Environmental Declaration in compliance with ISO 14025 thanks to a collaborative program of electrical and electronic industry: the PEP ecopassport program

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ABSTRACT

The need for environmental product impacts information in the electrical, electronic and HVAC-R (heating, ventilation, air-conditioning, refrigeration) equipment industry has merged, due in particular to carbon footprint or Eco design directives increasing requirements based on life cycle assessments. To ensure fair market and reliable information, these environmental declarations should be in compliance with ISO 14025 [1].

Then, the electrical industry stakeholders, on a voluntary basis and with a consensus approach have developed a program called PEP ecopassport. This program, designed for international EEE, ensures compliance with the standard 14025 and provides the detailed rules for electrical equipment. It carries reflections on the harmonization of environmental indicators for the benefit of downstream users, such as the association for high environmental quality of buildings. The ambition of the program is to provide a common framework to describe the performance environment with a robust LCA.

This program is being piloted by a non-profit association. The role of this PEP association is to develop internationally the environmental declaration program PEP ecopassport concerning electrical, electronic and HVAC products.

In this paper we develop rules for making PEP according to PEP ecopassport and we make recommendations to achieve the goal of PEP ecopassport program in the context of a medium voltage circuit breaker.

INTRODUCTION

The environmental quality of electrical, electronic and HVAC-R (Heating, Ventilation, Air-Conditioning and Refrigeration) equipment is becoming an important parameter of choice for prescribers and customers. Manufacturers of such equipment have increased accountability for control of their environmental impacts and energy consumption (Directives: Energy related Products (ErP), Energy Performance of Buildings Directive (EPBD), limit and traceability of hazardous substances (Directive: Restriction of the use of certain Hazardous Substances (RoHS), Reglementation: Registration, Evaluation and Authorization of Chemicals (REACh) and management of end of life (Directive: Waste Electrical and Electronic Equipment (WEEE)) [2]. In this context, it is essential that environmental information meets a single repository robust and consensual [3].

PEP ecopassport PROGRAM

The association P.E.P. aims to develop international program named (eponymous): PEP ecopassport and supports compliance with upcoming regulatory requirements. It provides framework with the procedures allowing any company to prepare, check and publish an eco declaration type III named PEP in compliance with the ISO 14025 requirements. PEP is established on a voluntary basis and under the responsibility of the manufacturer who publishes it [3].The ambition of the program is to provide a robust method to characterize quantitatively the environmental impacts of a given product based on a multi-criteria LCIA [4]. Beyond this LCIA it is striving to create a common framework to compare consensually and robustly, the environmental performance of a product through a PCR (Product Category Rules) [5]. This document gives the generic rules applicable to all EE product categories and also specific rules depending of the category of the product.

All documents related to PEP ecopassport program are available on www.pep-ecopassport.org.

LIFE CYCLE ASSESSMENT

The LCA has to be performed according the ISO 14044 standard [6]. The functional unit (FU) is the quantity that quantifies the function of the product on the basis of which the analyses are compared. Its role is to provide a benchmark against which all elementary flows are reported. The FU should be clearly explained. It must include a unit quantifying the function studied, the level of performance achieved by the product, and its life time [5]. It should be noted that the FU must include the product's packaging [5].

Regarding the phases to be considered of the environmental life cycle, there are five periods to be considered: manufacturing, distribution, installation, use and end of life.

