rated output of max. 70 kW (EU Regulation No. 811/2013) |
| EPD International | PCR 2021:02 Air Conditioners | UN CPC 43912 Air-conditioning machines air conditioners and heat pumps with a capacity limit <= 12 kW (residential, tertiary sector) |
| EPD International | c-PCR-027:02 Fan coils | Hydronic Fan Coil Unit (FCU) with both air free delivery and air ducted with maximum external |

| | | |
|---|---|---|
| | | static pressure due to duct resistance of 120 Pa (UN CPC 43912, HS 2007 8415.83, BS EN 1397:2021) |
| PEP | PSR-0013-ed3.0-EN-2023-06-06 | Thermodynamic generator with electric compression (EN 14511-1) |
| EPD Italy | PCR EPDItaly019 – HVAC Home Appliances | Air-conditioning machines (CPC 43912) Refrigerating and freezing equipment and heat pumps, except household type equipment (CPC 43913) |
| PEP | PCR-ed4-EN-2021 09 06 | Electrical, electronic and HVAC-R |
| CEN-CENELEC | EN 50693 | Electrical and Electronic Equipment |

*Table 1: cPCR's for heat pump and air conditioning equipment and other related product categories*

More details are available in the corresponding mapping report. The mapping also included a deep dive into existing LCA's and EPD's for the products in scope, some published and some subject to confidentiality. The results of this mapping exercise have been considered in the work developing this recommendation.

# 5. Recommendations

## 5.1. Product description, scope and performance characteristics

### 5.1.1. Unique product identification

Eurovent recommends that LCA's and EPD's shall specify the product trade name(s), number(s), or other identifier(s) that unambiguously identify the products included in the study (e.g. with the use of a GTIN code). This way, the EPD users can know with certainty which product variants are covered by the EPD.

### 5.1.2. Inclusion of components and semi-finished product parts

Eurovent recommends that all components needed to enable the function of the product shall be included in the scope of the LCA or EPD. It is recommended to be as inclusive as possible and to clearly specify and justify in the EPD which components have been left out. Although it is not possible here to make an exhaustive list of all components, it is recommended to consider especially hydronic pumps, expansion tanks, and indoor units, for instance. The aim is to prevent inconsistencies in the EPD's due to manufacturers excluding different components.

## 5.2. Functional unit and declared unit

### 5.2.1. Declared unit

Eurovent recommends that the declared unit (or reference unit according to PEF) shall be defined as '***one piece of heat pump or air conditioning equipment***'. Having a declared unit allows for subsequent specific calculations at the building level and is sufficient for LCA studies that do not include the use stage.

### 5.2.2. Functional unit

A functional unit describes the value delivered by the product and increases the comparability of LCA studies. When the use stage is included, a functional unit must be defined.

In PEF studies, the definition of the functional unit is similar to EN 15804 and must quantify the aspects shown in the table below:

| Aspect: | Theoretical example: |
|---|---|
| What? | Provide indoor heating |
| How much? | 1 kW |
| How well? | According to seasonal scenario X, Y, Z |
| For how long? | *X* years |

*Table 2: Functional unit specification in PEF with a theoretical example*

Eurovent recommends that functional unit shall be defined as ***'1 kW heat exchanged with the building according to the defined use stage scenario and reference service life'***. With this phrasing, the use stage scenario defined for the EPD is an integral part of the functional unit. The reason for this is that the function(s) delivered by the product depend on the use-conditions.

The capacity to be used to recalculate the results is specified in table 5.

Heat exchange should be understood to include both heating and cooling. For equipment, that delivers other functions in addition to heat exchange, such as domestic hot water production, these shall be added to and quantified as part of the functional unit and in line with the applied use stage scenario.

## 5.3. Reference Service Life

The RSL is an uncertain and generic value. The actual lifetime is highly sensitive to the use conditions, including for example how well the equipment is serviced or how much it is used. Default values are recommended for comparability, equal terms and to avoid having multiple options for defining an RSL value for a given product. That said, there are currently two well-established sources for default RSL values:

- the Ecodesign Impact Accounting STOCKBAU tables; and
- the PEP PSR-0013 for thermodynamic generators with electric compression.

