



EAST AFRICAN STANDARD

Pumps — Rotodynamic pumps — Circulation pumps having a rated power input not exceeding 200 W for heating installations and domestic hot water installations — Part 1: Non-automatic circulation pumps, requirements, testing, marking

EAST AFRICAN COMMUNITY

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

© East African Community 2010 — All rights reserved*

East African Community

P O Box 1096

Arusha

Tanzania

Tel: 255 27 2504253/8

Fax: 255-27-2504481/2504255

E-Mail: eac@eachq.org

Web: www.each.int

Contents

1	Scope	1
2	Normative references.....	1
3	Terms and definitions.....	1
4	Symbols and units	2
5	Performance and safety requirements	3
5.1	Hydraulic characteristic	3
5.2	Rated power	3
5.3	Starting characteristics	3
5.4	Resistance to internal pressure	3
5.5	Temperature resistance.....	3
5.6	Resistance to thermal cycling.....	3
5.7	Venting and deblocking	3
5.8	Material- and design requirement.....	3
5.9	Fluid and structure borne noise emission	3
6	Test methods	3
6.1	General	3
6.2	Testing of the hydraulic characteristic	3
6.3	Measurement of rated power input.....	6
6.4	Starting conditions.....	6
6.5	Testing of resistance to internal pressure.....	6
6.6	Testing of temperature resistance	6
6.7	Testing of resistance to thermal cycling.....	6
6.8	Venting and deblocking	8
7	Information for use.....	8
7.1	General	8
7.2	Instruction handbook.....	8
7.3	Marking	8
	Annex A (informative) Additives.....	10
	Bibliography	11

Introduction

For the purpose of this document, circulation pumps having a rated power input < 200 W are generally considered for domestic use and circulation pumps having a rated power input > 200 W are considered for professional/commercial use.

In the preparation of this East African Standard, the following source was consulted extensively:

BS EN 1151-1:2006, *Pumps — Rotodynamic pumps — Circulation pumps having a rated power input not exceeding 200 W for heating installations and domestic hot water installations — Part 1: Non-automatic circulation pumps, requirements, testing, marking*

Assistance derived from this source and others inadvertently not mentioned is hereby acknowledged.

Draft for comments only — Not to be cited as East African Standard

Pumps — Rotodynamic pumps — Circulation pumps having a rated power input not exceeding 200 W for heating installations and domestic hot water installations — Part 1: Non-automatic circulation pumps, requirements, testing, marking

1 Scope

This part of CD/K/044:2009 establishes general principles for the construction, use and testing of circulation pumps of the glandless type, having a rated power input $P_1 \leq 200$ W, intended to be used in heating installations and domestic hot water service installations.

NOTE The requirements of this document may apply to circulation pumps for domestic use having a rated power input above 200 W up to and including 300 W. However, this decision depends on agreement between the supplier and purchaser.

Circulation pumps with a rated power input above 200 W for professional/commercial use are excluded from the scope of this document. This document applies to:

- a) A.C. circulation pumps having a rated power input $P_1 \leq 200$ W intended for use in ordinary heating water systems with a maximum permissible inlet temperature of $T_F \leq 110$ °C and a maximum outlet working pressure $p_{2\max 0} \leq 6$ bar.
- b) A.C. circulation pumps having a rated power input $P_1 \leq 200$ W intended for use in domestic hot water installations with a permissible inlet temperature of $T_F \leq 65$ °C and a maximum outlet working pressure $p_{2\max 0} \leq 10$ bar.

This document applies to circulation pumps, which are manufactured after the date of issue of this document.

This document covers the performance for circulation pumps. All known hazards which are likely to occur at normal installation and operation are covered by the CD/K/043:2009 and IEC 60335-2-51.

As regards safety for electrotechnical parts of circulation pumps, IEC 60335-2-51 applies.

2 Normative references

The following referenced documents are indispensable for the application 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.

CD/K/044-2:2009, *Pumps — Rotodynamic pumps — Circulation pumps having a rated power input not exceeding 200 W for heating installations and domestic hot water installations — Part 2: Noise test code (vibro-acoustics) for measuring structure- and fluid-borne noise*

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

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

ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles*

IEC 60038, *IEC Standard voltages*

3 Terms and definitions

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

3.1**circulation pump**

centrifugal pump which circulates heating water and/or domestic hot water, as determined by its type

NOTE A circulation pump is a pumping device consisting of a hydraulic, a mechanical and an electric part including a motor.

