

Working Document

COMMISSION REGULATION (EU) No .../...

of ...

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

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products¹ and in particular Article 15 (1) thereof,

After consulting the Ecodesign Consultation Forum,

Whereas:

- (1) Under Directive 2009/125/EC ecodesign requirements are to be set by the Commission for energy-related products representing significant volumes of sales and trade, having a significant environmental impact and presenting significant potential for improvement in terms of their environmental impact without entailing excessive costs.
- (2) Article 16(2) of Directive 2009/125/EC provides that in accordance with the procedure referred to in Article 19(3) and the criteria set out in Article 15(2), and after consulting the Ecodesign Consultation Forum, the Commission will as appropriate introduce an implementing measure for water heating equipment.
- (3) The Commission has carried out a preparatory study which analysed the technical, environmental and economic aspects of water heaters and hot water storage tanks. The study has been developed together with stakeholders and interested parties from the Union and third countries, and the results have been made publicly available.
- (4) The environmental aspect of water heaters that is identified as significant for the purposes of this Regulation is the energy consumption in the use phase and the emissions of nitrogen oxides. The significant environmental aspect of hot water storage tanks is energy consumption due the standing losses. The preparatory study shows that requirements regarding other ecodesign parameters referred to in Annex I, Part 1 to Directive 2009/125/EC are not necessary.

¹ OJ L 285, 31.10.2009, p. 10.

- (5) The scope of this regulation should be limited to water heaters which are dedicated to providing hot drinking and sanitary hot water. Products providing heat both for space heating purposes and their combinations with water heaters should not be covered by this regulation, but should be covered by a separate regulation.
- (6) Depending on the outcome of further technical, economical and environmental analyses, ecodesign requirements for water heaters specifically designed for using biofuels or solid fuels, including from biomass, should be set at a later stage, if appropriate.
- (7) The annual energy consumption related to water heaters and hot water storage tanks was estimated to be ... in the Union, corresponding to ... CO₂ emissions. If no specific measures are taken to limit this consumption, the energy consumption is predicted to be ... in 2020. The annual emissions of nitrogen oxides were estimated to be ... in the Union. If no specific measures are taken to limit these emissions, it is predicted that the annual emissions will be ... in 2020. The preparatory study shows that use-phase energy consumption and the nitrogen oxides emissions can be significantly reduced.
- (8) Reduction of energy consumption of water heaters and hot water storage tanks is possible by applying existing non-proprietary cost-effective technologies which lead to a reduction of the combined expenses for purchasing and operating water heaters and hot water storage tanks.
- (9) Ecodesign requirements should harmonise energy efficiency and nitrogen oxides emissions requirements for water heaters, and ecodesign requirements for standing losses of storage tanks throughout the Union, thus contributing to the functioning of the internal market and to the improvement of the environmental performance of these products.
- (10) The ecodesign requirements should not have a negative impact on the functionality of the product or on consumers, in particular as regards its affordability, or negatively affect health, safety or the environment.
- (11) A progressive introduction of the ecodesign requirements provides an appropriate timeframe for manufacturers to adapt their products. The timing should be such that cost impacts for manufacturers, in particular small and medium sized enterprises, are taken into account, while ensuring timely achievement of the objectives of this Regulation.
- (12) Measurements and calculations of the relevant product parameters should be performed through reliable, accurate and reproducible measurement and calculation procedures, which take into account the recognised state of the art measurement and calculation methods including, where available, harmonised standards adopted by the European standardisation bodies, as listed in Annex I to Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations and of rules on Information Society services².

² OJ L 204, 21.7.1998, p. 37.

- (13) This Regulation should increase the market penetration of technologies that reduce the environmental impact of water heaters and hot water storage tanks, leading to estimated annual energy savings of ... PJ, and a reduction of annual nitrogen oxides emissions of ... by in 2020, compared to a business-as-usual scenario.
- (14) In conformity with Article 8 of Directive 2009/125/EC, this Regulation should specify the applicable conformity assessment procedures.
- (15) In order to facilitate compliance checks, manufacturers should provide information in the technical documentation referred to in Annexes IV and V of Directive 2009/125/EC in so far as this information relates to the requirements laid down in this Regulation.
- (16) In order to further limit the environmental impact of water heaters and hot water storage tanks, manufacturers should provide relevant information on disassembly, recycling or disposal.
- (17) Benchmarks for currently available water heaters and hot water storage tanks with high energy efficiency should and small standing losses should be identified. This will help to ensure the wide availability and easy accessibility of information, in particular for small and medium-sized enterprises and very small firms, which will further facilitate the integration of best design technologies and the development of more efficiency products for reducing energy consumption and emissions of nitrogen oxides.
- (18) The measures provided for in this Regulation are in accordance with the opinion of the Committee established by Article 19(1) of Directive 2009/125/EC,

