SLOVENSKI STANDARD
SIST EN 16297-1:2013

01-maj-2013

Nadomešča:
SIST EN 1151-1:2007
SIST EN 1151-1:2007/AC:2008

Črpalke - Centrifugalne črpalke - Obtočne črpalke - 1. del: Splošne zahteve in postopki za preskus in izračun indeksa energijske učinkovitosti (EEI)

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

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Pumpen - Kreiselpumpen - Umwälzpumpen in Nassläuferbauart - Teil 1: Allgemeine Anforderungen und Verfahren zur Prüfung und Berechnung des Energieeffizienzindexes (EEI)

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Pompes - Pompes rotodynamiques - Circulateurs sans presse-étoupe - Partie 1: Exigences générales et procédures pour les essais et le calcul de l'indice d'efficacité énergétique (IEE)

Ta slovenski standard je istoveten z: **EN 16297-1:2012**

ICS:

23.080	Črpalke	Pumps

SIST EN 16297-1:2013 **en,fr**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16297-1

October 2012

ICS 23.080

Supersedes EN 1151-1:2006

English Version

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

Pompes - Pompes rotodynamiques - Circulateurs sans presse-étoupe - Partie 1: Exigences générales et procédures pour les essais et le calcul de l'indice d'efficacité énergétique (IEE)

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This European Standard was approved by CEN on 18 August 2012.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Ref. No. EN 16297-1:2012: E

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Foreword

This document (EN 16297-1:2012) 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document, together with EN 16297-2:2012, supersedes EN 1151-1:2006.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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*:

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— 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;

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— 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.

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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 circulators.

The document comprises standalone circulators and circulators integrated in products.

NOTE For the purpose of this document, the term "product" is used in the sense of an appliance that generates and/or transfers heat.

Standalone circulator means a circulator designed to operate *independently* from the product and should be tested and calculated in accordance with EN 16297-2.

Circulator integrated in a product means a circulator designed to operate *dependently* of the products and should be tested and calculated in accordance with EN 16297-3.

The following table can be used as guidance for deciding when EN 16297-3 applies. A circulator is considered to be operated dependently if it carries at least one of the design details listed in Table 1.

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Table 1 — When EN 16297-3 applies

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Design	Details	Examples (non exhaustive list)
Pump housing	Designed to be mounted and used inside a product	Housings designed for use inside products e.g. with clip connections, with back panel connection or plate heat exchanger connections.
		Housings integrating electrically or thermally driven valve functions
Control	Designed to be speed controlled by the product	Circulators with product specific control signal interfaces
Safety measures	Designed with safety features not suitable for stand alone operation	Product takes over safety features (ISO IP classes)
	Circulator is a defined part of product approval or product CE marking	Circulator is part of the component list of product approval or product CE marking

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1 Scope

This European Standard specifies general performance requirements and general requirements and procedures for testing and calculation of the energy efficiency index (EEI) for glandless circulators having a rated hydraulic output power of between 1 W and 2500 W designed for use in heating systems or cooling distribution systems.

All known hazards which are likely to occur at normal installation and operation are covered by the European Standards EN 809 and EN 60335-2-51.

As regards safety for electro-technical parts of circulators, EN 60335-2-51 applies.

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 1151-2:2006 *Pumps — Rotodynamic pumps — Circulation pumps having a rated power input not exceeding 200 W for heating installations and domestic hot water installations — Noise test code (vibro-acoustics) for measuring structure- and fluid-borne noise*

EN 50160:2007, *Voltage characteristics of electricity supplied by public distribution networks*

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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*

EN ISO 9906:2012*, Rotodynamic pumps — Hydraulic performance acceptance tests – Grades 1, 2 and 3 (ISO 9906:2012)*

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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
heating system
system where heat is generated and/or transferred

3.2
cooling distribution system
system where a cooling medium is distributed

3.3
impeller pump
machine to transfer mechanical energy through a rotating impeller to gain velocity and pressure for the pumped liquid

3.4
pump housing
part of an **impeller pump** (3.3) which is connected to the pipework of the **heating system** (3.1) or **cooling distribution system** (3.2)

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3.5
circulator
impeller pump **with or without pump housing** (3.4) designed for use in **heating systems** (3.1) or **cooling distribution systems** (3.2)

3.6
glandless circulator
circulator (3.5) with the rotor directly coupled to the impeller and immersed in the pumped medium

Note 1 to entry: For the purpose of this document, the term **circulator** is used in the following in place of **glandless circulator**.

3.7
double circulator
double pump
twin head pump
two **circulators** (3.5) mounted on a single **pump housing** (3.4) with two volutes

3.8
inlet pressure (static pressure)
pressure at the pump inlet to which the pump is subjected during operation

Note 1 to entry: All pressures in this document are gauge pressures except for the **differential pressure** (3.9) measured in 6.2.10.4.2.

