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Električni pretočni grelniki vode - 1. del: Splošne zahteve

Electric instantaneous water heaters -- Part 1: General requirements

Elektrische Durchfluss-Durchflusserwärmer -- Teil 1: Allgemeine Anforderungen

Chauffe-eau électriques instantanés -- Partie 1: Exigences générales

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Electric instantaneous water heaters - Part 1: General requirements

Chauffe-eau électriques instantanés -
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Elektrische Durchfluss-
Durchflusserwärmer -
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CENELEC

European Committee for Electrotechnical Standardization
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Contents

Foreword

This document (EN 50193-1:2013) has been prepared by CLC/TC 59X "Performance of household and similar electrical appliances".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-11-05
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2015-11-05

This document supersedes EN 50193:1997.

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1 Scope

This European Standard applies to **electric instantaneous water heaters** for domestic hot water heating for household and similar applications, which show both of the following characteristics:

– fulfilling at least one load pattern from Annex A;

– heating up to temperatures below the boiling temperature.

This European Standard specifies terms, definitions and measurement methods for the assessment of energy efficiency.

This European Standard does not take into account requirements regarding the safety of the appliances.

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 ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1)*

3 Terms and definitions

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

3.1
instantaneous water heater
appliance intended to heat water while it flows through the appliance

3.1.1
electric instantaneous water heater
electric powered **instantaneous water heater**, independent from the kind of the controller system

3.1.2
closed instantaneous water heater
instantaneous water heater intended to operate at the pressure of the water system, the flow of water being controlled by one or more valves in the outlet system

3.1.3
open-outlet instantaneous water heater
instantaneous water heater in which the flow of water is controlled by a valve in the inlet pipe, there being no valve in the outlet pipe

3.1.4
hydraulic instantaneous water heater
instantaneous water heater each of whose heating elements can be switched on or off, depending on the water flow rate or water pressure

3.1.5
instantaneous water heater with manual variable power setting
instantaneous water heater where the heating power can be manually and variably set by the user

3.1.6
electronically controlled instantaneous water heater
instantaneous water heater with electronically controlled heating elements, where the outlet water temperature can be controlled by varying the power consumed by the heating elements without affecting the flow rate or mixing with cold water. The outlet water temperature is not thermostatically regulated and will change as a result in a change in flow or inlet water temperature (no feedback from outlet temperature and/or flow rate)

3.1.7
electronically regulated instantaneous water heater
instantaneous water heater with electronically controlled heating elements, where the outlet water temperature can be controlled by varying the power consumed by the heating elements without affecting the flow rate or mixing with cold water. The outlet water temperature is thermostatically regulated and will not change significantly as a result in a change in flow or inlet water temperature (with feedback from outlet temperature and/or flow rate)

3.1.8
electronic instantaneous water heater
electronically controlled instantaneous water heater or **electronically regulated instantaneous water heater**

3.2
temperature selector
actuator which presets the temperature set point value of the water outlet and which can be adjusted by the user

3.3
temperature control
actuator which adjusts the temperature of the outlet water by means of varying the flow of water through the appliance or by varying the power applied to the heater(s) or by a combination of the two

3.4
independent flow control
actuator which adjusts the flow of water through the appliance with no significant change in the outlet water temperature

3.5
flow regulator
actuator which limits the flow of water through the appliance regardless of variations in line pressure

3.6
flow restrictor
device which defines a flow of water through the appliance for a set pressure

3.7
power selector
actuator which presets electrical power of the unit and which can be adjusted by the user

Note 1 to entry: The water outlet temperature depends on flow rate and/or inlet temperature.

3.8
power limiter
actuator which presets the maximum electrical power consumed by the unit and which can be adjusted during installation

Note 1 to entry: The outlet temperature and the flow rate can to a large extent be set independently of each other.

3.9
heating-up duration
time interval between the opening of the withdrawal device and the moment when the final outlet temperature is obtained

3.10
response time
time interval between the beginning of the change in the setting of the temperature selector or the flow rate, or after the flow rate was interrupted, and the moment the final outlet temperature is obtained

3.11
theoretical net energy demand
physical energy demand which is calculated from flow rate, temperature difference and duration of the water withdrawal

3.12
measured energy demand
energy demand resulting from measurements

3.13
rating data
characteristics assigned to the appliance by the manufacturer

3.14
load profile/load pattern
a means of illustrating the power consumption of an **instantaneous water heater** over a 24 hour period

3.15
daily profile
defined withdrawals effected during one day

3.16
pressure switch
switch that operates in response to a change in pressure

3.17
flow switch
switch that operates in response to a flow of water

3.18
smart control
system that can demonstrate a reduction in energy consumption

3.19
multifunctional appliance
appliance designed to supply various outlets where the outlet configuration is defined by the installer

3.20
usable water
water at or above the temperature T_m for the relevant draw-off and load pattern specified in the tables of Annex A

4 General test conditions

4.1 Test conditions and tolerances on the test results

Unless otherwise specified, the table below gives additional test conditions and tolerances on the test results (i.e. thermal energy).