Considering the inventory of the flows, the cutting rule applies: the maximum mass of intermediate flows which can not be taken into account must be less than or equal to 5% of the total mass of the elementary flow [5]. For example, for equipment (an article, under REACh) weighing 200 kg (packaging included), the mass of neglected parts when performing the life cycle impact assessment must not exceed 10 kg. Moreover, transports related to each phase of the life cycle have to be taken into account (distance, type of transport). In case of

unavailability of data, penalizing average data were established under the PEP ecopassport and are to be used. These data are listed in Table 1.

transport scenario	mode of transport	Distance (km)
World	Boat	19000
	Truck > 32 tons	1000
Intra-continental	Truck > 32 tons	3500
Local	Truck > 32 tons	1000

Table 1. *Transport scenarios by default (unfavorable: the round is half full and empty return) [4].*

Regarding the use phase, scenarios are described in the product Specific Rules (PSR) document. PSR are additional rules specific to each of the categories of products and they are part of the PCR [5]. For example, the Medium voltage circuit breakers belong to the category "Passive products". For this category the use scenario considered a useful life of 20 years and a load rate of 30% of rated current.
Concerning the calculation of environmental impacts, the indicators used in the PEP ecopassport include a common set of mandatory indicators and optional indicators.
Table 2 describes the impact indicators taken into account.

Indicator	Acronym	Unit	Statut
Greenhouse effect	GWP	g~CO_2	Mandatory
Ozone Depletion Potential	ODP	g~CFC-11	Mandatory
Eutrophication	WE	g~PO_4^{3-}	Mandatory
Photochemical ozone	POC	g~C_2H_4	Mandatory
Air acidification	AA	g~H^+	Mandatory
Energy Depletion	ED	MJ	Mandatory
Water consumption	WD	dm^3	Mandatory
Raw material depletion	RMD	$Year^{-1}$	Optional
Air Toxicity	AT	m^3	Optional
Water Toxicity	WT	m^3	Optional
Hazardous Waste production	HWP	Kg	Optional

Table 2. *Environmental indicators according to the today PEP ecopassport program.*

These indicators will be completed by additional impact indicators to take in consideration market evolution. In particular, building impact indicators that are already standardized will be added in actual indicators to be more and more exhaustive.

PEP DECLARATION

The Product Category Rules (PCR) document provides generic rules for writing the PEP. Electrical, electronic and HVAC-R equipment are allocated into specific categories such as "Switchgear and control gear", "solutions and cable management", "Autonomous safety lighting" and "Wire and cables", "Heating equipment", etc. In the Switchgear and control gear solutions, there are three categories of products: passive products (*e.g.*: circuit breaker), active products (*e.g.*: temperature control device) and enclosures (*e.g.*: electrical cabinets).

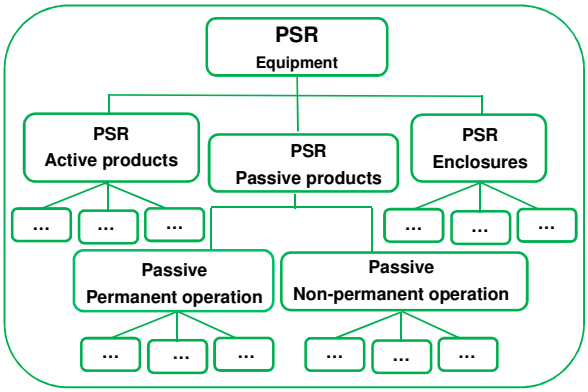

Figure 1. *Overview of the PSR equipment: switchgear, control gear solutions, and cable management (PSR: Product Specific Rules).*

With the increase of the scope of the PEP program, more categories will be added in the near future. New PSR will be published in the near future with more details: standard reference, functional units, extrapolation rules, maintenance in use phase,

According to the product specific rules of equipment, the life time during the "use" phase for passive products and enclosures category has been agreed to be 20 years although it is, for active products, only 10 years.
For no permanent passive products to simulate watt losses during the "use" phase only 30% of nominal current is taken into account and during only 30% of life time of product category *i.e.* 6 years and not 20 years. This is unlike permanent passive products for which watt losses are simulated at 100% of life time but with 30% of nominal current.
Some information must appear on the document to prove that the PEP has been verified by an independent party. For example, the sentence: "Independent verification of the declaration data in accordance with ISO 14025: 2006" and the number enabling the auditor must appear on the PEP[5].
Regarding the product studied, in addition to basic information (name and visual product), it is necessary to indicate the functional unit (UF) and the category to which the product belongs to (indicated in the PSR).
Environmental impacts assessment should be in tabular

form, including at least all mandatory indicators (see Table 2). The name of the LCIA software, its version, and the scenarios used for the different phases of the life cycle are also included in this part [5].