3.2**rated power input**

electrical power input at nominal voltage at normal operational condition and maximum load

3.3**glandless pump**

circulation pump where the rotor of the motor is in direct contact with the water being pumped

3.4**speed setting**

setting attained (for pumps with different settings) when the speed of the electric motor is changed

3.5**range of operation**

range of the H(Q) characteristic specified by the manufacturer for normal operation of the pump

3.6**maximum inlet pressure (static pressure)**

highest inlet pressure to which the pump is subjected during operation

NOTE All pressures in this document are gauge pressures except for the differential pressure measured in 6.2.2.2.

3.7**differential pressure**

gain in pressure between the pump inlet and pump outlet

NOTE All pressures in this document are gauge pressures except for the differential pressure measured in 6.2.2.2.

3.8**maximum outlet working pressure**

sum of maximum inlet pressure and maximum differential pressure at rated conditions

4 Symbols and units

For the purpose of this document, the symbols, quantities and units given in Table 1 apply.

Table 1 — Symbols and units

Symbol	Quantity	Unit
g	Acceleration due to gravity	m/s ²
H	Head (water gauge)	m
P_1	Rated power input	W
p	Pressure	bar
$p_{1\max o}$	Maximum inlet pressure	bar
p_{1-2}	Differential pressure	Pa
$p_{2\max o}$	Maximum outlet working pressure	bar
Q	Flow rate	m ³ /h
T	Temperature	EC
T_F	Fluid temperature at inlet port	EC
V	Average velocity of water	m/s
P	Density	kg/m ³

5 Performance and safety requirements

5.1 Hydraulic characteristic

The hydraulic characteristic of the circulation pump shall be in accordance with the data published by the manufacturer. For circulation pumps with different speed settings, the performance curve of each setting shall be given (see 6.2 for test arrangement).

5.2 Rated power

For circulation pumps with different speed settings, the rated power input, P_I shall be given for at least the maximum and minimum settings (see 6.3 for test arrangement).

5.3 Starting characteristics

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

5.4 Resistance to internal pressure

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

5.5 Temperature resistance

During the test in accordance with 6.6, the circulation pump shall be resistant to temperatures there defined.

5.6 Resistance to thermal cycling

During the test under the conditions specified in 6.7 the circulation pump shall be resistant to thermal cycling.

5.7 Venting and deblocking

During the test in accordance with 6.8, the operation of venting and de-blocking devices shall not cause a hazard.

5.8 Material- and design requirement

Circulation pumps for domestic hot water shall not emit any toxic, biological or microbiological hazards, when tested in accordance with 6.9.

5.9 Fluid and structure borne noise emission

When knowledge on the fluid and structure borne noise of a circulation pump is required, the pump shall be tested according to CD/K/044-2:2009.

6 Test methods

6.1 General

The tests can be carried out using several samples of the same type of pump. Hence the tests are to be regarded as type tests. A running-in period of 1 h shall be observed.

6.2 Testing of the hydraulic characteristic

6.2.1 General

The hydraulic characteristic of a circulation pump in accordance with this document is described in the form of a $H(Q)$ performance curve for the permissible range of operation.

The hydraulic performance value assigned by the manufacturer refers to the point where the product of the flow rate, Q , and the head, H , reaches the maximum value (point 1 in Figure 1a). A tolerance of $\pm 10\%$ of $H(Q = 0)$ (point 2 in Figure 1a) shall apply to the head specified for this point (point 1 in Figure 1a).

In the case of circulation pumps with different speed settings, the above tolerance shall be found at the maximum setting and applies to the minimum settings at the point where the product of the flow rate, Q , and the head, H , reaches the maximum value (point 3 in Figure 1b).

