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Electric instantaneous water heaters — Methods for measuring the Performance

Part 1: General requirements

National foreword

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The UK participation in its preparation was entrusted to Technical Committee CPL/59, Performance of household electrical appliances.

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

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European foreword

This document (EN 50193-1:2016) 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) 2017-05-23
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2019-05-23

This document supersedes EN 50193-1:2013.

EN 50193-1:2016 includes the following significant technical changes with respect to EN 50193-1:2013:

- Alignment of the terms and formulas with those detailed in Commission communication in the framework of the implementation of Commission Regulation (EU) No 814/2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water heaters and hot water storage tanks and of Commission Delegated Regulation (EU) No 812/2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of water heaters, hot water storage tanks and packages of water heater and solar device (2014/C 207/03).
- Clarification of the Smart Control Factor and the issues surrounding its application for Electric Instantaneous Water Heaters.
- Updates to the references and bibliography.
- Addition of an informative annex for alternative test methods under development.
- Addition of Annexes ZZA and ZZB.

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

For the relationship with EU Directive(s) see informative Annex ZZA and ZZB, which are integral parts of this document.

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 reference 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 22768-1, *General tolerances - Part 1: Tolerances for linear and angular dimensions without individual tolerance indications (ISO 2768-1)*

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**

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 are switched on or off, depending on the water flow rate or water pressure

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

load profile/load pattern

a means of illustrating the power consumption of an **instantaneous water heater** over a 24 hour period

3.9

smart control

a system that can demonstrate a reduction in energy consumption

3.10

useable 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 Measurement Equipment

The table below gives the accuracy of measurement equipment.

Table 1 — Measurement Equipment Accuracy

Measurement parameters	Unit	Measurement uncertainty (accuracy)	Remarks
Ambient temperature	°C/K	± 1 K	5)
Time	s	± 0,1 s	2)
Cold inlet water temperature	°C/K	± 0,2 K	2) 101)
Hot outlet water temperature	°C/K	± 1 K	1) 2)
Water flow rate	l/min	±0,1 l/min or ±1%	2) 4)
Water pressure	Mpa	± 5 %	3)
input power	kW	± 1 %	2)
Input power	W	± 1 %	5)
Voltage	V	± 0,5 %	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.
101) The cold water temperature T_{cold} shall be $15^{\circ}\text{C}^{\pm 5\text{K}}$ for the performance tests according to clause 102ff (EN 50193-2-1).

4.2 Number of appliances to be tested

The tests shall be performed on the same appliance.

4.3 General 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.

The supply voltage shall be maintained at the main terminal at $230\text{ V} \pm 1\%$ or at $400\text{ V} \pm 1\%$ as defined by the manufacturer's installation guide, while the heating elements are switched on. The supply frequency shall be at a nominal $50\text{ Hz} \pm 1\%$.

The measured voltage and frequency of the power supply used during testing shall be reported.

The tests shall be carried out in a draft free environment at an ambient temperature of $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$. The environment shall not deviate by more than 2K during the test period.

The flow rates provided to the appliance for the test shall be maintained within a tolerance of $\pm 0.3\text{l/min}$ or $\pm 3\%$ whichever is higher but shall be not be below the minimum required for the individual draw-off. The flow rates supplied during the test shall be reported.

Unless otherwise specified cold inlet water temperature shall be $10\text{ °C} \pm 1\text{ °C}$

4.4 Test setup

The appliance shall be installed in accordance with the installation instructions.

The load pattern should be chosen according to manufacturer classification. The load profile selected can be the maximum or one below the maximum load profile the water heater can fulfil.

The measurement setup shall correspond to Annex B.

5 Energy efficiency

5.1 Test methods

5.1.1 General

The following tests are required to enable the values of Q_{elec} , Q_{cor} and AEC to be calculated using the formulas described in 5.2 for a chosen tapping pattern as defined in Annex A. Losses resulting during idling are not taken into account.

5.1.2 Static efficiency

This test shall measure the static loss of the appliance P_{loss} at nominal load P_{nom} under steady state conditions.

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 the value stated in the manufacturer's installation instructions, or where this is not stated, it shall be set to the highest value.

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

For the purpose of this test 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 to 25°C. The inlet water temperature and flow rate must be such that the appliance is caused to operate at full power continuously.

The value of P_{nom} is the power consumption of the appliance measured after a minimum of 30 minutes of operation under full load conditions.

