



NSAI
Standards

Irish Standard
I.S. EN 17038-2:2019&AC:2020&AC:2021

Pumps - Methods of qualification and verification of the Energy Efficiency Index for rotodynamic pump units - Part 2: Testing and calculation of Energy Efficiency Index (EEI) of single pump units

I.S. EN 17038-2:2019&AC:2020&AC:2021

Incorporating amendments/corrigenda/National Annexes issued since publication:

EN 17038-2:2019/AC:2020
EN 17038-2:2019/AC:2021

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on:

EN 17038-2:2019

Published:

2019-05-08

This document was published under the authority of the NSAI and comes into effect on:

2021-10-31

ICS number:

23.080

NOTE: If blank see CEN/CENELEC cover page

NSAI
1 Swift Square,
Northwood, Santry
Dublin 9

T +353 1 807 3800
F +353 1 807 3838
E standards@nsai.ie
W NSAI.ie

Sales:
T +353 1 857 6730
F +353 1 857 6729
W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

National Foreword

I.S. EN 17038-2:2019&AC:2020&AC:2021 is the adopted Irish version of the European Document EN 17038-2:2019, Pumps - Methods of qualification and verification of the Energy Efficiency Index for rotodynamic pump units - Part 2: Testing and calculation of Energy Efficiency Index (EEI) of single pump units

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

For relationships with other publications refer to the NSAI web store.

Compliance with this document does not of itself confer immunity from legal obligations.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document.

This page is intentionally left blank

EUROPEAN STANDARD

EN 17038-2:2019/AC

NORME EUROPÉENNE

October 2021

EUROPÄISCHE NORM

ICS 23.080

English version

Pumps - Methods of qualification and verification of the Energy Efficiency Index for rotodynamic pump units - Part 2: Testing and calculation of Energy Efficiency Index (EEI) of single pump units

Pompes - Méthodes de qualification et de vérification de l'indice de rendement énergétique des groupes motopompes rotodynamiques - Partie 2 : Essais et calcul de l'indice de rendement énergétique (EEI) des groupes motopompes simples

Pumpen - Methoden zur Qualifikation und Verifikation des Energieeffizienzindex für Kreiselpumpen - Teil 2: Prüfung und Berechnung des Energieeffizienzindex (EEI) einzelner Pumpenaggregate

This corrigendum becomes effective on 13 October 2021 for incorporation in the official English version of the EN.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

© 2021 CEN All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.
Tous droits d'exploitation sous quelque forme et de quelque manière que ce soit réservés dans le monde entier aux membres nationaux du CEN.
Alle Rechte der Verwertung, gleich in welcher Form und in welchem Verfahren, sind weltweit den nationalen Mitgliedern von CEN vorbehalten.

Ref. No.:EN 17038-2:2019/AC:2021 E

Contents		Page
1	Changes related to EN 17038-2:2019/AC:2020 (00197C15)	3
1.1	Modification to 5.2.3, Determination of part load and over load points and reference control curve	3
1.2	Modification to 6.3.4, Determination of $Q_{100\%}$ from Q_{BEP}	3
1.3	Modification to 6.3.5, Determination of the $P_{1,avg,c}$-value	3
2	Changes related to EN 17038-2:2019/AC:2021 (00197C17)	4
2.1	Modification to 5.2.3, Determination of part load and over load points and reference control curve	4
2.2	Modification to 6.2, The semi-analytical model of the pump	4
2.3	Modification to 6.4.2, The model of the Power Drive System (PDS)	4
2.4	Modification of B.2.1, Additional supporting points at $Q/Q_{BEP} = 0,25$	5
2.5	Modification of D.2, The measurement uncertainty of the EEI-value determined by test ...	6
2.6	Modification of D.3.2, Operation mode: Fixed speed	6

1 Changes related to EN 17038-2:2019/AC:2020 (00197C15)

1.1 Modification to 5.2.3, Determination of part load and over load points and reference control curve

Format the line "Determination of part load and over load points and reference control curve" as heading 5.2.3.

1.2 Modification to 6.3.4, Determination of $Q_{100\%}$ from Q_{BEP}

In 1), replace "Formula 6.23" with "Formula (23)".