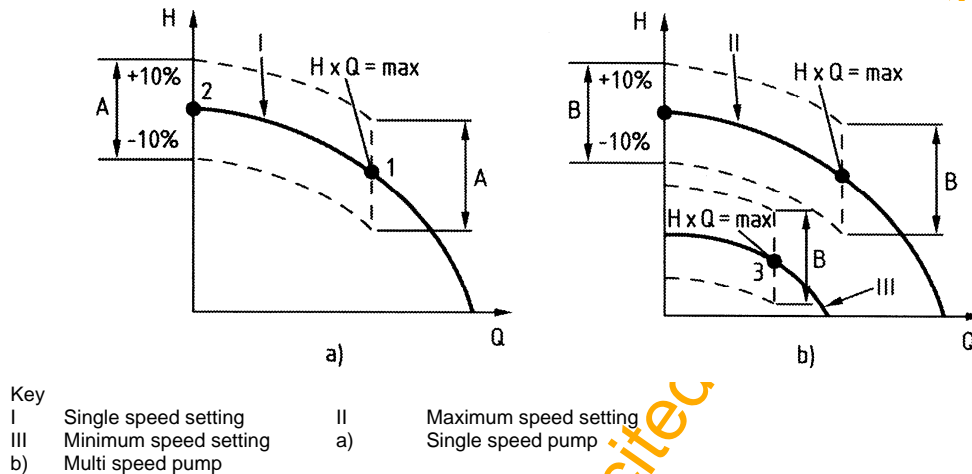


Figure 1 — Hydraulic performance values and tolerances

6.2.2 Test conditions

6.2.2.1 Water quality

The test system shall be supplied with clean water without solids having a temperature of $20\text{ }^{\circ}\text{C} + 5\text{ }^{\circ}\text{C}$. Care shall be taken that the water is free of bubbles.

6.2.2.2 Static pressure

A static pressure of 2 bar $\begin{pmatrix} +0.5 \\ 0 \end{pmatrix}$ bar shall be maintained in the test system.

6.2.2.3 Motor input voltage

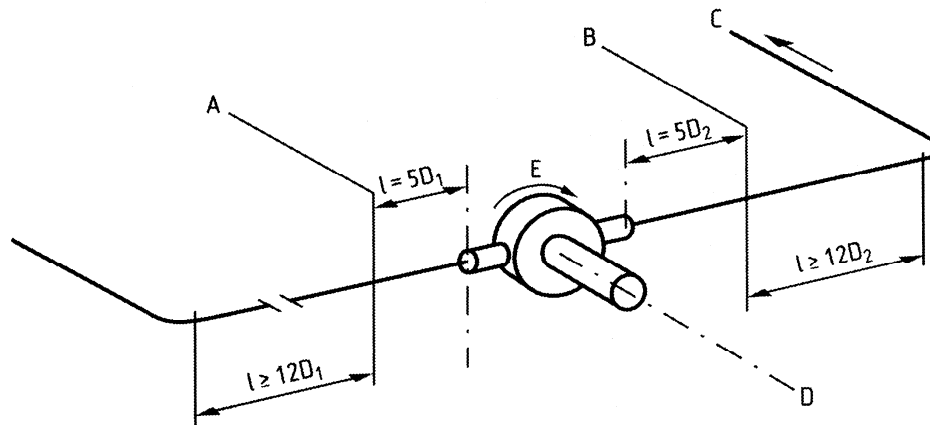
The nominal voltage of the power supply shall be sinusoidal in accordance with IEC 60034-1 with a tolerance of $\pm 2\%$, the input being maintained at a constant level.

6.2.2.4 Test circuit

6.2.2.4.1 General

The circulation pump is connected to an open or a closed test arrangement that conforms to Figure 2.

The arrangement shall be made so that it is possible to control the temperature of the water (adding new water or cooling).



- 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 2 — Test circuit

6.2.2.4.2 Form and size of connectors for measurement of pressure

The pressure shall be measured at the points specified in Figure 2. They 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 3). The inside surface of the pipe shall be free from burrs and other irregularities.

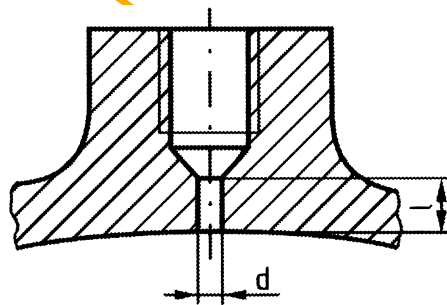


Figure 3 — Example of connector for pressure measurement

6.2.3 Testing of hydraulic performance

6.2.3.1 Flow rate

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

6.2.3.2 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

Under the conditions described in 6.2.2.