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 measured after a minimum of 30 minutes of operation under full load conditions.

For instantaneous water heaters with semiconductor power switches (e.g Triacs) the voltage across the semiconductor power terminals is subtracted from the measured voltage losses, if the semiconductor power switches are thermally connected to the water pipe. In this case, the heat developed by the semiconductor power switches is transferred to useful energy to heat up the water.

The static efficiency is calculated from the formula:

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

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 a factor

5.1.3 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** and the power consumption P_{static_i} of the appliance at steady state during 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 steady state conditions of the appliance for the specific draw-off i .

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 the value stated in the manufacturer's installation instructions, or where this is not stated, it shall be set to the highest 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 until the appliance is able to provide hot water continuously with static heating conditions. This increased flow rate is used for the individual draw-off instead of the prescribed minimum flow rate. It may be necessary to determine the required flow rate for each individual draw-off where the product may not be able to run continuously at the prescribed minimum flow rate by experimentation before beginning the full series of draw-offs for the chosen load pattern of Annex A.

Three measurements shall be performed for each specific draw-off type i and the mean value calculated from these measurements. Each of these measurements shall be performed with the product flushed. This should be done by flowing cold water through the product without the heating elements being energised and monitoring the inlet and outlet temperatures until the difference between the inlet and outlet temperatures is within 1K.

The start-up loss for each specific draw-off i is calculated from the formula:

$$Q_{start_i} = P_{static_i} \times \frac{t_{start_i}}{3600}$$

where

t_{start_i} measured start-up time in seconds

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-off i

5.1.4 Determination of the smart control factor SCF

SCF = 0

NOTE The calculation of the water heating energy efficiency of water heaters is based on tapping profiles. These tapping profiles are based on the energy content of the withdrawn water.

In the case of electric instantaneous water heaters (EIWH) different technologies exist, hydraulically and electronically controlled products. Electronic electric instantaneous water heaters (EEIWH), through an electronic control system are better able to fine-tune the electrical power consumption to heat up the water to the requested water temperature, without the need of mixing cold water. This results in a reduction of the energy consumption when comparing EEIWHs to simple hydraulic electric instantaneous water heaters (HEIWH) for a real daily usage.

The fact that the load profiles provided refer to energy content of the withdrawn water regardless of actual withdrawal flow rate or temperature either of which may be above the minimum requirement for an individual tapping. It is not possible to show any difference in efficiency between simple instantaneous water heaters and those which are able to regulate the energy input during the delivery of water

For this reason the SCF = 0.

5.1.5 Determination of smart control compliance

If SCF is $\geq 0,07$ the value of smart shall be one.

In all other cases the value smart shall be zero.

5.2 Calculation methods

5.2.1 General

The following calculation methods enable the values of Q_{elec} , Q_{cor} and AEC to be calculated using the results from the tests described in 5.1 for a chosen tapping pattern as defined in Annex A.

5.2.2 Daily 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.

The daily energy demand is calculated from the formula:

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

Where

Q_{elec} is the daily energy demand in kWh

Q_{start_i} is the start-up losses for specific draw-off i in kWh determined in 5.1.3

Q_{tap_i} is the predefined useful energy content per draw-off i in kWh as specified for the relevant **load pattern** in Annex A.

η_{static} is the static efficiency of the appliance determined in 5.1.2

5.2.3 Correction factor

The correction factor is calculated from the formula:

$$Q_{cor} = -k \times CC (Q_{elec} - Q_{ref})$$

where

k is the stated k-value in the regulation

CC is the Primary energy factor

Q_{elec} is the daily energy demand determined in 5.2.2

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

NOTE 1 k is currently 0.23 for load profiles 3XS to XL and is 0 for profiles XXL to 4XL in the regulation

NOTE 2 The value of CC is currently 2.5 in the regulation

5.2.4 Energy efficiency

The efficiency of the appliance is calculated from the formula:

$$\eta_{iwh} = \frac{Q_{ref}}{CC \times Q_{elec} \times (1 - SCF \times smart) + Q_{cor}} \times 100\%$$

Where

CC is the Primary energy factor

Q_{elec} is the daily energy demand determined in 5.2.2

Q_{cor} correction factor determined in 5.2.3

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

SCF is the smart control factor determined in 5.1.4

smart is the smart compliance rating determined in 5.1.5

5.2.5 Annual electricity consumption

The annual electricity consumption of the appliance is calculated from the formula:

$$AEC = 219.6 \times \left(Q_{elec} \times (1 - SCF \times smart) + \frac{Q_{cor}}{CC} \right)$$

Where

CC is the Primary energy factor

Q_{elec} is the daily energy demand determined in 5.2.2

Q_{cor} correction factor determined in 5.2.3

SCF is the smart control factor determined in 5.1.4

smart is the smart compliance rating determined in 5.1.5

Annex A **(informative)** **Load pattern**

Tables A.1, A.2 and A.3 specify the tapping patterns for the chosen load pattern.

