BS EN 16297-1:2012

BSI Standards Publication

Pumps — Rotodynamic pumps — Glandless circulators

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

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National foreword

This British Standard is the UK implementation of EN 16297-1:2012. Together with BS EN 16297-2:2012, it supersedes BS EN 1151-1:2006 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/6, Pumps and pump testing.

A list of organizations represented on this committee can be obtained on request to its secretary.

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

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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of an identical text or by endorsement, at the latest by April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.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*:

— 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 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.

Table 1 – When EN 16297-3 applies

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

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*

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)*

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)

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

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

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:

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

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

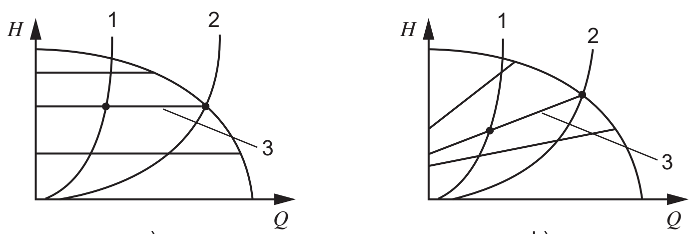
3.12
rated hydraulic output power
$P_{\text{hyd,r}}$
hydraulic power generated by a circulator in maximum setting where the hydraulic power is maximum

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

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)

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

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
ν	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)	-

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.

Table 3 – Maximum permissible distance between $H_{100\%}$ and published curve

Rated power input	≤100 W	> 100 W
Maximum permissible distance	± 20%	± 10%

5.1.2 $Q_{100\%}$ and $H_{100\%}$

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

5.2 Rated and minimum power input

For circulators with different speed settings (non-control curve), the rated power input shall be given in accordance with EN 60335-2-51 for at least the maximum and minimum settings (see 6.3 for test arrangement).

For differential pressure controlled circulators (see EN 16297-2) the rated and minimum power input shall be given in accordance with EN 60335-2-51 for the pump on maximum setting and the minimum power shall be given at minimum setting (see 6.3 for test arrangement).

5.3 Starting characteristics

The circulator shall start satisfactorily (see 6.4 for test conditions).

5.4 Resistance to internal pressure

During the test in accordance with 6.5, the circulator shall be pressure tight.

5.5 Resistance to thermal cycling

During the test under the conditions specified in 6.6, the circulator shall be resistant to thermal cycling.

5.6 Venting and deblocking

Loosening or removing of screws, plugs or similar seals, e.g. intended for venting and freeing, these operations shall not expose the operator to any risk (e.g. from escaping fluid, steam or rotating parts).

5.7 Fluid and structure borne noise emission

When knowledge on the fluid and structure borne noise of a circulator with a rated power input below 200 W below is required, the pump shall be tested in accordance with EN 1151-2.

6 General test methods

6.1 General

Circulators need a certain run in period to meet the right energy efficiency index. A run in period of minimum 10 h shall be ensured before measurement.

The performance tests can be carried out using several samples of the same type of pump. Hence, these tests are to be regarded as type tests.

For double pumps, the measurements and calculations are performed in single pump operation if this is a selectable mode of operation. Otherwise, the measurements and calculations are performed in double pump operation.

In single pump operation the circulator with the lowest energy efficiency index, ε_{EEI}, shall be used.

Test equipments shall be in accordance with EN ISO 9906 Grade 1 for measurement of flow, head and power input.

6.2 Testing of the hydraulic characteristic

6.2.1 Rated hydraulic output power, $P_{hyd,r}$

The rated hydraulic output power, $P_{hyd,r}$, (see Figure 2) is calculated by using the following procedure:

a) Where a circulator has more than one setting of head and flow, measure the circulator at the maximum setting;

b) Use at least 10 points distributed around a predicted $Q_{100\%}$, $H_{100\%}$, suitable for a least square fit of the Q-H curve in this area ;

c) Least square fit the function $H_{fit} = A \times Q^3 + B \times Q^2 + C \times Q + D$;

d) Calculate the hydraulic output power as $P_{hyd}(Q) = 2{,}72 \times Q \times H_{fit}(Q)$;

e) Find rated hydraulic output power ($P_{hyd,r}$) at max{P_{hyd}};

f) Find $Q_{100\%}$ as the flow at rated hydraulic power;

g) Find $H_{100\%}$ as the head at $Q_{100\%}$ by using $H_{fit}(Q_{100\%})$.

