IEC 63159-2-1

Edition 1.0 2021-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Household electric instantaneous water heaters – Methods for measuring the performance –
Part 2-1: Multifunctional electric instantaneous water heaters

Chauffe-eau instantanés électrodomestiques – Méthodes de mesure de l'aptitude à la fonction –
Partie 2-1: Chauffe-eau instantanés électriques multifonctions

IEC 63159-2-1:2021-10(en-fr)

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Part 2-1: Multifunctional electric instantaneous water heaters

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International Standard IEC 63159-2-1 has been prepared by subcommittee 59C: Electrical heating appliances for household and similar purposes, of IEC technical committee 59: Performance of household and similar electrical appliances.

The text of this International Standard is based on the following documents:

Draft	Report on voting
59C/268/FDIS	59C/272/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

This International Standard is to be used in conjunction with IEC 63159-1:2021.

This standard supplements or modifies the corresponding clauses in IEC 63159-1. When a particular subclause of IEC 63159-1 is not mentioned in this standard, that subclause is applicable as far as reasonable. Where this standard states "addition", "modification" or "replacement", the relevant requirements, test specifications or explanatory matter in IEC 63159-1 should be adapted accordingly.

Subclauses or figures that are additional to those in IEC 63159-1 are numbered starting from 101. Additional annexes are lettered AA, BB, etc.

A list of all the parts in the IEC 63159 series, published under the general title *Household electric instantaneous water heaters – Methods for measuring the performance*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

HOUSEHOLD ELECTRIC INSTANTANEOUS WATER HEATERS – METHODS FOR MEASURING THE PERFORMANCE –

Part 2-1: Multifunctional electric instantaneous water heaters

1 Scope

This clause of IEC 63159-1:2021 is applicable with the following exception:

Addition:

This document applies to electrical instantaneous water heaters designed to operate as multifunctional appliances with an electric rated power > 2 kW.

This document specifies tests for the assessment of the performance.

2 Normative references

This clause of IEC 63159-1:2021 is applicable with the following exception:

Addition:

IEC 63159-1:2021, *Household electric instantaneous water heaters – Methods for measuring the performance – Part 1: General aspects*

3 Terms and definitions

This clause of IEC 63159-1 is applicable with the following exceptions:

Addition:

3.101
setpoint value
changeable value that is allocated to the appliance or the individual components thereof

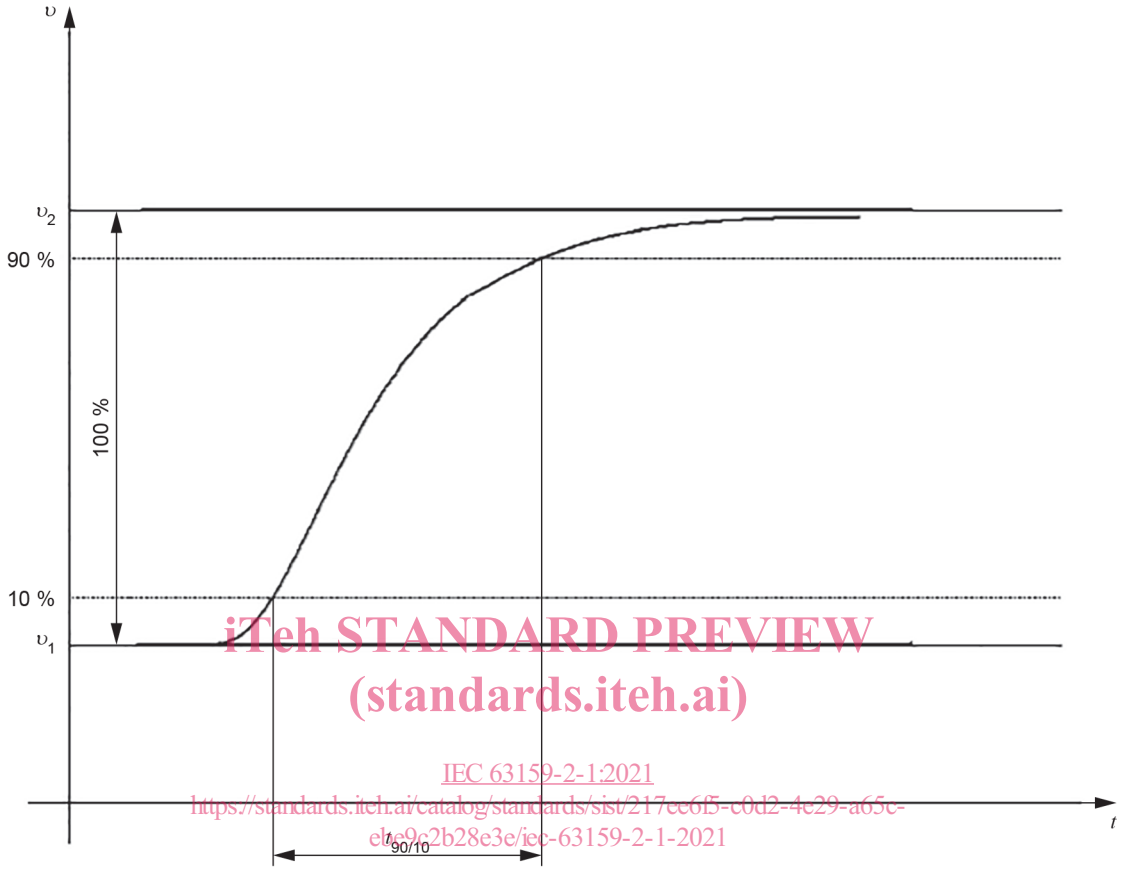
3.102
pressure drop on activation of the heating capacity
pressure drop in the instantaneous water heater, at which the heating capacity is, and remains, activated