Parameters in the table are:

- Load pattern [3XS-4XL, in header row of the tables];
- h: Hour [hh:mm] starting at 0:00 h;
- Q_{tap}: Useful energy content of water withdrawal to be achieved in the draw-off [in kWh];
- F: Minimum flow rate to be reached during tapping [in l/min];
- T_m: Temperature from which counting of useful energy content starts [in °C];
- T_p: Minimum (peak) temperature to be achieved during tapping [in °C];
- Q_{ref}: Daily (24h) useful energy content of all water draw-offs [in kWh/d, effectively the sum of all Q_{tap}].

Table A.1 — Water heater load patterns (reference test tapping patterns) 3XS to S

H	3XS				XXS				XS				S			
	Qtap	f	Tm	Tp	Qtap	f	Tm	Tp	Qtap	F	Tm	Tp	Qtap	F	Tm	Tp
	kWh	l/min	°C	°C	kWh	l/min	°C	°C	kWh	l/min	°C	°C	kWh	l/min	°C	°C
07.00	0,015	2	25		0,105	2	25						0,105	3	25	
07.05	0,015	2	25													
07.15	0,015	2	25													
07.26	0,015	2	25													
07.30	0,015	2	25		0,105	2	25		0,525	3	35	-	0,105	3	25	
07.45																
08.01																
08.05																
08.15																
08.25																
08.30					0,105	2	25						0,105	3	25	
08.45																
09.00	0,015	2	25										0,105	3	25	
09.30	0,015	2	25		0,105	2	25						0,105	3	25	
10.00																
10.30																
11.00																
11.30	0,015	2	25		0,105	2	25						0,105	3	25	
11.45	0,015	2	25		0,105	2	25						0,105	3	25	
12.00	0,015	2	25		0,105	2	25									
12.30	0,015	2	25		0,105	2	25									
12.45	0,015	2	25		0,105	2	25		0,525	3	35	-	0,315	4	10	55
14.30	0,015	2	25													
15.00	0,015	2	25													
15.30	0,015	2	25													
16.00	0,015	2	25													
16.30																
17.00																
18.00					0,105	2	25						0,105	3	25	
18.15					0,105	2	25						0,105	3	40	
18.30	0,015	2	25		0,105	2	25									
19.00	0,015	2	25		0,105	2	25									
19.30	0,015	2	25		0,105	2	25									
20.00					0,105	2	25									
20.30									1,050	3	35	-	0,420	4	10	55
20.45					0,105	2	25									
20.46																
21.00					0,105	2	25									
21.15	0,015	2	25		0,105	2	25									
21.30	0,015	2	25										0,525	5	45	
21.30	0,015	2	25		0,105	2	25									
21.45	0,015	2	25		0,105	2	25									
Qref	0,345				2,100				2,100				2,100			