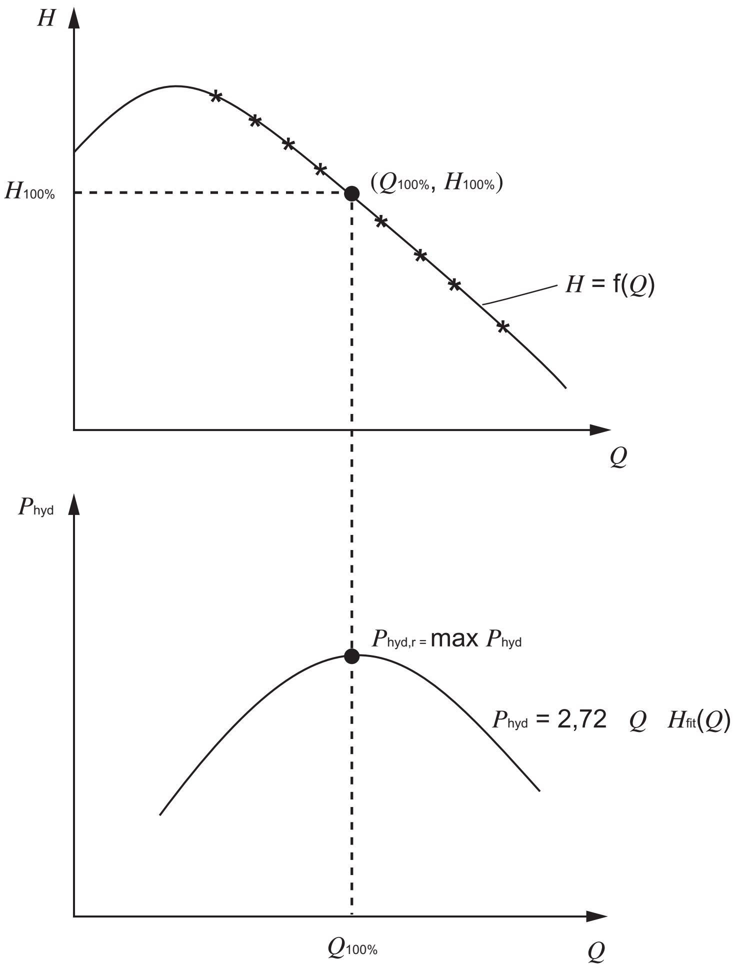


Figure 2 — Rated hydraulic output power

6.2.2 Reference power, P_{ref}

The reference power, P_{ref} , is calculated as:

$$P_{ref} = 1{,}7 \times P_{hyd,r} + 17 \times (1 - e^{-0{,}3 \times P_{\text{hyd,r}}})$$

6.2.3 Tolerance on $H_{100\%}$ at maximum hydraulic power

The tolerance, t, at $H_{100\%}$ is -20 % of $H_{100\%}$ or -0,5 m (whichever is the largest absolute value) (see Figure 3).

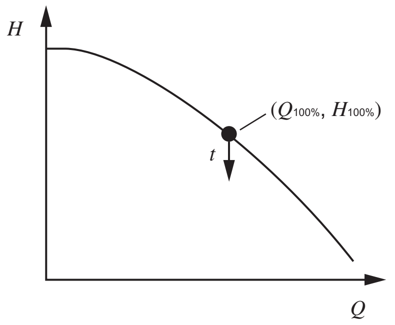


Figure 3 — Tolerance on $H_{100\%}$

6.2.4 Reference control curve

Straight line between ($Q_{100\%}$,$H_{100\%}$) and ($Q_{0\%}$,$H_{100\%}$/2) where the theoretical operating points (Q, H_{ref}) are defined as shown in Figure 4.

