Circulators

How to apply ecodesign regulations for your pumps

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Introduction

- Objective with this workshop
  - Discussion about how to apply the ecodesign regulation to circulators
  - Discussion about the relevant documents related to ecodesign requirements for circulators
  - Discussion about interpretations of the legal text
  - Show how to qualify circulators to ecodesign requirements based on the legal text and the related standards
Introduction

• Relevant Commission regulations and directives
  – Directive 2009/125/EC – framework for the setting of eco-design requirements for energy related products (ErP)
  – Commission regulation 641/2009 (EC) and 622/2012 (EC)

• Related standards
  – EN 16297 Part 1,2,3

• Europump guidelines
  – Guideline on the application of COMMISSION REGULATION 641/2009/EC and the amendment 622/2012/EC with regard to ecodesign requirements for circulators
  – Energy Efficiency of Circulators
Introduction

13.00 - 14.30  Explanation and interpretation of the legal text

14.30 – 14.50  Coffee break

14.50 - 16.15  How to qualify circulators for ecodesign requirements
               - Calculation of Energy Efficiency Index
               - How to apply the legal text and the harmonized standards
Explanation and Interpretation of the Legal Text

- Objective
  - Reduce the *environmental impact* of energy using products
  - Contributing to sustainable development
  - Security of energy supply

- Scope
  - All energy using products except vehicles for transport of persons and goods
  - Sales volume of more than 200,000 units a year within the EU
  - Have a significant environmental impact and potential for reductions
  - All energy sources
Commission regulation 641/2009 (EC)


- The regulation establishes ecodesign requirements for the placing on the market of glandless standalone circulators and glandless circulators integrated in products.

- Review of methodology for product integrated circulators should take place before January 1, 2013.
Commission regulation 622/2012 (EC)

- COMMISSION REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No 641/2009 with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products

- Amending 641/2009 (EC) – Especially with respect to definitions

- Includes the updated methodology for product integrated circulators as a result of the review.
Commission regulation 622/2012 (EC)

Definitions

For the purposes of this Regulation, the following definitions shall apply:

(1) “circulator” means an impeller pump, with or without pump housing, which has the rated hydraulic output power of between 1 W and 2 500 W and is designed for use in heating systems or in secondary circuits of cooling distribution systems;

(2) “glandless circulator” means a circulator with the rotor directly coupled to the impeller and the rotor immersed in the pumped medium;

(3) “standalone circulator” means a circulator, designed to operate independently from the product;
Commission regulation 622/2012 (EC)

(5) “circulator integrated in a product” means a circulator designed to operate as part of a product carrying at least one of the following design details:

(a) the pump housing is designed to be mounted and used inside a product;

(b) the circulator is designed to be speed controlled by the product;

(c) the circulator is designed for safety features not suitable for standalone operation (ISO IP classes);

(d) the circulator is defined as part of product approval or product CE marking;
Commission regulation 622/2012 (EC)

(4) “product” means an appliance that generates and/or transfers heat;

(6) “drinking water circulator” means a circulator specifically designed to be used in the recirculation of water intended for human consumption as defined in Article 2 of the Council Directive 98/83/EC (*);
What happens in 2013 and 2015?

• 2013 Energy Efficiency requirements
  – **From 1 January 2013**, glandless standalone circulators, with the exception of those specifically designed for primary circuits of thermal solar systems and of heat pumps, shall have an energy efficiency index (EEI) of not more than 0.27.

• 2013 Benchmark level
  – From **2013** the benchmark for the best available technology on the market for circulators is EEI ≤ 0.20. Please note that this is NOT an energy efficiency requirement but a benchmark, or indicative, level.