Table A.2 — Water heater load patterns (reference test tapping patterns) M to XL

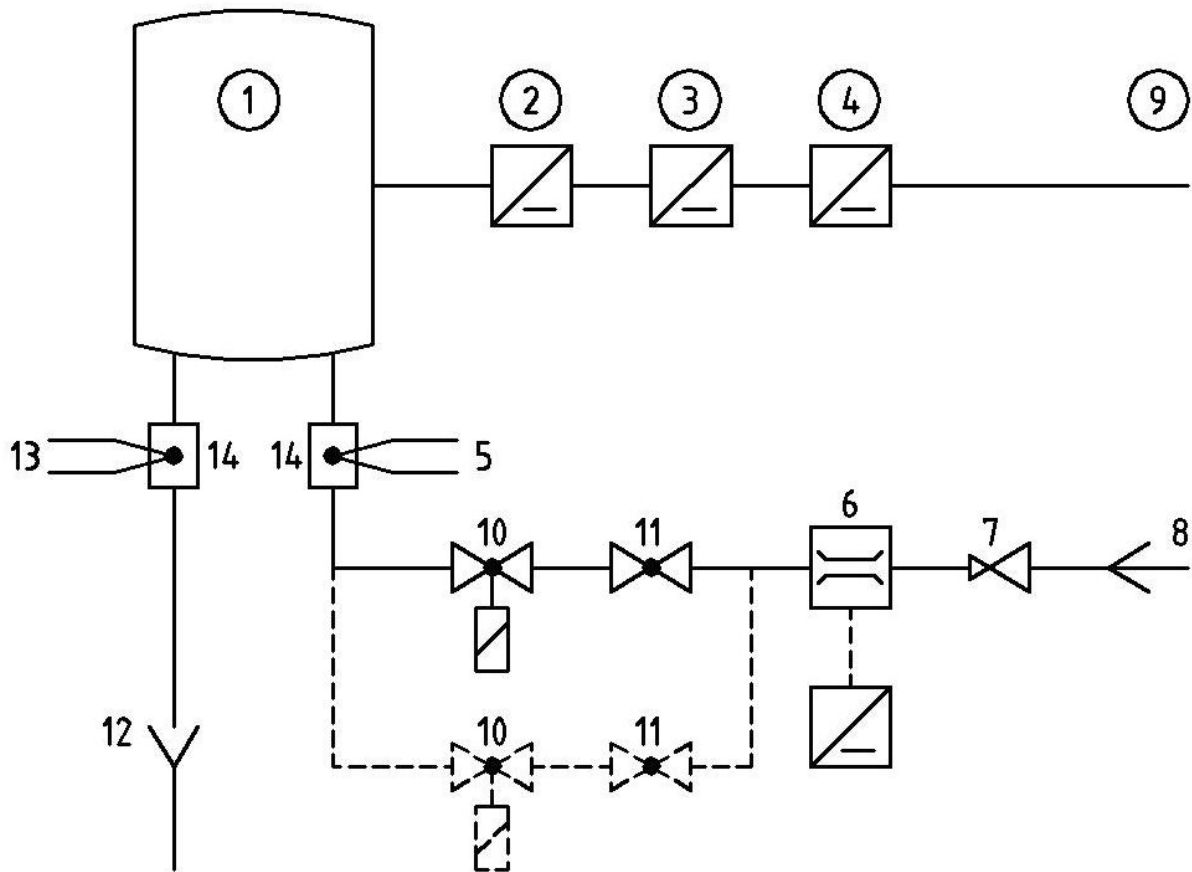
h	M				L				XL			
	Qtap	f	Tm	Tp	Qtap	f	Tm	Tp	Qtap	f	Tm	Tp
	kWh	l/min	°C	°C	kWh	l/min	°C	°C	kWh	l/min	°C	°C
07.00	0,105	3	25		0,105	3	25		0,105	3	25	
07.05	1,400	6	40		1,400	6	40					
07.15									1,820	6	40	
07.26									0,105	3	25	
07.30	0,105	3	25		0,105	3	25					
07.45					0,105	3	25		4,420	10	10	40
08.01	0,105	3	25						0,105	3	25	
08.05					3,605	10	10	40				
08.15	0,105	3	25						0,105	3	25	
08.25					0,105	3	25					
08.30	0,105	3	25		0,105	3	25		0,105	3	25	
08.45	0,105	3	25		0,105	3	25		0,105	3	25	
09.00	0,105	3	25		0,105	3	25		0,105	3	25	
09.30	0,105	3	25		0,105	3	25		0,105	3	25	
10.00									0,105	3	25	
10.30	0,105	3	10	40	0,105	3	10	40	0,105	3	10	40
11.00									0,105	3	25	
11.30	0,105	3	25		0,105	3	25		0,105	3	25	
11.45	0,105	3	25		0,105	3	25		0,105	3	25	
12.00												
12.30												
12.45	0,315	4	10	55	0,315	4	10	55	0,735	4	10	55
14.30	0,105	3	25		0,105	3	25		0,105	3	25	
15.00									0,105	3	25	
15.30	0,105	3	25		0,105	3	25		0,105	3	25	
16.00									0,105	3	25	
16.30	0,105	3	25		0,105	3	25		0,105	3	25	
17.00									0,105	3	25	
18.00	0,105	3	25		0,105	3	25		0,105	3	25	
18.15	0,105	3	40		0,105	3	40		0,105	3	40	
18.30	0,105	3	40		0,105	3	40		0,105	3	40	
19.00	0,105	3	25		0,105	3	25		0,105	3	25	
19.30												
20.00												
20.30	0,735	4	10	55	0,735	4	10	55	0,735	4	10	55
20.45												
20.46									4,420	10	10	40
21.00					3,605	10	10	40				
21.15	0,105	3	25						0,105	3	25	
21.30	1,400	6	40		0,105	3	25		4,420	10	10	40
21.30												
21.45												
Qref	5,845				11,655				19,070			