Both are presented below. Until further convergence is achieved at European level, manufacturers should clearly state which reference has been applied and use it consistently across the declaration.

### 5.3.1 RSL values from the Ecodesign Impact Accounting STOCKBAU tables

The following default RSL values are sourced from the Ecodesign Impact Accounting[1] STOCKBAU tables:

| Product family | Lifetime (years) | Ecodesign Lot |
|---|---|---|
| Dedicated Water Heater Heat Pump | 15.4 | ENER Lot 2 |
| Central Heating Electric Heat Pump | 18 | ENER Lot 1 |
| Chiller, Air-cooled, Electric, Small (≤ 400 kW) | 20 | ENER Lot 21 |

[1] https://op.europa.eu/en/publication-detail/-/publication/392bc471-76ae-11ed-9887-01aa75ed71a1/language-en

| | | |
|---|---|---|
| Chiller, Air-cooled, Electric, Large (> 400 kW) | 25 | ENER Lot 21 |
| Chiller, Water-cooled, Electric, Small (≤ 400 kW) | 20 | ENER Lot 21 |
| Chiller, Water-cooled, Electric, Medium (> 400 kW; ≤ 1500 kW) | 25 | ENER Lot 21 |
| Chiller, Water-cooled, Electric, Large (> 1500 kW) | 25 | ENER Lot 21 |
| High Temperature Process Chiller, Air-cooled, Electric, Small | 15 | ENER Lot 21 |
| High Temperature Process Chiller, Air-cooled, Electric, Large | 15 | ENER Lot 21 |
| High Temperature Process Chiller, Water-cooled, Electric, Small | 15 | ENER Lot 21 |
| High Temperature Process Chiller, Water-cooled, Electric, Medium | 15 | ENER Lot 21 |
| High Temperature Process Chiller, Water-cooled, Electric, Large | 20 | ENER Lot 21 |
| AC Rooftop | 15 | ENER Lot 21 |
| AC Split | 15 | ENER Lot 21 |
| AC Variable Refrigerant Flow | 15 | ENER Lot 21 |
| Room Air Conditioner, fixed, < 6 kW | 12 | ENER Lot 10 |
| Room Air Conditioner, fixed, 6-12 kW | 12 | ENER Lot 10 |
| Room Air Conditioner, portable, < 12 kW | 10 | ENER Lot 10 |
| Process Chiller, all, medium-temperature and low-temperature | 15 | GROW Lot 1 |

*Table 3: RSL values for different types of equipment from Ecodesign Impact Accounting STOCKBAU tables*

Very High Temperature Process Chillers apply the same lifetime values as High Temperature Process Chillers.

### 5.3.2 PEP PSR-0013 for thermodynamic generators with electric compression

The following default RSL values are sourced from the PEP PSR-0013 for thermodynamic generators with electric compression:

| **Product** | **Reference Service Life** | |
|---|---|---|
| | Individual residential | Collective residential / Commercial |
| Air conditioners | 17 years | 22 years |
| VRF or split system > 12kW | 17 years | 22 years |
| Heat pump | 17 years | 22 years |
| Chiller | Not applicable | 22 years |
| Rooftop | Not applicable | 22 years |

*Table 4: RSL values for different types of equipment from PEP PSR-0013*

Eurovent recommends that no EPD is allowed to specify a higher RSL than the abovementioned default values regardless of the available documentation and justification. This is because there is no well-established standardised method for assessing durability at this time. This might change in the future. That said, it remains possible to do sensitivity assessments and LCA's with alternative values, but these are not to be declared in a formal EPD.

Finally, Eurovent recommends that the following sentence shall be stated next to the RSL in a general EPD: *'The RSL is an uncertain and generic value. The actual lifetime is highly sensitive to the actual use conditions of the unit.'*

## 5.4. Product stage (A1-A3)

### 5.4.1. Components (A1)

Eurovent recommends that data for purchased components must include the production of the components, with representative or at least conservative data. Data on the raw materials alone is not sufficient.