3.103
90 % method
stop point of the measurement when 90% of value is reached

Note 1 to entry: Usually, a physical value reaches a final (average) value in an asymptotic manner. To reach a valid measurement result, a stop point of the measurement has to be defined. The measurement is stopped when the value finally reaches 90 % of the difference between the (average) starting value and the (average) final value.

3.104
10 %/90 % method
range between the start and stop points

Note 1 to entry: Usually, a physical value changes with a time delay in an asymptotic manner between the start value and the final value. To reach a valid measurement result, a start point and a stop point have to be defined for the measurement. The measurement is started when the physical value first reaches 10 % of the difference between the (average) starting value and the (average) final value. The measurement is stopped when the value finally reaches 90 % of the difference.



3.105
response time
time interval between the beginning of the changing of a value or parameter and the moment a steady-state condition is obtained

Note 1 to entry: The 90 % method shall be used.

3.106
flow rate
rate at which water flows, expressed in l/min

3.107
heating-up duration
time interval between the opening of the withdrawal device and the obtainment of the final outlet temperature

Note 1 to entry: The 90 % method shall be used.

3.108
pressure difference
difference between the pressure at the water inlet and the water outlet of the appliance at a defined flow rate

3.109
multifunctional appliances
instantaneous water heater that shall supply one or more outlets suitable for several functions, for instance kitchen sinks, hand-washing sinks, showers and bathtubs

4 General test conditions

This clause of IEC 63159-1:2021 is applicable with the following exceptions:

4.3 General conditions

Modification:

The cold water temperature T_{cold} shall be 15 °C ± 5 °C for the performance tests.

4.4 Test setup

This subclause of IEC 63159-1:2021 is not applicable.

Addition:

4.101 Symbols and units

For the purposes of this document, the symbols and units of Table 101 apply.

Table 101 – Symbols and units

Symbol	Unit	Description
T_{min}	°C	The minimum setting of the temperature setting mechanism settable by user at which the appliance heats. If no user-accessible temperature selector is available, the relevant measurements with T_{min} are not performed.
T_{38}	°C	Standard hot water temperature setpoint for various tests: 38 °C. If the temperature setting mechanism settable by user does not permit an outlet temperature setting of 38 °C, a temperature as close as possible above 38 °C as possible shall be chosen. This temperature shall be stated in the test report and shall be used for any further measurements, instead of 38 °C. The positions of the temperature setting mechanism shall be marked for reproducible settings, taking into consideration the fact that T_{38} settings may depend on the direction of the rotation of a knob. If no user-accessible temperature selector is available, the temperature factory setting is defined to be the T_{38} setting.
T_{max}	°C	The maximum setting of the temperature setting mechanism settable by the user. If no user accessible temperature selector is available, the relevant measurements with T_{max} are not performed.
T_{Pmin}	°C	Temperature at the minimum permanent setting of the power selector settable by user at which the appliance heats. If no user-accessible power selector is available, the relevant measurements with T_{Pmin} are not performed.
T_{Pmax}	°C	Temperature at the maximum permanent setting of the power selector settable by user. If no user-accessible power selector is available, the temperature factory setting is defined to be the T_{Pmax} setting.
$\dot{V}_{90\,\%\,P}$	l/min	The flow rate where the power consumption is 90 % of rated power at T_{38} and an inlet temperature of 15 °C.
$K_{\dot{V}}$	Factor	The correction value for $\dot{V}_{90\,\%\,P}$ if the inlet temperature differs by more than 1 K from 15 °C.