1.3 Modification to 6.3.5, Determination of the $P_{1,avg,c}$ -value

In 5), replace "Formula (10)" with "Formula (4)".

EUROPEAN STANDARD

EN 17038-2

NORME EUROPÉENNE

EUROPÄISCHE NORM

May 2019

ICS 23.080

English Version

**Pumps - Methods of qualification and verification of the
Energy Efficiency Index for rotodynamic pump units - Part
2: Testing and calculation of Energy Efficiency Index (EEI)
of single pump units**

Pompes - Méthodes de qualification et de vérification
de l'indice de rendement énergétique des groupes
motopompes rotodynamiques - Partie 2 : Essais et
calcul de l'indice de rendement énergétique (EEI) des
groupes motopompes simples

Pumpen - Methoden zur Qualifikation und Verifikation
des Energieeffizienzindex für Kreiselpumpen - Teil 2:
Prüfung und Berechnung des Energieeffizienzindex
(EEI) einzelner Pumpenaggregate

This European Standard was approved by CEN on 15 July 2018.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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.

CEN members are the national standards bodies of 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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents		Page
European foreword.....		4
Introduction		5
1	Scope	6
2	Normative references.....	6
3	Terms and definitions	6
4	Reference flow-time profiles and reference pressure control curves.....	8
4.1	General.....	8
4.2	Reference flow-time profiles	9
4.3	Reference pressure control curves.....	10
5	Determination of average electric power input $P_{1,avg}$ by test.....	10
5.1	General.....	10
5.1.1	Test requirements	10
5.1.2	Test conditions.....	10
5.1.3	Measuring instrumentation	11
5.2	Calculation of load points.....	12
5.2.1	General.....	12
5.2.2	Determination of $Q_{100\%}$ and $H_{100\%}$	12
5.3	Calculation of $P_{1,avg}$	14
5.3.1	General.....	14
5.3.2	Pump units evaluated with the reference flow-time profile for constant flow operation.....	14
5.3.3	Pump units evaluated with the reference flow-time profile for variable flow operation.....	14
5.3.4	Procedures for testing and evaluation of pump units with special pump types.....	15
6	Determination of the Energy Efficiency Index of pump units by the means of a semi-analytical model	16
6.1	General.....	16
6.2	The semi analytical model of the pump	17
6.3	Pump units in fixed speed operation	19
6.3.1	General.....	19
6.3.2	The model of the electric motor.....	20
6.3.3	Interaction of pump and motor.....	21
6.3.4	Determination of $Q_{100\%}$ from Q_{BEP}	22
6.3.5	Determination of the $P_{1,avg,c}$ -value	23
6.4	Pump units with a Power Drive System (PDS).....	24
6.4.1	General.....	24
6.4.2	The model of the Power Drive System (PDS)	26
6.4.3	Interaction between pump and PDS.....	29
6.4.4	Determination of $Q_{100\%}$ and $H_{100\%}$ from Q_{BEP} and H_{BEP}	30
6.4.5	Determination of $P_{1,avg,v}$ and $P_{1,avg,c}$ for pump units with PDS	31
7	Determination of reference electric power input $P_{1,ref}$	32
8	Calculation of Energy Efficiency index (EEL).....	35