Table A.3 — Water heater load patterns (reference test tapping patterns) XXL to 4XL

h	XXL				3XL				4XL			
	Qtap	f	Tm	Tp	Qtap	F	Tm	Tp	Qtap	f	Tm	Tp
	kWh	l/min	°C	°C	kWh	l/min	°C	°C	kWh	l/min	°C	°C
07.00	0,105	3	25		11,2	48	40		22,4	96	40	
07.05												
07.15	1,820	6	40									
07.26	0,105	3	25									
07.30												
07.45	6,240	16	10	40								
08.01	0,105	3	25		5,04	24	25		10,08	48	25	
08.05												
08.15	0,105	3	25									
08.25												
08.30	0,105	3	25									
08.45	0,105	3	25									
09.00	0,105	3	25		1,68	24	25		3,36	48	25	
09.30	0,105	3	25									
10.00	0,105	3	25									
10.30	0,105	3	10	40	0,84	24	10	40	1,68	48	10	40
11.00	0,105	3	25									
11.30	0,105	3	25									
11.45	0,105	3	25		1,68	24	25		3,36	48	25	
12.00												
12.30												
12.45	0,735	4	10	55	2,52	32	10	55	5,04	64	10	55
14.30	0,105	3	25									
15.00	0,105	3	25									
15.30	0,105	3	25		2,52	24	25		5,04	48	25	
16.00	0,105	3	25									
16.30	0,105	3	25									
17.00	0,105	3	25									
18.00	0,105	3	25									
18.15	0,105	3	40									
18.30	0,105	3	40		3,36	24	25		6,72	48	25	
19.00	0,105	3	25									
19.30												
20.00												
20.30	0,735	4	10	55	5,88	32	10	55	11,76	64	10	55
20.45												
20.46	6,240	16	10	40								
21.00												
21.15	0,105	3	25									
21.30	6,240	16	10	40	12,04	48	40		24,08	96	40	
21.30												
21.45												
Qref	24,53 0				46,76 0				93,52 0			

Annex B
(normative)