When excluding the use stage, then module A1 often dominates the results for the product categories in scope. In many LCA's, this stage is modelled with secondary data. The aim of this recommendation is to avoid LCA's that model components such as compressors simply based on a bill of materials for this component. This is not sufficient – among others, the energy consumption and material loss during production of such components should be included as well.

This is challenging since it can lead to a large number of material flows with unknown processing, and the information is usually either unavailable or lies further upstream in the supply chain. Therefore, in cases where sufficient representativeness of data for modelling components is not possible, it is recommended to use more generic but conservative datasets.

### 5.4.2. Co-allocation in manufacturing (A3)

The co-allocation hierarchy in PEF and ISO 14040/44 are not completely aligned with EN 15804. As a consequence, also the LCA's and EPD's differ in this regard, where the mapping showed the use of a variety of allocation keys including pieces, mass, volume and working hours.

The manufacturing sites may differ in many ways, including which co-products are produced together with the units in scope of the EPD. For this reason, it is not recommended to have a standardised, default allocation key for distributing inputs and outputs such as utilities and waste between the co-products.

Eurovent recommends that the choice of allocation key must be justified, and the differences between the co-products must be described in the LCA report.

## 5.5. Construction process stage (A4-A5)

### 5.5.1. Transport to installation (A4)

Most of the existing LCA's and EPD's included in the mapping have modelled the transport in module A4 with primary product specific data. No default values for distances in A4 are recommended for a future cPCR.

Eurovent recommends that the transport scenario and the choice of the transportation dataset shall be described in the LCA report.

### 5.5.2. Installation energy (A5)

The energy for installing the products in a building is typically not a significant contribution to the LCA results. Eurovent recommends to permit leaving out energy consumption for product installation.

## 5.6. Use stage (B1-B7)

### 5.6.1. Maintenance (B2)

Heat pump and air conditioning equipment must be inspected regularly. The inspection frequency shall be specified in the LCA report. If the frequency is dictated by law in the country or region of sales, then this frequency shall be applied. Where relevant, manufacturers shall apply the scenarios of

Regulation (EU) 2024/573 to specify the frequency of maintenance operations and leak checks for equipment containing fluorinated refrigerants.

Eurovent further recommends that:

- the default vehicle type for transporting the operator is a van
- the default distance is 50km one way, which is 100 km including the return trip
- the default weight of the operator is 80kg

### 5.6.2. Replacement (B4)

Eurovent recommends that the replacement of components during the use stage shall be based on the experience and sales documentation of the manufacturer, as well as on any applicable regulations. The replacement of parts due to malfunction does not need to be taken into account. The end-of-life treatment of replaced components shall be modelled according to the scenarios applied in the product end-of-life stage. If a component in the equipment is replaced by the operator when this person inspects the equipment, then the transport of this person is only counted once (see maintenance chapter below for operator transport scenario).

### 5.6.3. Operational energy use (B6)

For heat pump and air conditioning equipment, the electricity use in B6 is significant and dominant in some results categories. Operational energy use depends on a wide range of use conditions, including outdoor climate conditions, temperature settings, etc. That said, a default use stage scenario is needed to harmonise assumptions. Fortunately, a robust methodology exists to assess operational energy consumption at standard conditions in accordance with EN 14825 and also used in European product regulations applicable to heat pump and air conditioning equipment.

Default use stage scenario for generic EPD's at standard conditions:

Operational energy use is calculated by multiplying annual energy consumption by the Reference Service Life.