Q in % of $Q_{100\%}$	H_{ref} in % of $H_{100\%}$
100	100
75	87.5
50	75
25	62.5

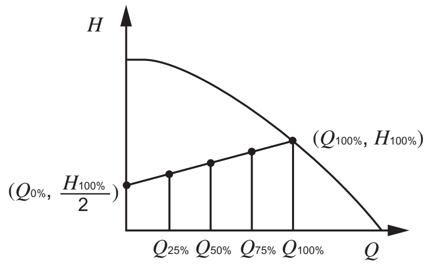


Figure 4 — Reference control curve

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

The load profile for calculation of average compensated power input, $P_{L,avg}$, is shown in Table 4.

Table 4 – 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
75	L_2
50	L_3
25	L_4

L_x (L_1 - L_4) is the time in percentage of annual operating hours of the individual applications. L_x is specified in the relevant parts of this document.

6.2.6 Part load operating points

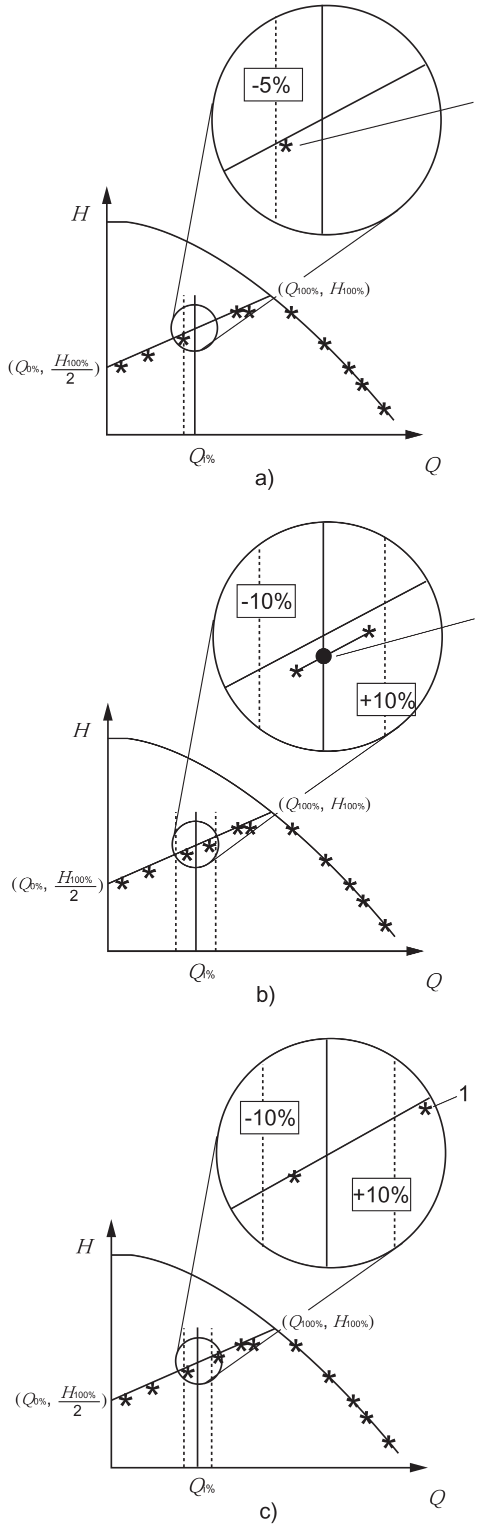
Part load operating points are measured by using following procedure:

Determine H_{meas} and $P_{1,\ meas}$ at each part load operating point by using direct measurements or interpolation.

— If direct measurements are used the tolerances of flow values are 0 % to -5 % of $Q_{100\%}$ (Figure 5a).