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

The rated power input, P_1 , of the circulation pump shall be measured by means of a wattmeter.

6.4 Starting conditions

Under the conditions described in 6.2.2.

When switched on at the maximum speed setting, the circulation pump shall start at a voltage 85 % of the nominal voltage.

6.5 Testing of resistance to internal pressure

The circulation pump shall be submitted to an internal pressure test using water of a temperature of $20\text{ °C} + 10\text{ °C}$. The pump shall withstand a water pressure of 1.3 times the declared maximum outlet working pressure for 5 minutes. The pump is then subjected, for 1 minute, to a water pressure of 1 bar.

After the test there shall be no visible permanent deformation or leakage.

6.6 Testing of temperature resistance

The circulation pump shall be switched off and tested at a pressure according to 6.2.3.2 and a water temperature during a period of 10 hours, as specified in Table 2. The water temperature classes are determined in accordance with 6.1 of IEC 60335-2-51.

Table 2 — Water temperature classes

Class	Water temperature
$T_F 60$	70 °C ($\pm 5\text{ °C}$)
$T_F 95$	110 °C ($\pm 5\text{ °C}$)
$T_F 110$	130 °C $\begin{pmatrix} +0 \\ -5 \end{pmatrix}$ °C

There shall be no external visible permanent deformation or leakage. This test is regarded as a destructive test and correct performance of the pump after the test is not required.

6.7 Testing of resistance to thermal cycling

6.7.1 Motor supply voltage

For the tests within nominal voltage range, the rated voltage of the electrical supply with the tolerances specified in IEC 60038 shall be applied.

6.7.2 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 0.5Q and 1.5Q, 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 might be carried out by controlling the head of the circulation pump.

The circulation pump shall operate under the conditions given in Table 3 for a total of 1000 hours:

- a) Water temperature during the periods:

Table 3 — Conditions

Class	Water temperature		Ambient temperature
	T_1 off-period	T_2 operating period	
$T_F 60$	$20\text{ °C} \pm 10\text{ °C}$	$60\text{ °C} \pm 5\text{ °C}$	$20\text{ °C} \pm 5\text{ °C}$
$T_F 95$	$50\text{ °C} \pm 10\text{ °C}$	$90\text{ °C} \pm 5\text{ °C}$	
$T_F 110$	$60\text{ °C} \pm 10\text{ °C}$	$110\text{ °C} \pm 5\text{ °C}$	

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

- b) Operating period / Off period

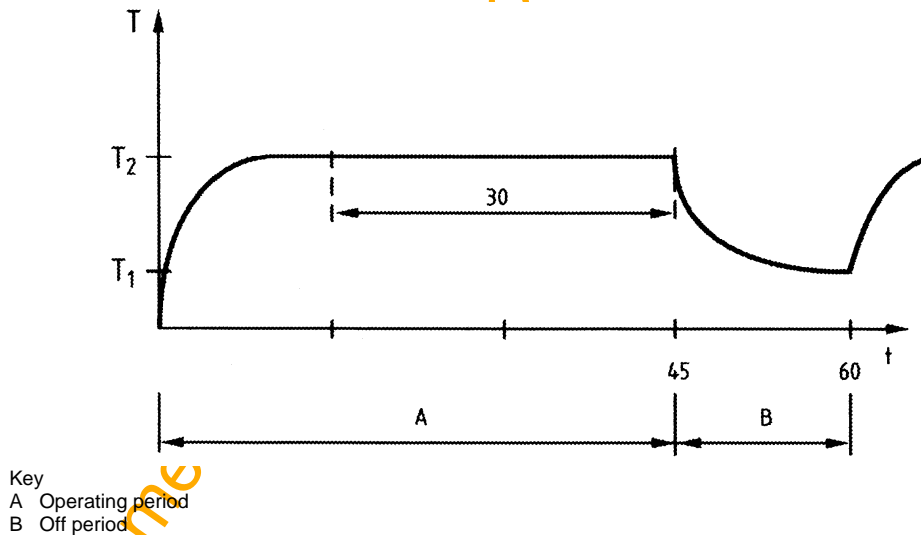


Figure 4 — Operating period / Off period

- c) Operating period = 45 minutes, the temperature T_2 being maintained for at least 30 minutes.
d) Off period = 15 minutes
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 circulation pump is started again.