Total annual energy consumption shall include the annual energy consumption for cooling ($Q_{CE}$ for comfort chillers and Q for process chillers according to EN 14825), the annual energy consumption for heating ($Q_{HE}$ according to EN 14825) and annual electricity consumption for hot water production (AEC according to EN 16147) for the intended use of the product and declared in accordance with the relevant Ecodesign Regulations:

- Commission Regulation (EU) No 206/2012
- Commission Regulation (EU) 2015/1095
- Commission Regulation (EU) 2016/2281
- Commission Regulation (EU) No 813/2013
- Commission Regulation (EU) No 814/2013

If the equipment is declared for many temperature applications in heating mode under Ecodesign, the data relating to the hottest temperature must be used.

The equipment must be declared for average climate according to Ecodesign (corresponding to Strasbourg climate conditions). Declarations for colder and warmer climates are optional.

For VRF systems, the outdoor unit (OU) is rated with a combination of indoor units (IU). Operational energy use should be adjusted to exclude IU consumption. IU should have their own procedure for operational energy use (OEU) calculation:

- $OEU_{IU} = P_e*(H_{CE}+H_{HE})*RSL$
- $OEU_{OU} = (Q_{HE}+Q_{CE})*RSL$ - sum ($OEU_{IU}$ for the tested combination)

The capacities to be used to recalculate the impacts for the functional unit are the following:

| Type of generator | $P_h$ | $P_c$ |
|---|---|---|
| A/W and W/W heat pumps used in heating-only mode, P ≤ 400 kW (Regulation n°813/2013) | $P_{rated,h}$ | $P_{rated,c}$* |
| A/A heat pump or air conditioner, reversible or not, P ≤ 12 kW (Regulation n°206/2012) | $P_{design,h}$ | $P_{design,c}$ |
| W/A heat pump (Regulation 2016/2281) | $P_{rated,h}$ | $P_{rated,c}$ |
| A/A heat pump, air conditioner, rooftop unit, reversible or not, 12 kW < P ≤ 1 MW (Regulation n°2016/2281) | $P_{rated,h}$ | $P_{rated,c}$ |
| A/W, W/W chiller used in cooling-only mode, P ≤ 2 MW; | | $P_{rated,c}$ |
| A/W, W/W chiller, reversible, 400 kW < P ≤ 2 MW (Regulation n°2016/2281) | $P_{rated,h}$* | $P_{rated,c}$ |
| Process chillers (Regulations (EU) 2015/1095 and 2016/2281) | | $P_a$ |
| *not required by regulation but recommended to be included | | |

*Table 5: capacities to be used to recalculate the impacts for the functional unit*

- Heating-only: $P_{ref} = P_h$
- Cooling-only: $P_{ref} = P_c$
- Reversible: $P_{ref} = (P_h*H_{HE}+P_c*H_{CE})/(H_{HE}+H_{CE})$

Annual heating and cooling hours $H_{HE}$ and $H_{CE}$:

| Regulation | Function | Season | Hours |
|---|---|---|---|
| A/A heat pump or air conditioner, reversible or not, P ≤ 12 kW (Regulation n°206/2012) | Cooling | | 350 |
| | Heating | Average | 1400 |
| | | Colder | 2100 |
| | | Warmer | 1400 |
| A/A heat pump, air conditioner, rooftop unit, reversible or not, 12 kW < P ≤ 1 MW | Cooling | Average | 600 |
| | | Colder | 300 |
| | | Warmer | 900 |
| W/A heat pump<br>A/W, W/W chiller used in cooling-only mode, P ≤ 2 MW;<br>A/W, W/W chiller, reversible, 400 kW < P ≤ 2 MW | Heating | Average | 1400 |
| | | Colder | 2100 |
| | | Warmer | 1400 |

| | | | |
|---|---|---|---|
| (Regulation n°2016/2281) | | | |
| A/W and W/W heat pumps, P ≤ 400 kW (Regulation n°813/2013) | Heating | Average | 2066 |
| | | Colder | 2465 |
| | | Warmer | 1336 |
| Process chillers | Cooling | | 7409.3 |

*Table 6: Annual heating and cooling hours $H_{HE}$ and $H_{CE}$*

The source of electricity shall be average European or national grid mix depending on the geographical boundary of the LCA.