Symbol	Unit	Description
$\dot{V}_{38}$	l/min	The flow rate related to the outlet temperature of 38 °C.
T_m	°C	Temperature from which counting of useful energy content starts.
T_p	°C	Minimum (peak) temperature to be achieved during tapping.
T_{cold}	°C	Cold water inlet temperature.
F	l/min	Minimum flow rate to be reached during tapping.
P_{min}	kW	Minimum required instantaneous heating power to fulfil tapping.
T_d	S	Tapping duration.
P_{real}	kW	Minimum requited heating power of the appliance.
P_{nom}	kW	Nominal heating power of the appliance.
Q_{nom}	kWh	Nominal daily energy consumption of the appliance.
Q_r	kWh	Real daily energy consumption of the appliance.

4.102 Time constants (measuring time)

Time constants shall be determined by means of the 10 %/90 % method.

4.103 Test setup

4.103.1 Measurement setup

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

The measurement setup shall correspond to Figure B.101 for open-outlet appliances (single point) and to Figure B.102 for closed-outlet (multi point) appliances.

4.103.2 Setpoints

Unless no specific setpoints for the individual test are defined, all non-user adjustable set-points shall be adjusted in accordance with the manufacturer's instructions for a standard setup.

User adjustable selectors have to be set as follows:

– If the appliance has a power selector, the selector shall be adjusted to the highest value.
– If the appliance has a temperature-independent flow selector, it shall be adjusted to the highest value.
– If the appliance has a flow-independent temperature selector, it shall be adjusted to the highest value.
– All other selectors shall be set in accordance with the manufacturer's instructions.

4.103.3 Measurement of flow pressure and flow rate

Flow pressure and flow rate shall be measured in accordance with Annex B. Flow pressure shall be determined by measuring the pressure difference.

4.103.4 Temperature measurement

The inlet and outlet temperatures of the water shall be measured using the setup shown in Figure B.103.

5 Energy efficiency

This clause of IEC 63159-1:2021 is applicable.

Replacement:

6 Performance tests

6.1 Determination of classification factor CF

6.1.1 General

To test the performance of instantaneous water heaters, it is necessary to specify classes: "H class" (e.g. hydraulic instantaneous water heaters) and "E class" (e.g. smart electronic instantaneous water heaters).

The following procedure shall be used to determine the classification. For that, it is necessary to define a reference instantaneous water heater.

6.1.2 Definition of a reference instantaneous water heater

For each single tapping, the minimum required instantaneous heating power $P_{\text{ref},i}$ is calculated as:

$$P_{\text{ref},i} = \Delta T_i \times f_i \times 14{,}3$$

Where

14,3 is the conversion factor between units;

f_i is the flowrate, in accordance with Annex A

$$\Delta T_i = T_{\text{p},i} - T_{\text{cold}};$$

T_{cold} is the cold water temperature;

$T_{\text{p},i}$ is the temperature, in accordance with Annex A. If not given, $T_{\text{m},i}$ shall be used.

Every single tapping results in a tapping duration. The time t_{d} [s] is calculated as:

$$t_{\text{d},i} = 3\,600 \times Q_{\text{tap},i} / P_{\text{ref},i}$$

Where

$Q_{\text{tap},i}$ is in accordance with Annex A.

The reference instantaneous water heater is defined as a typical hydraulic instantaneous water heater with two power levels of 50 % and 100 % of the nominal power P_{nom} of the sample.

The assumed power control of the reference instantaneous water heater is defined as follows:

– $P_{\text{real},i}$ = P_{nom}, if $P_{\text{ref,i}}$ of a single tapping is larger than 0,5 × P_{nom};

– otherwise $P_{\text{real},i}$ = 0,5 × P_{nom}.

where

P_{nom} is the maximum rated device power of the sample;

$P_{\text{real},i}$ is the defined device power for the reference unit depending on the respective tapping;

$P_{\text{ref},i}$ is the minimum device power for the reference unit needed to fulfill the respective tapping.

6.1.3 Calculation method of nominal energy consumption

For every single daily tapping, a nominal energy consumption $Q_{\text{nom},i}$ [kWh] is calculated as follows:

$$Q_{\text{nom},i} = \frac{t_{\text{d},i} \times P_{\text{real},i}}{3\,600}$$

where

$P_{\text{real},i}$ is the defined device power for the reference unit depending on the respective tapping

6.1.4 Determination of energy demand of the sample

The measuring is carried out in accordance with Annex A for every different single tapping event of a daily pattern. The flow rate is increased from zero to at least f until the appliance switches on. If the sample has a user-accessible temperature setpoint, the temperature setpoint of the appliance is adjusted to reach at least $T_{\text{p},i}$ or $T_{\text{m},i}$, whichever is higher. The energy consumption P [kWh] of the unit is measured at steady-state conditions.