• 2015 Energy Efficiency requirements
  – From **1 August 2015**, glandless standalone circulators and glandless circulators integrated in products shall have an energy efficiency index (EEI) of not more than 0.23.
Time table and EEI requirements

- **Standalone circulators**
  - Heating and cooling systems
  - No EEI-requirements until 1.1.2013
  - EEI ≤ 0.27 from 1.1.2013
  - EEI ≤ 0.23 from 1.8.2015

- **Circulators integrated in a product**
  - New installed products
  - No EEI-requirements until 1.8.2015
  - EEI ≤ 0.23 from 1.8.2015

- **Circulators integrated in a product**
  - Replacement case
  - No EEI-requirements until 1.1.2020
  - EEI ≤ 0.23 from 1.1.2020

07/03/2013
Product information requirements

From 1 January 2013:

a) the energy efficiency index of standalone circulators calculated in accordance with Annex II, shall be indicated on the name plate and packaging of the standalone circulator and in the technical documentation of the standalone circulator as follows: “EEI ≤ 0,\([xx]\)”; 

b) the following information shall be provided on standalone circulators and on circulators integrated in products: “The benchmark for the most efficient circulators is EEI ≤ 0,20.”;

c) information concerning disassembly, recycling, or disposal at end-of-life of components and materials, shall be made available for treatment facilities on standalone circulators and on circulators integrated in products;
Product information requirements

From 1 January 2013 continued:

d) for drinking water circulators, the following information shall be provided on the packaging and in the documentation: “This circulator is suitable for drinking water only”;

e) for circulators integrated in products and placed on the market no later than 1 January 2020 as replacement for identical circulators integrated in products and placed on the market no later than 1 August 2015, the replacement product or its packaging shall clearly indicate the product(s) for which it is intended.

• Manufacturers shall provide information on how to install, use and maintain the circulator in order to minimise its impact on the environment.

• The information listed above shall be visibly displayed on freely accessible websites of the circulator manufacturer.
Product information requirements

From 1 August 2015

- for circulators integrated in products, the energy efficiency index calculated in accordance with Annex II, shall be indicated on the name plate of the circulator and in the technical documentation of the product as follows: “EEI ≤ 0,[xx]”;
In March 2005 ‘Europump’ launched the voluntary industry commitment to improve the energy performance of stand-alone circulators.

... the voluntary industry commitment will finish by the end of 2012.
The regulation establishes ecodesign requirements for the placing on the market of:
1. glandless standalone circulators
2. glandless circulators integrated in products

**Scope:**
Glandless circulators with a rated hydraulic output power between 1 W and 2500 W and designed for use in heating systems or in secondary circuits of cooling distribution systems.

**EEI → Energy Efficiency Index**

The EEI is an indicator for the efficiency of the circulator and has to be marked on the name plate.

\[
\text{EEI} \leq 0.27
\]
Example: Energy consumption*) of typical circulators

Comparison:
- High Efficiency Variable Speed Circulator with EEI 0,25
- “Old Standard Fixed Speed Circulator” and B-class label
- “Old Standard Variable Speed Circulator” and C-class label

*) assuming the standardized load profile for circulators in heating systems

Note:
Old Standard circulators use up to 3-times more electrical energy than modern High efficiency circulators!
“Cut off” of circulators due to legislation

EEI = 0.27 in 2013
EEI = 0.23 in 2015

Source: Europump, 2009
Ecodesign - Circulators

Circulators

Circulators


Europump has prepared a presentation (click here to download) to explain the core content of the regulation for circulators. It explains the Energy Efficiency Index (EEI) and what this means for circulators. It gives definitions and calculation method for the EEI, and explains the difference between “Standalone” circulators and those “Integrated in a product.”
Europump guideline on the application of ecodesign requirements for circulators
Ecodesign - Circulators

Guides and Guidelines

JUST RELEASED Guideline on the application of Commission Regulation 841/2009/EC and the amendment 622/2012/EC with regard to ecodesign requirements for circulators, October 2012

The aim of this guideline is to clarify possible questions when implementing the ecodesign requirements for circulators.

Click here to download the Guideline
Europump guideline on the application of ecodesign requirements for circulators

• **Placing on the market:**
  – Making an EuP/ErP available for the first time on the Community market with a view to its distribution or use within the Community whether for reward or free of charge and irrespective of the selling technique. (*EuP/ErP directive*)

  – Placing on the market is considered not to take place where a product is: transferred to a manufacturer for further measures (for example assembling, packaging, processing or labelling); *(New Approach and the Global Approach (Blue guide, 2000))**
Europump guideline on the application of ecodesign requirements for circulators

• **Placing on the market:**
  – A circulator sold to an OEM customer for integration into a product (i.e. boiler, heat pumps etc.) is **not** placed on the market.