Individual use stage scenarios for project-specific EPD's:

Contrary to product EPD's, in project-specific EPD's the use stage scenario may be known. Therefore, in a project EPD it may be relevant to apply specific use conditions instead of the default use stage scenario.

For project-specific energy calculations at building-level or project-specific EPD's, energy performance is calculated in accordance with EN 15316-4-2. If EN 14825 is applicable, path B is used. If EN 14825 is not applicable, path A is used.

## 5.7. End of life stage C1-C4

### 5.7.1. Demolition (C1)

Eurovent recommends that material and energy flows related to dismantling are cut-off, whenever it is reasonable to assume that dismantling is performed with manual tools.

### 5.7.2. End-of-life (C2-C4)

Eurovent recommends the default end-of-life scenario in Table 6 for LCA's with a European scope. Any LCA's with a different scope may apply a more geographically representative scenario, which shall be justified for example based on national statistical data.

| CATEGORY: | MATERIAL: | *R2 (recycling rate) %* | *R3 (energy recovery rate) %* | *Disposal rate (%)* |
|---|---|---|---|---|
| Metals | Steel | 85 | 0 | 15 |
| | other ferrous metals | 80 | 0 | 20 |
| | Aluminium | 85 | 0 | 15 |
| | Copper | 80 | 0 | 20 |
| | other non ferrous metals | 60 | 0 | 40 |
| Plastics | PP | 20 | 40 | 40 |
| | PS-HiPS | 20 | 40 | 40 |
| | ABS | 20 | 40 | 40 |
| | PU foam | 0 | 50 | 50 |
| | Rubber | 0 | 50 | 50 |
| | Other plastics | 0 | 50 | 50 |
| Minerals | Glass | 60 | 0 | 40 |
| | Other minerals | 0 | 0 | 100 |
| PCBs and other passive electronic components | PCBs (support) | 0 | 0 | 100 |
| | PCBs (metals) | 50 | 0 | 50 |

*Table 7: Default end-of-life scenario for average Europe*[2]

The chosen default end-of-life scenario is primarily based on EN 50693. This is because this source has relevant material categories that are deemed to be more representative for electronic products, and is more recent than PEF annex C, which is outdated. The recycling rates from EN 50693 also takes losses in the collection and recycling systems into consideration, which means that data for that will also be harmonised and the LCA practitioners do not need to retrieve such data elsewhere.

The copper R2 value stems from PEF Annex C and applies for copper in electronics.

The steel and aluminium values stem from PEF Annex C. The recycling rates from EN 50693 are deemed too low considering that heat pump and air conditioning equipment typically has large steel and/or aluminium components, which are easy to access and recycle.

The scenario does not include waste treatment rates for passive electronic components (capacitors, resistances, inductors etc.). Eurovent recommends that the same waste treatment rates as for PCBs shall apply to passive electronic components.

In PEF studies, end-of-life is calculated using the so-called Circular Footprint Formula (CFF). This allocates environmental impacts differently than EN 15804. However, the calculation is generally based on the same type of input data, which includes the recycling rate and inefficiencies in the recycling systems (R2) as well as the energy recovery rate (R3). Therefore, a default scenario in a cPCR for EPD's may potentially also be relevant for a future PEFCR.

[2] R2 is the proportion of the material in the product that will be recycled in a subsequent system. R2 shall take into account the inefficiencies in the collection and recycling processes. R2 shall be measured at the output of a recycling plant. R3 is the proportion of the material in the product that is used for energy recovery at end-of-life.

## 5.8. Refrigerants across the lifecycle

This chapter concerns the production, refills and disposal of refrigerants, including quantities and treatment methods throughout the product life cycle.

### 5.8.1. Manufacturing emissions

Refers to direct air emissions of refrigerant during equipment manufacturing and pre-charging in factory. Eurovent recommends applying a default value of 0,5% of refrigerant charge. Manufacturers may only declare better values if evidenced and justified (for example leakage tests made in compliance with EN 378).