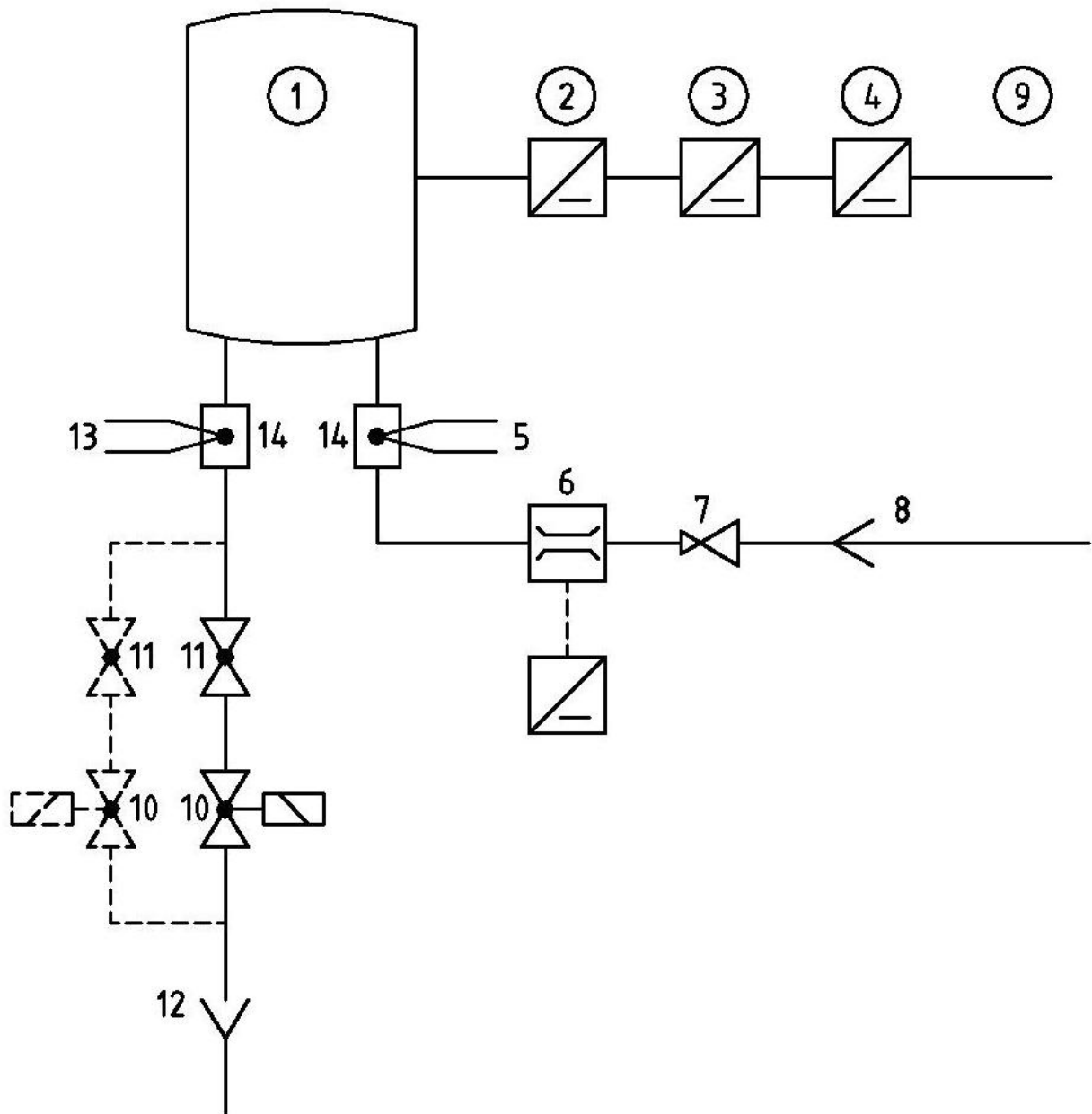
Test setup



Key

1	appliance under test	8	connection to the water distribution network
2	power meter - Powermeter or Ammeter required	9	electrical power connection
3	volt meter	10	magnetic valves
4	ampere meter - Powermeter or Ammeter required	11	flow regulator
5	inlet temperature sensor	12	open water outlet
6	flow meter	13	outlet temperature sensor
7	pressure reducing / regulating device	14	thermocouples in water connection part (see Figure B.3)