3.9
differential pressure
gain in pressure between the pump inlet and pump outlet

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3.10
maximum outlet working pressure
sum of maximum **inlet pressure** (3.8) and maximum **differential pressure** (3.9)

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3.11
hydraulic power
conventional expression of the arithmetic product of the flow, Q, the head, H, and a constant

Note 1 to entry For the purpose of this document, the **hydraulic power** is expressed by:

$$P_{hyd} = 2{,}72 \times Q \times H$$

where:

P_{hyd} is the hydraulic power [W]

Q is the flow [m³/h]

H is the differential head [m]

2,72 is the conversion factor assuming water temperature 20 °C and gravity of 9,81 m/s^2

3.12
rated hydraulic output power
$P_{hyd,r}$
hydraulic power generated by a circulator in maximum setting where the hydraulic power is maximum

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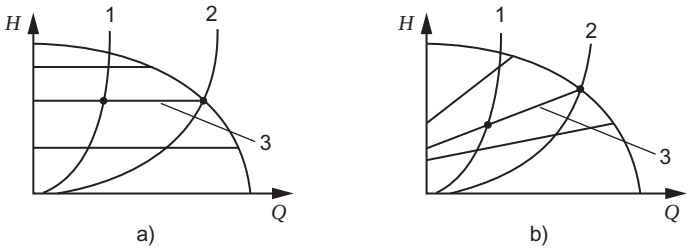
3.13
system curve
graphical representation of the sum of the static head and the friction loss due to flow of fluid through the system

3.14
control curve
graphical representation of relationship between flow and head (H = f(Q)), obtained by changing the speed of the motor automatically depending on the load

Note 1 to entry: For pumps with multiple control curves, the applicable curve is selected depending on the heating system.

Note 2 to entry: Examples of control curves are shown in Figure 1.



Key
a) Constant pressure control
b) Variable pressure control
1 Part load
2 Full load
3 Control curve

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NOTE The "Dots" shows the **operating points** (3.19) at full load and part load operation.

Figure 1 — Control curve examples

3.15
non-control curve
graphical representation of relationship between flow and head (H = f(Q)), obtained by non-automatic operation of the pump at different loads

3.16
maximum setting
curve, which gives the maximum **rated hydraulic output power** (3.12)

Note 1 to entry: This curve could be either a **control curve** (3.14) or a **non-control curve** (3.15) if that exists.

3.17
reference control curve
theoretical **control curve** (3.14) used for standardised measurements and calculation of **compensated power input** (3.20)

3.18
load profile
relationship between flow and relative running time of the **circulator** (3.5)

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3.19
operating point
point in the Q-H plane characterizing the intersection between a **system curve** (3.13) and either a **control curve** (3.14) or a **non-control curve** (3.15)

EXAMPLE $(Q_{100\%}, H_{100\%})$ is the operating point where hydraulic power is maximum.

3.20
compensated power input
calculated power, compensating for deviations between measured head values and head values on the **reference control curve** (3.17)

3.21
averaged compensated power input
$P_{L,avg}$
compensated power input (3.20) weighted on the **load profile** (3.18)

3.22
reference power input
P_{ref}
relation between hydraulic power and the power consumption of the circulator and is described by a function of hydraulic power ($P_{ref} = f(P_{hyd})$)

3.23
energy efficiency index (EEI)
η_{EEI}
ratio between **reference power input** (3.22) and the **average compensated power input** (3.21) multiplied by a factor

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4 Symbols and units

For the purpose of this document, the symbols, quantities and units given in Table 2 apply.

Table 2 — Symbols and units

Symbol	Quantity	Unit
g	Acceleration due to gravity	m/s^2
H	Head (water gauge)	m
H_{meas}	Measured head (water gauge)	m
H_{calc}	Calculated head (water gauge)	m
H_{ref}	Reference head (water gauge)	m
$H_{100\%}$	Head (water gauge) at maximum hydraulic power	m
P_1	Power input	W
P_L	Compensated power input	W
$P_{L,avg}$	Average compensated power input	W
$P_{1,\ meas}$	Measured power input	W
P_{hyd}	Hydraulic power	W
$P_{hyd,r}$	Rated hydraulic power	W
P_{ref}	Reference power input	W
p	Pressure	bar
$p_{1max\ o}$	Maximum inlet pressure	bar
p_{1-2}	Differential pressure	Pa
$p_{2max\ o}$	Maximum outlet working pressure	bar
Q	Flow rate	m^3/h
$Q_{100\%}$	Flow rate at rated hydraulic power	m^3/h
T	Temperature	°C
T_F	Fluid temperature at inlet port	°C
v	Average velocity of water	m/s
ρ	Density	kg/m^3
L_x	Time in % of annual operating hours	%
n_s	Specific speed of a circulator	$minute^{-1}$
n	Rotational speed	$minute^{-1}$
$C_{xx\%}$	Calibration factor	-
ε_{EEI}	Energy efficiency index (EEI)	-

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5 Performance requirements and safety requirements

5.1 Hydraulic characteristics

5.1.1 General

The hydraulic characteristics of the circulator shall be in accordance with the data published by the manufacturer (see 6.2 for testing). Maximum permissible distances between $H_{100\%}$ and published curves according to the rated power input are given in Table 3.