Calculation of real energy demand $Q_{\text{r},i}$:

$$Q_{\text{r},i} = \frac{t_{\text{d},i} \times P_i}{3\,600}$$

Calculation of classification factor (CF):

The CF is based on the sum of the energy demand of every single tapping during a day, defined in the load profiles, in comparison with the sum of the energy demand of the nominal unit.

$$CF = 1 - \frac{\Sigma Q_{\text{r},i}}{\Sigma Q_{\text{nom},i}}$$

6.1.5 Definition of classes H and E

The classification of the instantaneous water heater is

– Class H: CF < 5 %;
– Class E: CF ≥ 5 %.

6.2 Determination of flow rates

6.2.1 General

The purpose of this test is to determine reference values for further measurements.

6.2.2 E class water heater

The appliance is operated under the boundary conditions of IEC 63159-1:2021, 4.3.

Set flow rate to $\dot{V}_{90\,\%\,P}$

– Closed outlet appliances: the water pressure difference shall be increased up to the half of the nominal pressure of the appliance, if necessary. If the flow rate $\dot{V}_{90\,\%\,P}$ cannot be obtained, the flow rate at pressure difference of half nominal pressure of the appliance is defined to be 100 %.

– Open outlet appliances: 0,1 MPa is the maximum useable pressure. If the flow rate $\dot{V}_{90\,\%\,P}$ cannot be obtained, the flow rate at a pressure difference of 0,1 MPa is defined to be 100 %

If the inlet temperature deviates by more than 1 K from 15 °C, a correction factor $K_{\dot{V}}$ has to be included:

$$K_{\dot{V}} = \frac{\vartheta_{\text{in,real}} - T_{38}}{15\ °\text{C} - T_{38}}.$$

The $\dot{V}_{90\,\%\,P}$ value will be corrected to

$$\dot{V}_{90\,\%\,P} \times K_{\dot{V}} \triangleq 100\ \%$$

Both, the outlet-temperature T_{38} and $\dot{V}_{90\,\%\,P}$ shall be stated in the test report and shall be used for any further measurements.

Table 102 – Nominal values for E class water heater

Rated power	**90 % rated power**	$T_{\text{in,real}}$	T_{38}	$\dot{V}_{90\,\%\,P}$.	$K_{\dot{V}}$.	$\dot{V}_{90\,\%\,P} \times K_{\dot{V}}$ **≙ 100 %**
nominal pressure				pressure difference	Flow rate ≙ 100 % [l/min]	

6.2.3 H class water heater

The flow rate shall be increased until the outlet temperature reaches the value of 38 °C. If a high enough flow rate cannot be obtained, the water pressure shall be increased until the pressure difference has reached half the nominal pressure of the appliance. For single-point appliances, 0,1 Mpa is the maximum by which the pressure can be increased.

Nominal values shall be determined and recorded in the manner shown in Table 103.

The value of the flow rate is taken to be 100 %.

Table 103 – Nominal values for H class water heater

P_{nom}	T_{out}	T_{in}	$\dot{V}_{38}$
nominal pressure	pressure difference		Flow rate ≙ 100% [l/min]

6.2.4 Determination of the flow rate as a function of the pressure difference

The flow rates shall be determined at pressure differences given in Table 104 and in Table 105. All flow limiting devices shall be fully opened. The measurement shall be carried out without the supply voltage.

Table 104 – Flow pressure and flow rate for multi point appliances

Pressure difference MPa	Flow rate l/min
0,1	
0,2	
0,3	

Table 105 – Flow pressure and flow rate for single point appliances

Pressure difference MPa	Flow rate l/min
0,025	
0,05	
0,1	

6.3 Pressure difference on activation of the heating capacity

6.3.1 General

The purpose of this test is to measure the minimum pressure difference at the installation site, to ensure a failure-free continuous operation of the appliance.

6.3.2 E class water heater

The temperature selector shall be set to the temperature setting T_{38}.

The flow rate shall be steadily increased until the heating capacity is activated. The required pressure difference and the associated flow rate shall be given in Table 106.

Table 106 – Pressure difference and flow rate

Outlet temperature °C	Pressure difference MPa	Flow rate l/min	Power kW

6.3.3 H class water heater

The pressure difference shall be steadily increased until the heating capacity is activated or switched over and remains permanently activated. The necessary flow pressure and the corresponding flow rate shall be determined.

These measurements shall be carried out with the minimum (T_{Pmin}) and the maximum (T_{Pmax}) permanent settings of the power and temperature selector which can be set by the user.

The pressure difference and the flow rate shall be given in Table 107.