Figure B.1 — Test setup for open-outlet instantaneous water heater

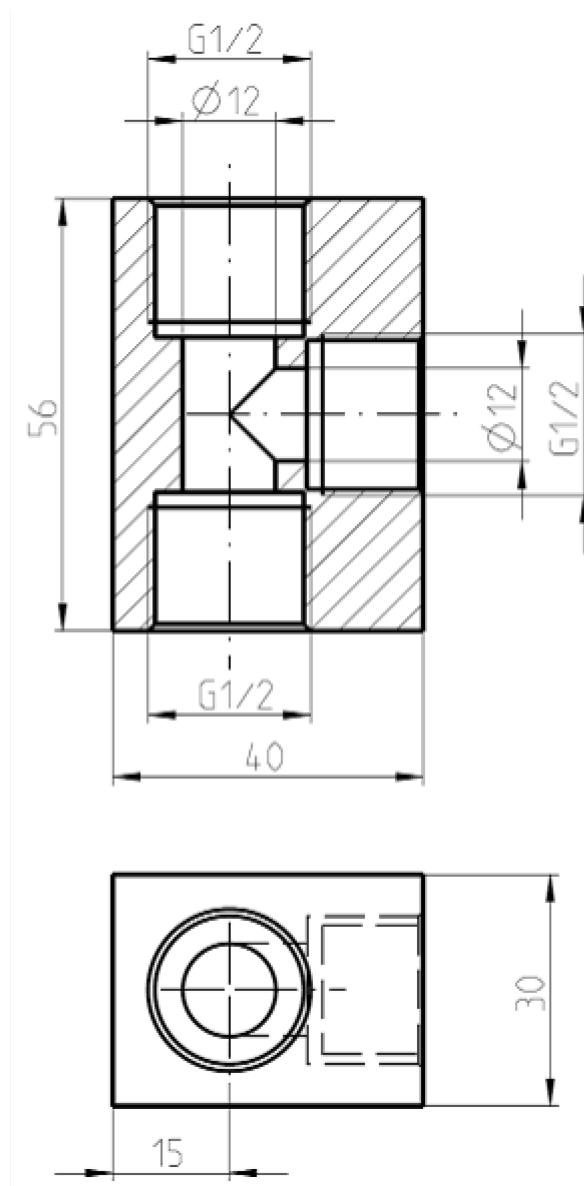


Key

- | | |
|---|---|
| 1 appliance under test | 8 connection to the water distribution network |
| 2 power meter | 9 electrical power connection |
| 3 volt meter | 10 magnetic valves |
| 4 ampere meter | 11 flow regulator (may be included in the appliance itself) |
| 5 inlet temperature sensor | 12 open water outlet |
| 6 flow meter | 13 outlet temperature sensor |
| 7 pressure reducing / regulating device (may be included in the appliance itself) | 14 thermocouples in water connection part (see Figure B.3) |

Figure B.2 — Test setup for closed instantaneous water heater

Dimensions in millimetres

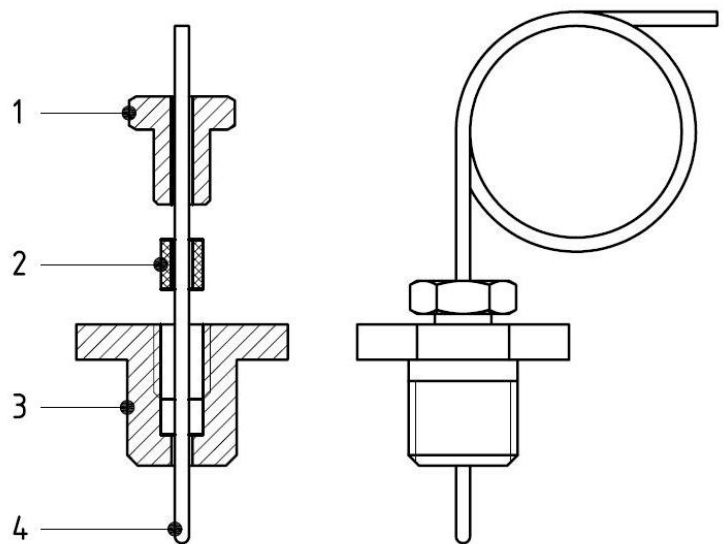
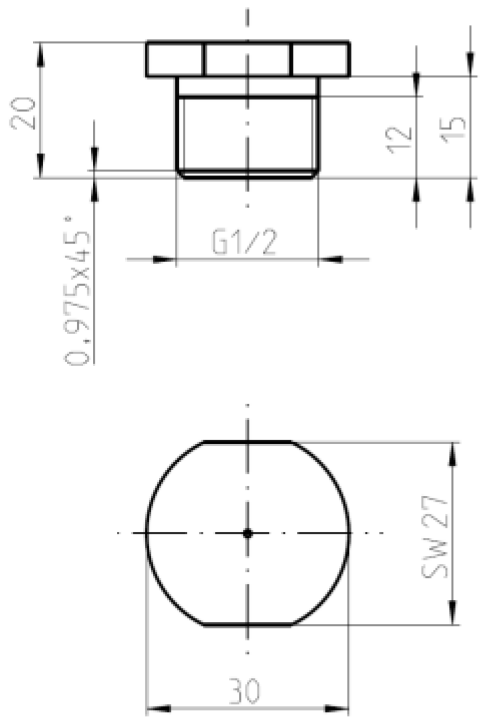


Material: PA66.

Thread in accordance with EN ISO 228-1.

Dimension tolerances according to EN 22768-1.

Figure B.3 — Thermocouple water connection part



Key

- 1 Screw
- 2 Seal
- 3 Screw
- 4 Thermocouple

Material: PA66.

Thread in accordance with EN ISO 228-1.

Figure B.4 — Example of a thermocouple feed through

Annex C (informative) Alternative test methods under development

C.1 General

Due to the nature of operation of instantaneous water heaters and the fact that the load profiles provided refer to energy content of the withdrawn water regardless of actual withdrawal flow rate or temperature either of which may be above the minimum requirement for an individual tapping. It is not possible to show any difference in efficiency between simple instantaneous water heaters and those which are able to regulate the energy input during the delivery of water. In fact both types are typically above 95% efficient because the water is always heated on demand, and the power consumption between individual draw-offs is minimal, the majority of the wasted heating energy is that which is expended during the heating up phase before the delivered water has reached its prescribed minimum temperature.

