140401-AB

Committente (Customer):

Ecodesign for Power Cables in Indoor Electrical Installations

Progetto (Project):

Ecodesign Preparatory Study on Power Cables (ENTR Lot 8)

Oggetto (Object):

PROPOSAL FOR THE DEFINITION OF POTENTIAL APPROACHES TO BE ADOPTED IN A POTENTIAL REGULATION ON CABLE SIZING

Preparato (Prepared):

Approvato (Approved):

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1. INTRODUCTION

The scope of this document is to present a couple of original potential approaches useful to regulate the energy performance of power cables in the context of the Ecodesign Directive 2009/125/EC.

At the end of the document some minor comments to the current revision of the preparatory study are also provided.

2. BACKGROUND

The Ecodesign Directive 2009/125/EC establishes a framework for the setting of ecodesign requirements for energy-related products with the aims

- of developing a policy to foster environmental and energy efficient products in the European market
- of ensuring the free movement of those products within the internal market.

It prevents disparate national legislations on the environmental performance of these products from becoming obstacles to the intra-EU trade and contributes to sustainable development by increasing energy efficiency and the level of protection of the environment, taking into account the whole life cycle cost.
The Ecodesign directive does not set binding requirements on products by itself but it provides the framework (rules and criteria) for setting such binding requirements through 'Implementing Measures'. It is also possible to introduce information requirements for components and sub-assemblies.

Power cables are listed among the product groups identified in the Working Plan 2012-14 Ecodesign Directive 2009/125/EC but they need to be defined exactly.

Product grouping, i.e. the exact definition of products to be included in a study or a measure, plays a very important role in the whole of the preparatory studies during the design of legislation.

The spirit of the Directive is to regulate products manufacturers side, however, the energy saving potential is in the installation for its intended use, not in the products used (cables) themselves.

The possibility to define a conventional index representing on the energy performance of the product should be useful to the need to regulate the market acting at manufacturer side[1] and could be also a transitional approach to move in the direction of more strict regulatory mechanism in the future.

Alternatively the adoption at least of a meaningful informative but synthetic data set accompanying the product seems to be a good compromise to start to approach power cables in the context under examination.

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1 To face the complexity introduced by functional performance approach, the document MEErP 2011 Methodology, among the others, mention that in the case of integrated and modular products (in the case under examination cables and lines) representing almost all the market, the requirements can be set for the modules only.
Regulation of the complete "product" (the line in the case under examination), built from individual modules placed on the market, should then take place through (non-Ecodesign) legislation that regulates the products
- at the level of combinations offered by the installer/retailer (the so-called installer label),
- at the level of (building) permits (e.g. EPBD),
- after installation (e.g. EPBD certification, operating permits).

3. PRODUCT VS INSTALLATION APPROACHES

In the field under examination and in the perspective of cable energy performance there is an underlying issue on the product vs installation regulatory approach. A definition and a number of principles apply to each category.

The dualism is between:

- a product, i.e. the cable with a given section and number of cores but without any given length
- an electrical line made with one or more cables to carry a given current over a given length for a given time in a given place. A line is an electrical installation[2] and is not a product or a part of a product.

Obviously for a given cable, at a given voltage and in given conditions, losses in a cable line depend on the length of the line i.e. a parameter of the electrical installation and not at all in the end of the cable manufacturer.

3.1. Installation approach

The installation approach seems to be the simplest way to face the energy performance issue of power cables (i.e. of electrical lines manufactured using power cables) but:

- Installation characteristics are managed by users while cable characteristics are managed by manufactures
- European Regulations related to ErP have to regulate the market acting at manufacturer side
- Market regulation acting at user side for example by way of EPBD could be much less effective than ErP Regulations as its application remains at national level and is often transposed in a very mild way that prevent savings happening.

3.2. Product approach

The product approach is closer to the need to regulate the market acting at manufacturer side[3] but shows some difficulties of definitions.

4. PROPOSALS OF POSSIBILE ORIGINAL APPROACHES FOR CABLE REGULATION WITHIN THE ECODESIGN FRAMEWORK

This paragraph presents two original basic concepts potentially useful to regulate energy performances of power cable within the Ecodesign framework.
Both approaches are intended to avoid shifting the regulation of cable energy performances to user side:

- The first one consists in suggesting an original index representing conventionally the cable energy performance without any reference to the length of the line and the size of the cable (cross-section);
- The second approach allows to take into account the length of the cable (i.e. of the line) working on the concept of the product.

[2] Let's neglect for the moment on board electrical lines for mobile application (like on board electrical installations on product like cars, trains, ships, electrical appliances in general).