  – A circulator integrated into a product is placed on the market when the product is placed on the market.
Europump guideline on the application of ecodesign requirements for circulators

• CE marking and declaration of conformity:
  – Circulators in scope of this commission regulation cannot be CE marked if they do not fulfill the ecodesign requirements.
  
  – Circulators out of scope of this commission regulation can be CE marked if they fulfill other directives.
  
  – Circulators out of scope of this commission regulation except for the product information requirement (i.e. drinking water circulators and spare part circulators for integration in products) can be CE marked without reference to this commission regulation, if they fulfill other directives.
Europump guideline on the application of ecodesign requirements for circulators

• Circulators in scope:
  – Is independent of the application
  – Follows the scope of the EuP/ErP directive.
  – This means that circulators in all application except transportation (ships, trains etc.) are covered.
Europump guideline on the application of ecodesign requirements for circulators

- **Standalone circulators for Solar and heat applications:**
  - Standalone circulators specifically designed for primary circuits of thermal solar systems and of heat pumps are exempted from the energy efficiency requirements until August 1, 2015.

  - Europump interprets the intension of the legal text such that an **EEI** should not be indicated on the name plate and in the technical documentation for these circulators before the requirements comes into force.

  - Europump recommends to clearly indicate these types of circulators for their specific application.
Europump guideline on the application of ecodesign requirements for circulators

• **Specific speed correction:**
  – For circulators integrated in products and specifically designed for primary circuits of thermal solar systems and for heat pumps the EEI calculation includes a correction for specific speed.
  
  – This correction does not comprise standalone circulators in these applications.
Europump guideline on the application of ecodesign requirements for circulators

• **Benchmark value**
  – Europump interprets the intension of the legal text in (Amendment, Annex I, 2. (b) such that the Benchmark should be in the documentation of the pump not on the pump itself

• **Reference to standard EN16297**
  – The EEI value on the name plate should be followed by an indication of which part of EN16297 that was applied for the determination of EEI i.e ‘EEI < 0.23 – PART2’
How to qualify circulators for ecodesign requirements
Harmonized EN standards

• The methodology for calculating the Energy Efficiency Index (EEI) of circulators is described in Annex III of Commission regulation 622/2012 (EC) and is applied by using the following standards which will be harmonized with this legislation

  – **PrEN 16297-1** Pumps — Rotodynamic pumps – Glandless circulators — Part 1: **General requirements** and procedures for testing and calculation of energy efficiency index (EEI)

  – **PrEN 16297-2** Pumps — Rotodynamic pumps – Glandless circulators — Part 2: Calculation of energy efficiency index (EEI) for **standalone circulators**

  – **PrEN 16297-3** Pumps — Rotodynamic pumps – Glandless circulators — Part 3: Energy efficiency index (EEI) for **circulators integrated in products**
Definitions and calculation method for the EEI

\[
\text{EEI} = \frac{P_{L,\text{avg}}}{P_{\text{ref}}} \quad C_{20\%}
\]

where is ...

- \( P_{L,\text{avg}} \): weighted average electrical input power of the relevant circulator (considering standardized load profile having 4 operating points and reference pressure control curve)

- \( P_{\text{ref}} \): Reference power
  - is the average input power of circulators having the same hydraulic output power as the relevant circulator

- \( C_{20\%} \): “Calibration factor“ = 0,49
  - the calibration factor - fixed by the legislation – ensures that only 20% of a certain type have an EEI \( \leq 0,20 \) (Benchmark)
Definitions and calculation method for the EEI

\[
EEI = \frac{P_{L,avg}}{P_{ref}} \cdot C_{20\%}
\]

This formula is valid for ...

a) ‘Standalone circulators’
b) ‘circulators integrated in products’