— Interpolated values are allowed if measured values are within a tolerance band of ±10 % of $Q_{100\%}$ (Figure 5b). Otherwise the next higher values must be used (Figure 5c).

— If the pump does not stabilise, time averaged values must be used. Due to hysteresis inside the pump, measurement of part load operating points must be done in both directions from 100 % flow to 0 % flow and from 0 % flow to 100 %



Key

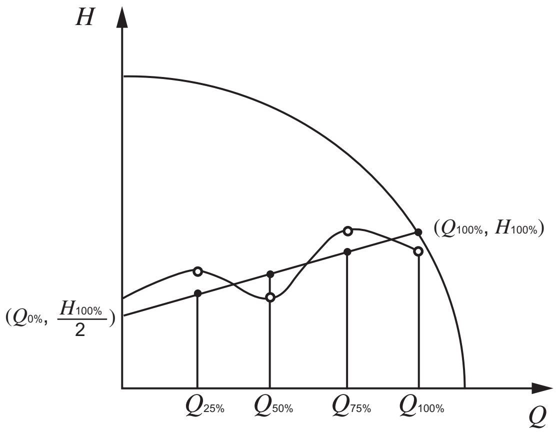
1 use this value
2 use interpolated value

Figure 5 — Interpolation rules

6.2.7 Calculation of compensated power input, P_L

Based on measured power input in part load operating points calculate the compensated power input, P_L, in each part load operating point (see Figure 6) as:

$$P_L = \frac{H_{ref}}{H_{meas}} \times P_{1,meas} \text{ if } H_{meas} \leq H_{ref} \text{ or } P_L = P_{1,meas} \text{ if } H_{meas} > H_{ref}$$



NOTE Circles illustrates measured head. Dots illustrates head on reference control curve

Figure 6 — Deviations from reference control curve in head

For DC supplied circulators the compensated power inputs in each part load points must be multiplied by the correction factor (1,05) to accommodate the AC to DC conversion.

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

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

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

by using the load profile defined in Table 4 and the reference control curve defined in 6.2.4.

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

The energy efficiency index (EEI), ε_{EEI}, is calculated as

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

Where:

$C_{xx\%}$ is a calibration factor depending on circulator type and application and ensures that at the time of defining the factor only XX % of circulators of a certain type have an EEI ≤ 0,20.

$C_{xx\%}$ is specified in the specific parts of this document.

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

6.2.10 Test conditions

6.2.10.1 Water quality

The test system shall be supplied with clean water without solids having a temperature of 20 °C ± 5 °C. Care shall be taken that the water is free of bubbles.

6.2.10.2 Static pressure

A static pressure of 2 bar $\begin{pmatrix}+0{,}5\\0\end{pmatrix}$ bar shall be maintained in the test system.

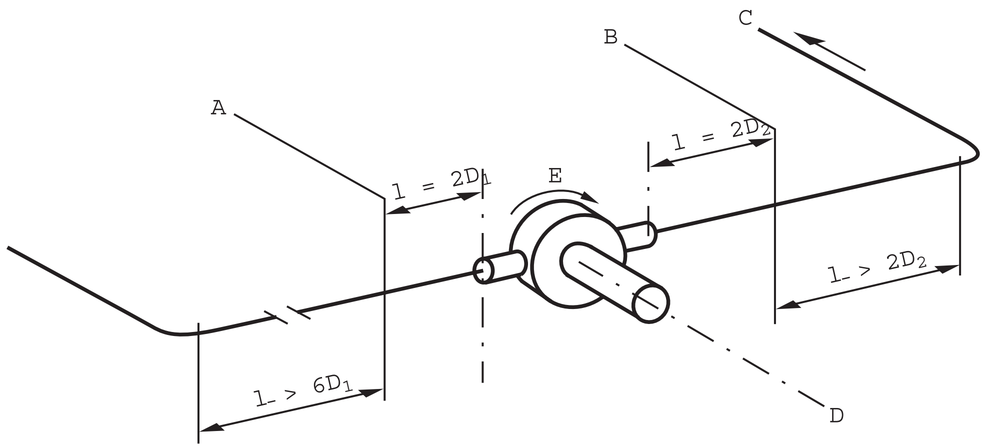
6.2.10.3 Input voltage

The input voltage to the circulator shall be the rated voltage of the circulator with a tolerance of ± 1 %.