[3] To face the complexity introduced by functional performance approach, the document MEErP 2011 Methodology, among the others, mention that in the case of integrated and modular products (in the case under examination cables and lines) representing almost all the market, the requirements can be set for the modules only.
Regulation of the complete "product" (the line in the case under examination), built from individual modules placed on the market, should then take place through (non-Ecodesign) legislation that regulates the products
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4.1. Cable energy performance index

The direct definition of the power cable energy performance as a product is difficult because the manufacturer has no knowledge about:

- The length
- The voltage or the power

of the line that will use it (the power cable) for the intended use.

An option to solve this issue could be to express the energy performance of the cable by an index (here referred as EPI - Energy Performance Index) based on the ratio between the losses per unit of length and the rated current at given conditions:

$$= \cdot = ( )$$

Where:

- $\dot{t}$ are the losses per unit of length
- I is the rated current of the cable in the reference condition
- R is the electrical resistance of the cable in the same reference condition

The basic reference condition should consist in:

- a basic* temperature
- a basic* installation method

i.e. a temperature and an installation method allowed by all types of cables, for example 40°C, free air.

Losses per unit of length of each cable could be calculated using the actual existing method and equations available in the standards:

- IEC 60287-1-1, Electric cables – Calculation of the current rating – Part 1-1: Current rating equations (100 % load factor) and calculation of losses – General
- IEC 60287-2-1, Electric cables – Calculation of the current rating – Part 2-1: Thermal resistance – Calculation of thermal resistance
- IEC 60853 (all parts), Calculation of the cyclic and emergency current rating of cables
- 4th new criteria : energy loss limitation. Current rating limited depending on intended use. There would be pre-defined values per installation type (industry, hotels, offices, etc) and per use (lighting, power, other).

As well as any other method also referred to other unknown technology.

With such approach:

- the energy performance of the cable at reference installation conditions[4] would be based only on the data available to the cable manufacturer at product design stage and could be managed in the way already standardized for managing deviations in the environmental temperature, solar radiation, proximity etc..
- once defined the maximum allowable value of the losses per unit length (W/(Am)) in the standard conditions, any future mandatory MEPS for power cables could be expressed re-defining maximum EPI
- the rating currents for cyclic currents could be defined and declared by the cable manufacturer for given standard and unified working cycles
- having standardized and unified working cycle, if needed the eventual future MEPS could also be expressed in terms of energy losses per ampere and unit of length (Wh/(Am))
- cables with enhanced technological insulating materials would not be penalized.

Allowing a direct comparison among cables of different sections and technologies, such index seems more meaningful than simple DC resistance.

[4] According to the method prescribed in the current standards.

4.2. Sized cable approach

In this proposed approach the regulated product is nor the electrical installation (because definitely the installed circuit is not a product) nor the cable in the package of the original manufacturer but the cable already cut ready to be installed, or in other terms the electrical circuit floating in the air just before being installed (i.e. the cut piece of cable or in other terms the sized cable)[5].

Practically this approach introduce two levels of manufacturers:

- The original one i.e. the company manufacturing cables in standard lengths (the companies actually classified as cable manufactures) – not regulated
- The manufactures of the sized cables i.e. typically the installers (not in the act of installation but in the act of cutting/sizing the cable) – regulated

An analogy could help in understanding this approach:

- Let's imagine we want to regulate thermal insulation performances of a piece of clothing
- Cables are like tissues, installers are like tailors
- Cut pieces of cable (sized cables) are equivalent to suits
- Tissues as well as suits are products, but the regulated product is not the tissue, the regulated products are the tissues cut and put together into a suit
- Obligations are set on tailors (installers) and not on tissues manufactures (cable makers)
- The installer, as well as the tailor, is the manufacturer of the final product

5. MINOR COMMENTS ON THE CURRENT RELEASE OF THE PREPARATORY STUDY

Ref. 7.1.2.1.1 Policy measures at product level by a generic ecodesign requirements on information

[...] On the package and sales websites:

- Cable losses per kilometer (VA/kilometer) at 50 % and 100% of the maximum current-carrying capacity of the cable in open air;
- Indication of the real measured DC ohmic resistance according to the compliance check as described in paragraph 7 of IEC 60228 and Annex A of the standard. The DC ohmic resistance is measured on a cable sample of at least 1 meter at a given room temperature and corrected to 20°C and a length of 1 km (R20 expressed in Ω/km).

Comments

- losses should be expressed in terms of W/km and not VA/km

- another communicative way to express/represent the DC resistance could be (W/(A km)) instead of ohm. Performing dimensional analysis it's easy to demonstrate that resistance is a loss per unit of length and per carried ampere (W/(A km)). The value is the same but it should be more meaningful for general users

[5] The installer indeed will remain responsible also of the installation (and therefore the installed circuit) but this is not argument of interest for the potential Regulation under exam.