Table 1 — Test conditions and test results — Setting values and tolerances

Measurement parameters	Unit	Value	Acceptable deviation (mean value)	Acceptable deviation of the individual measurement values	Measurement uncertainty (accuracy)	Remarks
Ambient temperature	°C/K	20 °C ± 5 °C	± 2 K	± 2 K	± 1 K	5)
Time	S				± 0,1 s	2)
Cold inlet water temperature for energy efficiency	°C/K	10 °C	± 2 K	± 2 K	± 1 K	2) 1)
Hot outlet water temperature for energy efficiency	°C/K	Sample			± 1 K	1) 2)
Flow rate	l/min	Sample			±0,1 l/min or ±1%	2) 4)
Pressure	Mpa				± 5 %	3)
input power	kW				± 1 %	2)
Input power	W				± 1 %	5)
Voltage	V				± 2 %	2)
Current	A				± 0,5 %	2)

1) Thermocouple with a diameter of maximum 0,5 mm, in midstream, positioned directly at the outlet and inlet of the appliance.

2) The measured values shall be expressed rounded to one decimal place.

3) The measured values shall be expressed rounded to three decimal places.

4) Whichever is higher.

5) The measured values shall be expressed rounded to integer.

4.2 Number of appliances to be tested

The tests shall be performed on a single appliance.

4.3 General measurement conditions

Unless otherwise specified, the appliance shall be installed commissioned and operated in accordance with the information provided in the installation and operating instructions.

Commissioning procedures shall be repeated following a supply voltage interruption, if required by the installation and operating instructions.

4.4 Test setup

The appliance shall be fixed in accordance with the installation instructions. The load pattern should be chosen according to manufacturer classification.

The measurement setup shall correspond to Annex B.

5 Energy efficiency

5.1 Test methods

The following tests are intended to establish the value Q_{elec} for a chosen tapping pattern as defined in Annex A. Losses resulting during idling are not taken into account.

5.2 Control settings

If the appliance has a **power selector**, the selector should be adjusted to the highest value. If the appliance has an independent **flow control**, it shall be adjusted to achieve manufacturers stated value.

If the appliance has a temperature control, the selector should be adjusted to the highest value.

The prescribed minimum flow rate f_i of each individual draw off of the tapping pattern is used as defined in Annex A. If this is not achievable increase the flow rate. This increased flow rate is used for the individual draw off instead of the prescribed minimum flow rate.

5.3 Static efficiency

The static loss of the appliance P_{loss} at nominal load P_{nom} under steady state conditions has to be determined.

The value of P_{loss} is the sum of all internal power losses (product of current and voltage losses between the terminals and the heating elements) of the appliance after a minimum of 30 minutes of operation under full load conditions.

For the purpose of this test the result is independent from the water inlet temperature; therefore this test can be carried out with a cold water inlet temperature in the range of 10 °C to 25 °C.

In every case the voltage across parts (e.g. wiring, power terminals, power switches, semiconductor switches) is subtracted from the measured voltage losses, if these parts are thermally connected to the water pipe. In this case, the heat developed by these parts is transferred to useful energy to heat up the water.

The static efficiency is calculated as:

$$\eta_{static} = \frac{P_{nom} - P_{loss}}{P_{nom}}$$

where

P_{nom} nominal power consumption of the appliance in kW

P_{loss} measured internal static losses of the appliance in kW

η_{static} static efficiency of the appliance as factor

5.4 Start up losses

This test shall measure the time t_{start_i} which elapses between energizing the heating elements and the delivery of **useable water** for each different draw off of the chosen **load pattern** of Annex A. The test method assumes the power consumption of the appliance during the start-up period is equal to the power consumed in static mode. P_{static_i} is the static power consumption in steady state conditions of the appliance for the specific draw off *i*.

Three measurements shall be done for each draw off *i*. The result is the mean value from these measurements.

The start up losses can be measured (defined Part 2-x) or calculated as:

$$Q_{start_i} = P_{static_i} \times \frac{t_{start_i}}{3\,600}$$

where

t_{start_i} measured start up time in sec

P_{static_i} measured steady state power consumption in kW for specific draw off *i*

Q_{start_i} start up losses in kWh for specific draw of *i*

5.5 Smart control compliance

Smart control compliance is defined in Part 2-x.

In case an appliance is equipped with a smart control and a benefit can be demonstrated a smart compliance factor B_{smart} shall be applied:

B_{smart} = 0,80 with smart compliance

B_{smart} = 1,00 without smart compliance

5.6 Calculation of energy demand

The daily energy demand Q_{elec} is the sum of losses and useful energy of all individual draw off *i* per day as defined in Annex A in conjunction with smart compliance factor.

The daily energy demand is calculated as:

$$Q_{elec} = B_{smart} \times \sum_{i=1}^{n} \left(Q_{start_i} + \frac{Q_{tap_i}}{\eta_{static}} \right)$$

where

B_{smart} smart compliance factor

Q_{start_i} start up losses for specific draw of *i* in kWh

Q_{tap_i} predefined useful energy per draw off *i* in kWh

η_{static} static efficiency of the appliance

5.7 Correction factor

Table 2 gives a look-up table of the correction factor:

Table 2

qcor_winter **October-April**	*qcor_summer* **June-August**	*(qcor)* **All year**
0,85	-0,71	0,32

The corrected energy is calculated as: $Q_{cor} = (Q_{elec} - Q_{ref}) * q_{cor}$

where

q_{cor} correction factor

Q_{ref} daily (24h) useful energy content as specified for the relevant **load pattern** in Annex A.

The efficiency of the appliance is calculated as: $\eta_{iwh} = Q_{ref} / (PEF * (Q_{elec} - Q_{cor})) * 100\%$