6.2.10.4 Test circuit

6.2.10.4.1 General

The circulator is connected to a closed test arrangement that conforms to Figure 7.



Key

A point of measurement of positive input pressure
B point of measurement of positive output pressure
C to measurement of Q and circuit regulating valve
D motor shaft - horizontal
E flow direction
D_1 inside diameter of pipe and pump inlet
D_2 inside diameter of pipe and pump outlet

Figure 7 — Test circuit

The arrangement shall be made so that it is possible to control the temperature of the water (adding new water or cooling). The best measuring conditions are obtained when, in the measuring sections, the flow has:

— an axially symmetrical velocity distribution;

— a uniform static pressure distribution;

— freedom from swirl induced by the installation.

6.2.10.4.2 Form and size of connectors for measurement of pressure

The pressure shall be measured at the points specified in Figure 7. The connectors for measurement of pressure allow determination of a static positive pressure at the level of the measurement point. They shall be provided in a plane perpendicular to the pipe axis. The axis of the measurement bore shall be perpendicular to the pipe axis. The diameter, d, of the measurement bore shall be 2 mm.

The length, l, of the measurement bore shall not be greater than twice the bore diameter (see Figure 8). The inside surface of the pipe shall be free from burrs and other irregularities.

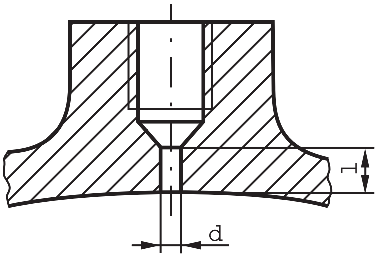


Figure 8 — Example of connector for pressure measurement

6.2.11 Testing of hydraulic performance

6.2.11.1 Flow rate

The flow rate is measured by means of an appropriate flowmeter forming an integral part of the test arrangement.

6.2.11.2 Head

The head, H, is calculated using the following formula where there is no difference in altitude between connectors for measurement of pressure:

$$H = \frac{p_{1-2}}{\rho g} + \frac{v_2^2}{2g} - \frac{v_1^2}{2g}$$

The positive pressure shall be given using an appropriate measuring instrument for determining the head, H.

6.3 Measurement of rated power input

The measurement is carried out under the conditions described in 6.2.10.

At any normal operational condition the measured power input must not exceed the rated value + 10 %.

The rated power input, $P_{1,\text{ rated}}$, of the circulator shall be measured by means of a wattmeter.

6.4 Starting conditions

The measurement is carried out under the conditions described in 6.2.10.

When switched on at the maximum speed setting or in automatic mode (if this is the only possibility), the circulator shall start at a voltage 85 % of the nominal voltage.

6.5 Testing of resistance to internal pressure

The requirements of EN 60335-2-51 apply.

6.6 Testing of resistance to thermal cycling

6.6.1 Circulator supply voltage

For the tests, the supply voltage shall be in accordance with the tolerances specified in EN 50160.

6.6.2 Intermittent operation

The test shall be carried out in a closed circuit. The circuit shall be provided with a heating device capable of maintaining a temperature of T_2 (operating period) during the test and, if required, a cooling device for maintaining the temperature of T_1 (off period).

For the purpose of the test, the flow shall be adjusted to a value between 0,5 Q and 1,5 Q, assuming that Q is the flow rate corresponding to the maximum value of $Q \times H$. Control of the flow rate during the period of operation may be carried out by controlling the head of the circulator.