### 5.8.2. Installation emissions

Refers to direct air emissions of refrigerant during the installation of equipment on site. Assumed to be 0%.

### 5.8.3. Use stage emissions

Refers to direct air emissions of refrigerant during use of the equipment.

At present, different recognised approaches are used within the sector to define default values for refrigerant leakage during use. To reflect established practice and ensure broad applicability, this Recommendation accepts two alternative reference approaches, as described below.

Until further convergence is achieved at European level, manufacturers shall clearly state which reference has been applied and use it consistently across the declaration.

#### 5.8.3.1 Conservative scenario derived from real leakage data

Under this approach, the following default value shall be applied:

- 1.5% of refrigerant charge for all types of equipment

The conservative default value is based on available real leakage data from Germany[3], Italy[4], Poland[5] and Slovakia[6], which shows that average real leakages in HPAC equipment are trending downwards and are already well below 1.5%.

This default value assumes that the real or expected leakage rate of a specific product cannot be modelled based on product characteristics like refrigerant charge on the number of removable couplings. The default value represents an average leakage rate over all products based on empirical data.

[3] VDKF Information Juli August 2025

[4] ISPRA Italian GHG Inventory Document 2025

[5] Data from the Polish Central Register of Operators (CRO) as reported by Janusz Kozakiewicz at the 11th UNEP OzonAction's Regional Montreal Protocol Network for Europe and Central Asia meeting on electronic databases and equipment logbooks and reproduced in the UNEP OzonAction Technical Brief '*SETTING UP EQUIPMENT LOGBOOKS & DATABASES*', Figure 9: https://industriaeformazione.it/wp-content/uploads/2023/07/230711-UNEP-technical-brief-on-equipment-logbooks-2023-English-1MB.pdf

[6] Tomlein et al., (2019), *Evaluation of refrigerants leakage ratios based on electronic logging and reporting system*, Proceedings of the 25th IIR International Congress of Refrigeration: Montréal, Canada, August 24-30, 2019, DOI: http://dx.doi.org/10.18462/iir.icr.2019.0148

#### 5.8.3.2 PEP PSR-0013 for thermodynamic generators with electric compression

PEP PSR-0013 applies the following default value:

- 3 grams per year for hermetically sealed equipment,
- 5 grams per year per removable coupling for non-hermetically sealed equipment.

'Hermetically sealed equipment' is defined in Article 3(9) of Regulation (EU) 2024/573. Equipment not covered by this definition is considered non-hermetically sealed.

'Removable coupling' is defined as opposed to a non-removable or permanent coupling or fitting according to EN 378.

This approach is based on design- and definition-based criteria derived from Regulation (EU) 2024/573 and EN 378, rather than on measured in-use leakage data. The method provides a structured and reproducible framework for estimating refrigerant emissions, ensuring consistency and regulatory alignment, with no linkage to empirically observed leakage behaviour over time.

### 5.8.4. End-of-life scenario

Eurovent recommends applying the following conservative default scenario:

- 10% of the refrigerant is recovered at end of life for incineration or cracked to base chemical compounds,
- 80% is recovered for reuse or reclamation,
- 10% is assumed accidentally discharged to the atmosphere.

Non-fluorinated refrigerants that cannot be incinerated are instead assumed to be reused when recovered at end of life.

Notes:

1. HFC refrigerants are covered by the HFC quota system established by the F-Gas Regulation, and are therefore valuable, which presents an economic incentive for their reuse.

### 5.8.5. Total production of refrigerant to be modelled

Total production of refrigerant to be modelled = Manufacturing emissions + Equipment refrigerant charge + Refilled refrigerant.

If following the conservative scenario derived from real leakage data, then 'Refilled refrigerant' ≈ Use emission rate * Equipment refrigerant charge * RSL.

If following PEP PSR-0013 for use stage emissions, then 'Refilled refrigerant' ≈ Use emission rate * RSL.

