EUROPEAN ENVIRONMENTAL CITIZENS ORGANISATION FOR STANDARDISATION
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ORGANISATION EUROPÉENNE ENVIRONNEMENTALE CITOYENNE POUR LA NORMALISATION

Preparatory study on Electric Motors and Drives (Lot 30)

Comments on Task 4+5 draft reports

March 2013

Task 4

The Introduction of Chapter 4 (p. 4) defines 8 base cases and additional base cases for motor controllers. However, **no qualified or quantified reasons for the selection of these base cases are provided**. No references to information included in Tasks 1-3 reports are made, whereas MEErP Task 4 asks for references to Task 2 defining "Base Cases" (MEErP Report p. 77): "(...) *These impacts are not just environmental, but also the commercial and economical parameters established in Task 2 should fit with the average product features established for the Base Case.*"

In the same Introduction Chapter 4 (p. 4), base case products are defined having a specific Energy Efficiency class. **No specific justification is provided why these classes have been selected as being representative for the base case group of products**. We believe this is not easy to justify, since not even in 2015 all medium motors will be IE3. The lack of market surveillance amplifies further this problem. **We therefore propose that for small, medium and large motors, IE2 is taken as the base case**. **An additional base case for IE3 (including VFD) should also be established for all three categories**.

We understand that this is work in progress and would therefore like to point out further elements that need to be added to the reports. Standard chapters as detailed in the MEErP (MEErP report 2011 p. 76) have not been yet elaborated. The entire standard chapter 4.1 "Technical product description" is missing, which should include a chapter 4.1.1 titled "Capacity Building" for non-experts, on physical processes involved in the functional performance of motors, "in particular where responsible for resource use and emissions", as well as explanations for the use of technical experts on "latest research findings and what they would imply for the future functional and environmental performance" (see MEErP Report 2011 p. 76). Only two sentences in chapter 4.3 (Use phase, p. 6) provide information which can be regarded as an introduction on physical processes involved in the product performance

The title of the Task 4 Report chapter 4.4 (Motor system electricity use, p. 8) suggests that a ´Technical product description` according to the MEErP, will be given. On the contrary, it focuses on the external conditions of the system (power and network quality), transmission, and oversizing). Although in the beginning 9 factors are listed, later only 4 of them are

discussed (see page 8), plus motor efficiency and motor speed control in the previous chapter 4.3. **Discussion of other important factors as "Maintenance practices", "Load management and cycling" as well as "Efficiency of the end-use devices" are not analysed and should be therefore included**.

Chapters listed in the MEErP report for Task 4 that have not been tackled yet are included in the bullet points below, with some further comments given below these, respectively.

- 4.2.2 Assessment of the primary scrap production:
- 4.2.5 Actual means of transport employed in shipment of components, sub-assemblies and finished products

In the Task 3 report some relevant information is included: transport distances for repair of motors in chapter 3.2 (End-of-life behaviour) under 3.2.1 (Economical Product Life) in chapter 3.2.1.3 (Soft starters) under the title "Repair and maintenance frequency" in Table 3 "Transportation Distances for motors" and Table 4 "Transportation distance for repair - VSDs" (see pages 13 and 14). Information should be included streamlined with that in Task 4 and further elaborated.

- 4.2.6 Materials flow and collection effort at end-of-life

Similarly, the Task 3 report provides three paragraphs on recycling (without data) in its chapter 3.2 (End-of-life behaviour) under 3.2.1 (Economical Product Life) in chapter 3.2.1.3 (Soft starters) under the title "Best practice in facilities dismantling" (p. 14).

- 4.2.7 Technical product life

This information is provided in Task 3 report in chapter 3.2 (End-of-life behaviour) under 3.2.1 (Economical Product Life) for three specific product groups: "Average life of induction motors, including repairs" (see page 12, table 2, also named as table 3-3).