- f) When switched on, the pump shall restart without further auxiliary action.
- g) For circulation pumps with different speed settings, the maximum setting applies to the test. When this test has been completed, the pump shall comply with 5.1 and 5.4.

6.8 Venting and deblocking

When tested under the conditions specified in 6.7 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).

6.9 Toxicity, biological and microbiological test

To ensure that circulation pumps do not have any detrimental effect on the quality of the water with which it comes into contact, the materials in contact with water intended for human consumption shall conform to all the pertinent specifications concerned with effects of materials on water quality.

NOTE In the absence of such specifications, see respective national standards or regulations.

7 Information for use

7.1 General

The requirements laid down in 5.5 of ISO 12100-2 shall apply.

7.2 Instruction handbook

The requirements laid down in Clause 5 of ISO 12100-2 shall apply. The instruction book shall in addition include information about:

- a) Allowed mounting positions;
- b) Recommended applications for use;
- c) Operating limits (if any) in terms of flow rate or head;

In addition, the instruction handbook shall include warnings against:

- d) Installation in misaligned pipework,
- e) Human contact with pump surfaces which might be hot.

Where there is a hazard or a considered hazard from a freeing device, statement must be made in the installation leaflets.

7.3 Marking

The pump shall be marked with at least the minimum markings listed below: Minimum marking:

- a) Manufacturer's name and address
- b) CE-mark (if applicable)
- c) Type, designation
- d) Year of manufacture, serial number
- e) Rated voltage/voltage range
- f) Rated frequency

- g) Rated power input
- h) Direction of water flow
- i) Direction of motor rotation (if applicable)
- j) Class II (if applicable)
- k) Symbol for degree of protection against moisture
- l) T_F -class

Optional marking:

- m) AC symbol and/or number of phases
- n) Rated current
- o) Insulation class
- p) Maximum ambient temperature (if > 35 °C)
- q) Maximum outlet working pressure

Draft for comments only — Not to be cited as East African Standard

Annex A
(informative)

Additives

Hot water additives that might have an influence on the operation and the performance of the circulation pump have not been taken into consideration in this document. When additives are used, appropriate information should be obtained from the manufacturer particularly as to the resistance of the circulation pump (sealings).

Draft for comments only — Not to be cited as East African Standard

Bibliography

- [1] CD/K/043:2009, *Pumps and pump units for liquids — Common safety requirements*
- [2] ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology*
- [3] BS 5449:1990, *Specification for forced circulation hot water central heating systems for domestic premises*
- [4] BS 6920, *Suitability of non-metallic products for use in contact with water intended for human consumption with regards to their effect on the quality of the water*
- [5] DIN 2001:1983, *Eigen- und Einzeltrinkwasserversorgung — Leitsätze für Anforderungen an Trinkwasser -Planung, Bau und Betrieb der Anlagen — Technische Regel des DVGW*
- [6] DIN 4751-1:1994, *Wasserheizungsanlagen — Offene und geschlossene physikalisch abgesicherte Warmeerzeugungsanlagen mit Vorlauftemperaturen bis 120 °C — Sicherheitstechnische Anforderungen*
- [7] DIN 4751-2:1994, *Wasserheizungsanlagen — Geschlossene, thermostatisch abgesicherte Warmeerzeugungsanlagen mit Vorlauftemperaturen bis 120 °C — Sicherheitstechnische Ausrüstung*
- [8] DIN 4751-3:1993, *Wasserheizungsanlagen — Geschlossene, thermostatisch abgesicherte Warmeerzeugungsanlagen bis 50 kW Nennwärmeleistung mit Zwangumlauf-Warmeerzeugern und Vorlauftemperaturen bis 95 °C — Sicherheitstechnische Ausrüstung*
- [9] VDI 2035:1979, *Verhütung von Schaden durch Korrosion und Steinbildung in Warmwasserheizungsanlagen*

Draft for comments only — Not to be cited as East African Standard

Draft for comments only — Not to be cited as East African Standard