Annex A (normative) Scope	36
Annex B (informative) Determination of additional supporting points for semi-analytical model based on empirical correlations	39
B.1 General	39
B.2 Additional supporting points for end-suction pumps (pump types ESOB, ESCC and ESCCi)	41
B.2.1 Additional supporting points at $Q/Q_{BEP} = 0,25$	41
B.2.2 Additional supporting points at $Q/Q_{BEP} = 0,1$	41
B.3 Additional supporting points for vertical multistage pump (MS-V)	42
B.3.1 Additional supporting points at $Q/Q_{BEP} = 0,25$	42
B.3.2 Additional supporting points at $Q/Q_{BEP} = 0,1$	42
B.4 Maximum model uncertainties	42
Annex C (normative) Synthesis of the PDS supporting points from separate data for motor and CDM	46
C.1 General	46
C.2 Determination of the losses $P_{L,CDM}$ at the 3-supporting points needed for the PDS model	49
C.3 Determination of the losses $P_{L,PDS}$ at the 3 supporting points needed for the PDS model	50
Annex D (informative) Uncertainties and tolerances of EEI-values	52
D.1 General remarks	52
D.2 The measurement uncertainty of the <i>EEI</i>-value determined by test	52
D.3 The uncertainty of the <i>EEI</i>-value determined by the application of models	55
D.3.1 General	55
D.3.2 Operation mode: Fixed speed	55
D.3.3 Operation mode: Variable speed	56
D.4 The total tolerance of the mean <i>EEI</i>-value	58
D.4.1 Determination of the mean <i>EEI</i>-value by testing only one pump unit	58
D.4.2 Determination of the mean <i>EEI</i>-value by testing a sample of <i>M</i> pump units of the same type series	60
D.4.3 Determination of the mean <i>EEI</i>-value by application of the semi-analytical model	60
Annex E (informative) Mathematical solution of polynomial formulae of 3rd degree	63
Annex F (normative) CDM model fall back values for Semi Analytical Model	65
Bibliography	66

EN 17038-2:2019 (E)

European foreword

This document (EN 17038-2:2019) 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 November 2019, and conflicting national standards shall be withdrawn at the latest by November 2019.

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

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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This part of the European Standard is the second part of a series of standards describing a methodology to evaluate energy efficiency performance of single pump units, comprising the pump, the motor with or without frequency converter, based on a non-dimensional numerical value called Energy Efficiency Index (*EEI*). An *EEI* allows the comparison of different pump sizes and types with one common indicator. Physical influences such as pump size, specific speed, pump unit part-load operation, motor-efficiency characteristic and frequency converter influence are implemented into this metric.

Specific requirements for testing and a calculation method for an *EEI*, the so called semi-analytical model of a complete single pump unit, specific flow-time profiles and reference control curves are given in this part of the standard.

EEI is an index to rate pump units according to their energy efficiency but does not replace the need to do a life-time cost analysis regarding energy consumption over the life time of the pump unit.

EN 17038-2:2019 (E)

1 Scope

This document specifies methods and procedures for testing, calculating and determining the Energy Efficiency Index (*EEL*) of rotodynamic glanded single pump units for pumping clean water, including where integrated in other products.

The pump types and sizes covered by this document are described in the normative Annex A.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 16480, *Pumps — Minimum required efficiency of rotodynamic water pumps*

EN 17038-1:2019, *Pumps — Methods of qualification and verification of the Energy Efficiency Index for Rotodynamic pumps units — Part 1: General requirements and procedures for testing and calculation of energy efficiency index (EEL)*

EN 60034-1, *Rotating electrical machines — Part 1: Rating and performance (IEC 60034-1)*

EN 60034-2-1, *Rotating electrical machines — Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles) (IEC 60034-2-1)*

EN 60034-2-2, *Rotating electrical machines — Part 2-2: Specific methods for determining separate losses of large machines from tests — Supplement to IEC 60034-2-1 (IEC 60034-2-2)*

EN 60034-30-1, *Rotating electrical machines — Part 30-1: Efficiency classes of line operated AC motors (IE code) (IEC 60034-30-1)*

EN 60038, *CENELEC standard voltages (IEC 60038)*

EN 61800-9-2, *Adjustable speed electrical power drive systems — Part 9-2: Ecodesign for power drive systems, motor starters, power electronics & their driven applications — Energy efficiency indicators for power drive systems and motor starters (IEC 61800-9-2)*

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

EN ISO 17769-1, *Liquid pumps and installation — General terms, definitions, quantities, letter symbols and units — Part 1: Liquid pumps (ISO 17769-1)*

IEC/TS 60034-2-3, *Rotating electrical machines — Part 2-3: Specific test methods for determining losses and efficiency of converter-fed AC induction motors*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN ISO 17769-1 and the terms, definitions, symbols and subscripts given in EN 17038-1, together with the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- [Looking for additional Standards? Visit Intertek Inform Infostore](#)
 - [Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation](#)
-