# Appendix A – Participating organisation

| Organisations | Type |
|---|---|
| Aermec | Manufacturer of heat pump or air conditioning equipment |
| Alarko Carrier | Manufacturer of heat pump or air conditioning equipment |
| BDR Thermea | Manufacturer of heat pump or air conditioning equipment |
| Carrier | Manufacturer of heat pump or air conditioning equipment |
| Carver Group | Manufacturer of heat pump or air conditioning equipment |
| Clivet | Manufacturer of heat pump or air conditioning equipment |
| Daikin Applied | Manufacturer of heat pump or air conditioning equipment |
| Daikin Europe | Manufacturer of heat pump or air conditioning equipment |
| Eneko | Manufacturer of heat pump or air conditioning equipment |
| FläktGroup | Manufacturer of heat pump or air conditioning equipment |
| Flowair | Manufacturer of heat pump or air conditioning equipment |
| Galletti | Manufacturer of heat pump or air conditioning equipment |
| HiRef | Manufacturer of heat pump or air conditioning equipment |
| LFB Group | Manufacturer of heat pump or air conditioning equipment |
| Midea | Manufacturer of heat pump or air conditioning equipment |
| Mitsubishi Electric Hydronics & IT Cooling Systems | Manufacturer of heat pump or air conditioning equipment |
| NIBE | Manufacturer of heat pump or air conditioning equipment |
| Olimpia Splendid | Manufacturer of heat pump or air conditioning equipment |
| Panasonic | Manufacturer of heat pump or air conditioning equipment |
| Rhoss | Manufacturer of heat pump or air conditioning equipment |
| Swegon | Manufacturer of heat pump or air conditioning equipment |
| Systemair | Manufacturer of heat pump or air conditioning equipment |
| Vertiv | Manufacturer of heat pump or air conditioning equipment |
| AFEC | National HVACR association |
| Assoclima | National HVACR association |
| Uniclima | National HVACR association |
| VDMA FV ALT | National HVACR association |
| VELTEK | National HVACR association |
| VKE | National HVACR association |
| AAF | Other manufacturer |
| Airtecnics | Other manufacturer |
| Aldes | Other manufacturer |
| ALKO Air | Other manufacturer |
| ATREA | Other manufacturer |
| BAC | Other manufacturer |
| Belimo | Other manufacturer |
| CAREL | Other manufacturer |
| ebm-papst | Other manufacturer |
| Epta Refrigeration | Other manufacturer |

| | |
|---|---|
| Exhausto | Other manufacturer |
| Freudenberg | Other manufacturer |
| IV Produkt | Other manufacturer |
| J2 Innovations | Other manufacturer |
| Jasun | Other manufacturer |
| Klimor | Other manufacturer |
| Komfovent | Other manufacturer |
| Mann+Hummel | Other manufacturer |
| Munters | Other manufacturer |
| Purever Friemo | Other manufacturer |
| robatherm | Other manufacturer |
| Sagicofirm | Other manufacturer |
| Zehnder Group | Other manufacturer |
| Bureau Veritas | Knowledge partner |
| IMQ | Knowledge partner |
| Politecnico di Milano | Knowledge partner |
| Politecnico di Torino | Knowledge partner |
| TÜV SÜD | Knowledge partner |
| European Heating Industry | European industry association |

## About Eurovent

Eurovent is the voice of the European HVACR industry, representing over 100 companies directly and more than 1.000 indirectly through our 16 national associations. The majority are small and medium-sized companies that manufacture indoor climate, process cooling, and cold chain technologies across more than 350 manufacturing sites in Europe. They generate a combined annual turnover of more than 30 billion EUR and employ over 150.000 Europeans in good quality tech jobs.

### Mission

Eurovent's mission is to bring together HVACR technology providers to collaborate with policymakers and other stakeholders towards conditions that foster fair competition, innovation, and sustainable growth for the European HVACR industry.

### Vision

Eurovent's vision is an innovative and competitive European HVACR industry that enables sustainable development in Europe and globally, which works for people, businesses, and the environment.

→ For in-depth information and a list of all our members, visit www.eurovent.eu