SLOVENSKI STANDARD
SIST EN 16297-3:2013

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Črpalke - Centrifugalne črpalke - Obtočne črpalke - 3. del: Indeks energijske učinkovitosti (EEI) za vgrajene obtočne črpalke

Pumps - Rotodynamic pumps - Glandless circulators - Part 3: Energy efficiency index (EEI) for circulators integrated in products

Pumpen - Kreiselpumpen - Umwälzpumpen in Nassläuferbauart - Teil 3: Berechnung des Energieeffizienzindexes (EEI) von in Produkte integrierten Umwälzpumpen

Pompes - Pompes rotodynamiques - Circulateurs sans presse-étoupe - Partie 3: Calcul de l'indice d'efficacité énergétique (IEE) pour les circulateurs intégrés dans des produits

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Pumps - Rotodynamic pumps - Glandless circulators - Part 3: Energy efficiency index (EEI) for circulators integrated in products

Pompes - Pompes rotodynamiques - Circulateurs sans presse-étoupe - Partie 3: Calcul de l'indice d'efficacité énergétique (EEI) pour les circulateurs intégrés dans des produits

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Foreword

This document (EN 16297-3:2012) has been prepared by Technical Committee CEN/TC 197 “Pumps”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.

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For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

EN 16297 consists of the following parts under the general title *Pumps — Rotodynamic pumps —Glandless circulators*:

— Part 1: General requirements and procedures for testing and calculation of energy efficiency index (EEI);

— Part 2: Calculation of energy efficiency index (EEI) for standalone circulators;

— Part 3: Energy efficiency index (EEI) for circulators integrated in products.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European Standard has been prepared under mandate M/469 EN of 22 June 2010 given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Requirements of the EU Directive 2005/32/EC of 6 July 2005 and Commission Regulation (EC) 641/2009 of 22 July 2009 by describing procedures for measurement and calculation of hydraulic power, power consumption, and energy efficiency index of

1 Scope

This European Standard specifies the procedure for calculating the energy efficiency index (EEI) of circulators integrated in products.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 809:1998+A1:2009, *Pumps and pump units for liquids – Common safety requirements*

EN 16297-1:2012, *Pumps – Rotodynamic pumps – Glandless circulators – Part 1: General requirements and procedures for testing and calculation of energy efficiency index (EEI)*

EN 60335-2-51:2003, *Household and similar electrical appliances – Safety – Part 2-51: Particular requirements for stationary circulation pumps for heating and service water installations*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN 16297-1:2012 and the following apply.

3.1
circulators integrated in products
circulator designed to operate dependently of a product that generates and/or transfers heat

Note 1 to entry For the purpose of this document, the term **circulator** is used in the following in place of circulators integrated in products

3.2
specific speed of a circulator
dimensionless quantity used to classify pump impellers as to their type and proportions

Note 1 to entry Specific speed of a circulator is calculated by:

$$n_s = \frac{n}{60} \times \frac{\sqrt{Q}}{H^{0,75}}$$

where:

n_s is specific speed of a circulator

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

Q is flow rate in this instance defined as $Q_{100\%}$ (see also EN 16297-1)

H is Head in this instance defined as $H_{100\%}$ (see also EN 16297-1)

Note 2 to entry $n_{100\%}$ is determined by linear interpolation of speeds around $Q_{100\%}$ and $H_{100\%}$

3.3
inline pump housing
pump housing where inlet and outlet are on the same axis

4 Symbols and units

For the purpose of this document, the symbols, quantities and units given in Table 1 of EN 16297-1:2012 apply.

5 Performance requirements and safety requirements

The requirements of EN 16297-1, EN 809 and EN 60335-2-51 apply.

6 Calculation of energy efficiency index (EEI)

6.1 General conditions

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.

6.2 Procedure

6.2.1 Load profile for calculation of average compensated power input, P_{Lavg}

The load profile for circulators integrated in products is shown in Table 1.

Table 1 – Load profile for calculation of average compensated power input, $P_{L,avg}$

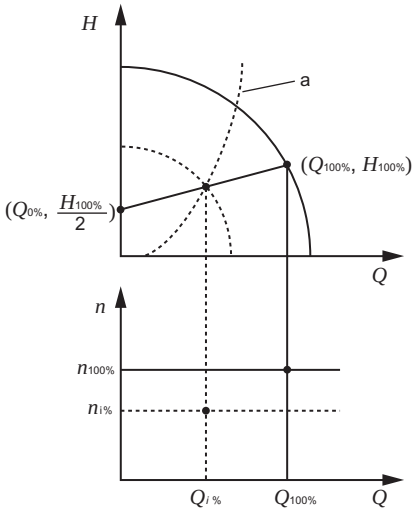
Q in % of $Q_{100\%}$	Time in % of annual operating hours
100	L_1 = 6
75	L_2 = 15
50	L_3 = 35
25	L_4 = 44

6.2.2 Part load points of circulators integrated in products

Part load operating points are measured by using following procedure:

a) Calculate H_{ref} at each part load point on the reference control curve (see Figure 4 in EN 16297-1:2012).

b) If a circulator has a differential pressure control mode then follow the procedure specified in EN 16297-2. Otherwise the system curve and speed of the circulator by using the communication interface for external signals (defined by the manufacturer) to meet the part load points Figure 1.



Key
a system curve

Figure 1 — Part load point

6.2.3 Test conditions

6.2.3.1 Signal generator for external signals

The speed is changed via an external signal. A signal specification and/or signal generator can be required from the circulator manufacturer.

6.2.4 Calculation of average compensated power input, $P_{L,avg}$

The average compensated power input, $P_{L,avg}$, is calculated as:

$$P_{L,avg} = L_1 \times P_{L,100\%} + L_2 \times P_{L,75\%} + L_3 \times P_{L,50\%} + L_4 \times P_{L,25\%}$$
$$= 0,06 \times P_{L,100\%} + 0,15 \times P_{L,75\%} + 0,35 \times P_{L,50\%} + 0,44 \times P_{L,25\%}$$

6.2.5 Calculation of energy efficiency index (EEI), ε_{EEI}

For product integrated circulators, the energy efficiency index (EEI), ε_{EEI}, is calculated as:

$$\varepsilon_{EEI} = \frac{P_{L,avg}}{P_{ref}} \times C_{20\%} = \frac{P_{L,avg}}{P_{ref}} \times 0,49$$

except for circulators integrated in products designed for primary circuits for thermal solar systems and for heat pumps where the energy efficiency index (EEI), ε_{EEI}, is calculated as:

$$\varepsilon_{EEI} = \frac{P_{L,avg}}{P_{ref}} \times C_{20\%} \times \left(1 - e^{\left(-3,8 \times \left(\frac{n_s}{30}\right)^{1,36}\right)}\right) = \frac{P_{L,avg}}{P_{ref}} \times 0,49 \times \left(1 - e^{\left(-3,8 \times \left(\frac{n_s}{30}\right)^{1,36}\right)}\right)$$

It is permissible to substitute the parameter ε_{EEI} by the abbreviation EEI in data sheets, manuals, leaflets, brochures etc.