Although it may not be possible to show a difference in energy efficiency, it is possible to show a difference in annual energy consumption if the individual draw-offs are considered to be durations of water draw-off rather than energy content.

The following sub-clause provides an alternative method for calculation of annual energy consumption, which may be considered for future development.

C.2 Annual energy consumption

C.2.1 General

The annual electricity consumption of the appliance is calculated based upon a calculated draw-off duration derived from the requirements specified in Annex A and the steady state power consumption of each individual draw-off i per day .

C.2.2 For individual draw-offs the following formulas are used to calculate the daily energy consumption for those draw-offs.

The draw-off duration for draw-offs is calculated from the formula:

$$Q_{time_i} = \frac{Q_{tap_i} * 60}{f_i * (T_i - 10) * shc}$$

Where

Q_{time_i} is the calculated draw-off duration in hours

shc is the specific heat capacity of water which is 4,20 kJ/kg °C assuming density of water is equal to 1kg/ litre

Q_{tap_i} is the predefined useful energy per draw-off i in kWh

f_i is the minimum flow rate per draw-off i in l/min according to 5.1.3

T_i is the predefined temperature T_m at which counting of useful energy content starts per draw-off i in °C . If T_p is defined for the individual tapping, T_p is used instead of T_m .

The energy consumed during draw-offs is calculated from the formula:

$$Q_T = \sum_{i=1}^n (Q_{start_i} + (P_{static_i} \times Q_{time_i}))$$

Where

Q_{time_i} is the calculated draw-off duration in hours

P_{static_i} measured steady state power consumption in kW for specific draw-off i determined in 5.1.3

Q_{start_i} start-up losses in kWh for specific draw-off i according to 5.1.3

C.2.3 The Annual Energy Consumption is calculated from the following formula:

$$AEC = 219,6 \times (Q_T + \frac{Q_{cor.}}{CC})$$

Where

AEC is the annual energy consumption in kWh

Q_T is the energy consumption determined in C.2.2

CC is the Primary energy factor

Q_{cor} is the correction factor determined in 5.2.3

Annex ZZA
(informative)
**Relationship between this European Standard and the energy
labelling requirements of Commission Delegated Regulation (EU) No
812/2013 aimed to be covered**

This European standard has been prepared under a Commission's standardisation request, M/534 C(2015) 2625 final to provide one voluntary means of conforming to the energy labelling requirements of Commission Delegated Regulation (EU) No 812/2013 of 18 February 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of water heaters, hot water storage tanks and packages of water heater and solar device, OJ L239, 6.9.2013.

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

Table ZZA.1 — Correspondence between this European Standard and Commission Delegated Regulation (EU) No 812/2013 of 18 February 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of water heaters, hot water storage tanks and packages of water heater and solar device, OJ L239, 6.9.2013 and Commission's standardisation request, M/534 C(2015) 2625 final

Energy labelling requirements of Regulation (EU) No 812/2013, OJ L239, 6.9.2013	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
Daily electricity consumption	5.2.2 Daily energy demand	
Annual electricity consumption	5.2.5 Annual electricity consumption	
Water heater energy efficiency	5.2.4 Energy-efficiency	

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WARNING 2: Other Union legislation may be applicable to the products falling within the scope of this standard.

Annex ZZB
(informative)
Relationship between this European Standard and the ecodesign requirements of Commission Regulation (EU) No 814/2013 aimed to be covered

This European Standard has been prepared under a Commission's standardization request, M/534 C(2015) 2625 final to provide one voluntary means of conforming to the ecodesign requirements of Commission Regulation (EU) No 814/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water heaters and hot water storage tanks, OJ L293, 6.9.2013.

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Ecodesign requirements of Regulation (EU) No 814/2013, OJ L293, 6.9.2013	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
Daily electricity consumption	5.2.2 Daily energy demand	
Water heater efficiency	5.2.4 Energy-efficiency	

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the products falling within the scope of this standard.

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DIRECTIVE 2010/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products

Commission Delegated Regulation (EU) No 812/2013 of 18 February 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of water heaters, hot water storage tanks and packages of water heater and solar device

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