Exception:
EEI for ‘Circulators integrated in products’ designed for primary circuits of thermal solar systems and for heat pumps has to be calculated as:

\[
EEI = \frac{P_{L,avg}}{P_{ref}} \cdot C_{20\%} \left( 1 - e^{-3.8 \left( \frac{n_q}{30} \right)^{1.36}} \right)
\]

where is ... \( n_q = \) specific speed
Circulators with or without pump housing

- Standalone circulators with pump housing shall be measured as a complete unit;

- Standalone circulators without pump housing shall be measured with pump housing identical to the pump housing in which they are intended to be used;

- Circulators integrated in products shall be dismantled from the product and measured with a reference pump housing;

- Circulators without pump housing intended to be integrated in a product shall be measured with a reference pump housing;

- where “reference pump housing” means a pump housing supplied by the manufacturer with inlet and outlet ports on the same axis and designed to be connected to the pipework of a heating system or secondary circuit of a cooling distribution system.
Definitions and calculation steps

1. Measurement of max. hydraulic curve
   - head “H” (in metres)
   - flow “Q” (in m³/h)

2. find the point where Q x H is maximum
   - head at this point is called $H_{100\%}$
   - flow at this point is called $Q_{100\%}$

3. Calculation of maximum hydraulic power $P_{hyd}$
   - $P_{hyd} = Q_{100\%} \times H_{100\%} \times 2.72$
4. Calculation of reference power $P_{\text{ref}}$

$$P_{\text{ref}} = 1.7 \times P_{\text{hyd}} + 17 \times (1 - e^{-0.3 \times P_{\text{hyd}}}) \quad 1 \text{ Watt} \leq P_{\text{hyd}} \leq 2500 \text{ Watt}$$

$P_{\text{ref}}$ is the average input power of real existing high efficiency circulators determined in 2008 by Technical University Darmstadt (TU Darmstadt)

5. Definition of reference control curve

![Reference control curve diagram]
6. Select a setting of the circulator ensuring that on the selected curve the circulator reaches the operating point $Q \times H = \text{max}$
7. Measurement of the circulator

- 4 operating points: $Q_{100\%}$, $Q_{75\%}$, $Q_{50\%}$ and $Q_{25\%}$
- Measuring $H$ and electrical power $P_1$ at these points
8. Interpretation and Calculation

- measured values of head and power are called $H_{\text{meas}}$ and $P_{1,\text{meas}}$
- the head on the reference control curve at the different flows is called $H_{\text{ref}}$

... if $H_{\text{meas}} > H_{\text{ref}}$ then $P_L = P_{1,\text{meas}}$

... otherwise $P_L = \frac{H_{\text{ref}}}{H_{1,\text{meas}}} P_{1,\text{meas}}$
9. Calculation of the weighted average power $P_{\text{avg}}$ by use of part load profile

$$P_{L,\text{avg}} = 0.06 \ P_{L,100\%} + 0.15 \ P_{L,75\%} + 0.35 \ P_{L,50\%} + 0.44 \ P_{L,25\%}$$
10. Calculation of EEI

\[
EEI = \frac{P_{L,\text{avg}}}{P_{\text{ref}}} \cdot C_{20%}
\]

where \( C_{20\%} = 0.49 \) is the calibration factor \( C_{20\%} \) - fixed by the legislation – ensures that only 20% of a certain type have an EEI \( \leq 0.20 \) (Benchmark)

**Exception:**

EEI for ‘*Circulators integrated in products*’ designed for primary circuits of thermal solar systems and for heat pumps has to be calculated as:

\[
EEI = \frac{P_{L,\text{avg}}}{P_{\text{ref}}} \cdot C_{20\%} \left( 1 - e^{-3.8 \left( \frac{n_q}{30} \right)^{1.36}} \right)
\]

where \( n_q \) = the specific speed defined as

\[
n_q = \frac{n_{100\%}}{60} \cdot \frac{\sqrt{Q_{100\%}}}{H_{100\%}^{0.75}}
\]

\( n_{100\%} \) is rotational speed in r.p.m. in this instance defined at \( Q_{100\%} \) and \( H_{100\%} \).