The circulator shall operate under the conditions given in Table 5 for a total of 1 000 hours:

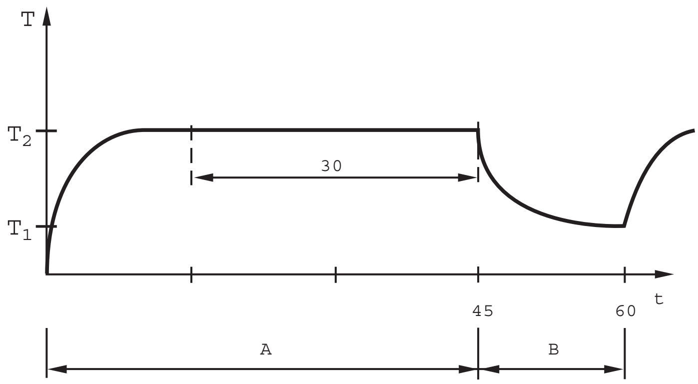
a) Water temperature during the periods:

Table 5 — Conditions

Class	Water temperature		Ambient temperature
	T_1 (off-period)	T_2 (operating period)	
T_F 60	20 °C ± 10 °C	60 °C ± 5 °C	20 °C ± 5 °C
T_F 95	50 °C ± 10 °C	90 °C ± 5 °C	
T_F 110	60 °C ± 10 °C	110 °C ± 5 °C	

The water temperature during the off period at T_1 shall be higher than the ambient temperature.

b) Operating period / Off period (see Figure 9).



Key
A operating period
B off period

Figure 9 — Operating period / Off period

c) Operating period = 45 min, the temperature T_2 being maintained for at least 30 min.

d) Off period = 15 min.

e) During the off period the flow rate shall be maintained by using an additional pump to ensure cooling down to the required temperature T_1 before the circulator is started again.

f) When switched on, the pump shall restart without further auxiliary action.

g) For all types of circulators, the maximum setting applies to the test.

When this test has been completed, the pump shall comply with 5.1 and 5.4.

7 Information for use

7.1 General

The requirements of EN 60335-2-51 apply.

7.2 Instruction handbook

The requirements of EN 60335-2-51 apply.

In addition, the instruction handbook shall include warnings against:

a) Installation in misaligned pipework.

b) Human contact with pump surfaces which might be hot.

c) Hazards or considered hazards from a freeing device.

7.3 Marking

The requirements of EN 60335-2-51 apply.

The energy efficiency index shall be indicated on the name plate and packaging of the product and in the technical documentation in plain text using two digit decimals as follows

EEI ≤ 0,__ __ - Part __

Two digit decimal places

Part number indicating whether the circulator is tested in accordance with EN 16297-2 or EN 16297-3.

EXAMPLE **EEI ≤ 0,21 – Part 3**

Annex ZA
(informative)

Relationship between this European Standard and the requirements of Commission Regulation (EC) No 641/2009

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to requirements

Commission Regulation (EC) No 641/2009 of 22 July 2009:

Implementing Directive 2005/32/EC[1] of the European Parliament and of the Council with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products

Once this standard is cited in the Official Journal of the European Union under that Commission Regulation , compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding requirements of that and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Commission Regulation (EC) No 641/2009

Clauses and sub-clauses of this EN	**Requirements of Commission Regulation (EC) No 641/2009**	**Qualifying remarks/Notes**
Part 1: 6.2.1	Annex II, 2., 3.	Calculation of Phyd
Part 1: 6.2.2	Annex II, 2., 4.	Calculation of Pref
Part 1: 6.2.4	Annex II, 2., 5.	Reference control curve
Part 1: 6.2.9	Annex II, 2., 9.	Calculation of EEI
Part 2: 6.2.5	Annex II, 2., 9.	Calculation of EEI
Part 3: 6.2.5	Annex II, 2., 9.	Calculation of EEI

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

[1] The Directive was replaced by the Directive 2009/125/EC.

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