A chapter 4.3 "Recommendations" should also be included, with the following subchapters:

- 4.3.1 refined product scope from the technical perspective (e.g. exclude special applications for niche markets)
- 4.3.2 barriers and opportunities for Ecodesign from a technical perspective
- 4.3.3 the typical design cycle for this product and thus approximately appropriate timing of measures

Data sources in Task 4

4.1 (Production phase, p. 3-5): Data on weights of motor material fractions were derived from "data provided for the previous study" on motors (Lot 11) by CEMEP (European Committee of Manufacturers of Electrical Machines and Power Electronics), "from product catalogues and input from individual manufacturers". There is no more detail or specific description of the data sources. Further information should be given concerning the data sets used for deriving average weights. No information is given, which kind of medium size motors have been considered for material weight data averages. Some of the material data of medium size motors differ significantly from data provided in Lot 11 Report (ISR- University of Coimbra, 18 February 2008) on motors of same size and same power categories (pages 67/68). Similarly, no specific information is provided regarding data sources for weights of Variable Speed Drives (Table 4.4) and 4.2 (Distribution phase, p. 5).

For all tables with bills of materials (tables 4.1, 4.2, 4.3, 4.4 - p. 4 & 5) we propose the

provision of percentage values as well.

Other issues
Concerning Table 4-11, belts have often higher losses than those indicated. Specifically for:

- multiple V-belts: Experience indicates that machines exist with 10 - 15 belts running in parallel, in which losses are much higher.
- V-belts wear out, get slack and consequently become hot. In this case the losses increase and this should be included in the report. Moreover, it should be highlighted that no belt (direct drive) is the best transmission.

Finally, when comparing LV to MV/HV, transformation losses should be included.

Task 5

Base case for small/medium/large motors
Based on our aforementioned comments, all the base cases should be IE2. Small motors have also many applications with long running hours, in the range of 6000 h/a, which should also be included. Moreover, the average life time of motors have to be increased based on real life experience. Efficient motors IE2 and IE3 run cooler, have better insulation, and less wear. They can consequently be operated for a longer period of time. This should be incorporated in the report. Regarding, lifetime of VSDs this has to be taken into account as half of that of the motor. The small motors base case should go below 0.37kW, so that the smallest size of 0.12 kW is taken into account.

Data sources in Task 5

Subtask 5.1, only refers to Task 4 regarding the information used instead of providing details on the data used for the base case calculation. It is therefore not possible to evaluate these, and more specifically assess issues such as their representativity (reflecting the current market or the criteria which formed the basis for this selection).

Chapter 5.1: For controllers, data should be included regarding Annual Energy Consumption and Total Energy Use of Stock. Hence, the basis for the calculation of Annual Energy losses and Total Energy Losses of Stock is unclear.

Chapter 5.1.5: The last sentence refers to an Annex 1 which is not indicated in the report ("*For clarity, the detailed outputs of the model are included as Annex 1.*").

Chapter 5.1.7, figures 5.4 and 5.7: There is data missing without any explanation given.

Chapter 5.2.: The statements contained in this section should be backed up by related arguments, which are currently not explained. e.g.: "*It is clear that Soft starters have only low life time energy losses*" and "*For all motors it is clearly that In-use phase dominates for each product*".

Chapter 5.3, figures 5.9 to 5.23 present percentages. **Data tables should be included, giving the actual figures, behind these, as is done with other preparatory studies**. Subtask 5.4 should also be included.

Other environmental aspects

Evaluation of environmental impacts uses broad material groups (Electrical Steel, Other Steel, Cast Iron, Aluminium, Copper, Insulation Packing, Impregnation Resin, Paint, PVC Plastic, PWB, small and large electronics). **Potentially harmful substances in broad material groups should be discussed, for example steel alloys, flame retardants in plastics, (toxic/radioactive) rare earth materials in permanent magnets**.

Recycling aspects like the problem of iron and steel scrap qualities containing contaminations disturbing the recycling process like copper (typical for motor recycling) are not tackled. However, problems of recycling have been included in the revised task 3 report in chapter 3.2 (End-of-life behaviour) under 3.2.1 (Economical Product Life) in chapter 3.2.1.3 (Soft starters) under the title "Best practice in facilities dismantling" (p. 14), mentioning a Siemens project for permanent magnet motor repair and segregation options for recycling. Description of this should be further elaborated and the sections streamlined.