In addition to LCA results, PEP provides information on product content and end of life aspects. The declaration of materials and substances in the PEP also follows specific rules. It is necessary to indicate in the document the total mass flow reference (product but also the packaging and the products requested for installation). Materials to be mentioned (expressed in weight % of the total mass of the flow of reference) are plastics, metals and others. These can be broken down by group of substances or materials. Hazardous substances according to RoHS directive must be declared when present. The substances are Lead, Mercury, Cadmium, Hexavalent Chromium, Polybrominated biphenyls on (PBB) and polybrominated diphenyl ethers (PBDE). This list may be extended depending on future legislation.

PEP provides recyclability rates calculated according to the recent IEC 62635 publication.

DISCUSSION AND RECOMMENDATIONS

In the field of medium voltage switchgear there are at least three families of products:

- Air insulation switchgear
- Gas insulation switchgear
- Solid insulation switchgear

Today PEP ecopassport PCR provides general rules on the PEP ecopassport. It is why we recommend to give more details in the PSR in order to be more accurate for given specific product. For example, we recommend to create three different PSR for each family of above switchgears.

The diagram in the figure 2 depicts seven key elements for the declaration of environmental profile conforming to the PEP ecopassport. There are:

- LCIA according to ISO 14044
- Cut rules during LCIA
- Declaration of hazardous substances according to RoHs and IEC 62474
- Verification of the PEP by independent party
- Report explaining the PEP elaboration and hypothesis chosen
- Declaration of PEP according to ISO 14025

To follow the above main key rules, even more specific PSR will be created in the near future.

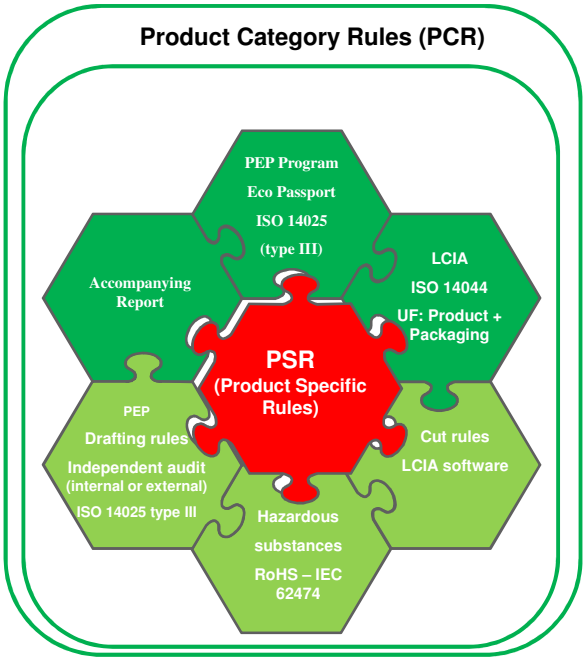

Figure 2. *Key elements for making and declaration of Product Environmental Profile.*

CONCLUSION

This paper presents the main rules described by the PEP ecopassport for achieving Environmental Profiles Products complying with ISO 14044 and 14025-14040 for the electrical, electronic and HVAC-R equipment. These rules allow the realization of LCA and declaring PEP based on principles of accountability and transparency.

PEP is the environmental profile of a product on a single document. This is a real environmental identity card which is quantified through 11 indicators taking into account the impact of the product on air, water, soil and natural resources throughout the life cycle of the product, its design to end of life through its distribution, its installation and use.

PEP ecopassport is a good answer to the market need in particular concerning the carbon foot print.

PEP ecopassport reflects the continuous improvement of products over time and transparency communication and added up relevant environmental information along a products value chain.

REFERENCES

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