HAS ADOPTED THIS REGULATION:

Article 1
Subject matter and scope

1. This Regulation establishes ecodesign requirements for the placing on the market of water heaters and hot water storage tanks.
2. This Regulation shall not apply to:
 - (a) water heating equipment specifically designed for using biofuels;
 - (b) water heating equipment using solid fuels;
 - (c) water heating equipment within the scope of Directive 2001/80/EC on Large Combustion Plants;
 - (d) water heating equipment driven by district heating, including district heating using waste heat from power plants, waste incineration plants and industrial installations;
 - (e) components and sub-assemblies of water heating equipment other than storage tanks, including burners, heat exchangers and controls;
 - (f) equipment generating heat for room heating purposes.

Article 2
Definitions

In addition to the definitions set out in Directive 2009/125/EC, the following definitions shall apply:

- (1) “water heater” means a device which:
 - is connected to an external supply of drinking or sanitary water;
 - generates and transfers heat to deliver drinking or sanitary hot water at certain temperature levels, quantities and flow rates during certain intervals;
 - has one or more heat generators, including cascades of the same type of heat generators;
 - provides drinking or sanitary hot water only, but does not provide heat for room heating;
- (2) “heat generator” means the part of a water heater that generates the heat using the following processes:
 - combustion of gaseous and/or liquid fossil fuels;
 - use of the Joule effect in electric resistance heating elements;
 - capture of solar thermal energy;
 - capture of ambient heat from air, water or ground source, and/or waste heat;
- (3) “biofuel” means a gaseous, liquid or solid fuel produced from biomass;
- (4) "biomass" means the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and agriculture, as well as the biodegradable fraction of industrial and municipal waste;
- (5) "fuel" means a gaseous, liquid or solid fuel of fossil origin;
- (6) "hot water storage tank", hereafter referred to as "storage tank", means a vessel for storing drinking, sanitary or room heating hot water, including with additives, and including vessels equipped with the means for indirect heating or cooling the water content by an external heat source or heat sink;
- (7) “energy efficiency”, *etawh* , means the ratio between the useful energy provided by a water heater, and the energy required for its generation, taking also into account effects of hot water distribution and waste heat recovery;
- (8) "standing loss", *S*, means the heating power dissipated from a storage tank at certain water and ambient temperatures.

Article 3
Ecodesign requirements

The ecodesign requirements for the placing on the market of water heaters and storage tanks are set out in points 2 and 3 of Annex I.

Ecodesign requirements shall apply in accordance with the following timetable:

- (1) The ecodesign requirements for water heaters applying from [date to be inserted: one year after this Regulation has come into force] are set out in points 2(1a), 2(2), 2(3), 2(4) and 2(6) of Annex I.
- (2) The ecodesign requirements for water heaters applying from [date to be inserted: three years after this Regulation has come into force] are set out in point 2(2b) of Annex I.
- (3) The ecodesign requirements for water heaters applying from [date to be inserted: five years after this Regulation has come into force] are set out in points 2(2c) and 2(5) of Annex I.
- (4) The ecodesign requirements for storage tanks set out in point 3 of Annex I apply from [date to be inserted: three years after this Regulation has come into force].

Compliance with ecodesign requirements shall be measured and calculated in accordance with requirements set out in Annex II.

Article 4
Conformity assessment

The conformity assessment procedure referred to in Article 8 of Directive 2009/125/EC shall be the internal design control system set out in Annex IV to that Directive or the management system for assessing conformity set out in Annex V to that Directive.

Article 5
Verification procedure for market surveillance purposes

When performing the market surveillance checks referred to in Article 3(2) of Directive 2009/125/EC, the authorities of the Member States shall apply the verification procedure set out in Annex III to this Regulation.

Article 6
Benchmarks

The indicative benchmarks for the best-performing water heaters and storage tanks available on the market at the time of entry into force of this Regulation are identified in Annex IV.

Article 7
Revision

The Commission shall review this Regulation in the light of technological progress of water heaters and storage tanks no later than five years after its entry into force and present the result of this review to the Ecodesign Consultation Forum.

Article 8
Entry into force

This Regulation shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels,

For the Commission
Member of the Commission

ANNEX I
Ecodesign requirements for water heaters and storage tanks

1. Definitions for the purposes of Annexes I and II

For the purposes of Annexes I and II the following definitions shall apply:

- (1) "Conventional water heater" means a water heater equipped with one or more conventional heat generator(s);
- (2) "conventional heat generator" means a heat generator that generates heat using the combustion of fuels or the Joule effect in electric resistance heating elements;
- (3) "heat pump water heater" means a water heater, which uses ambient and/or waste heat for heat generation;
- (4) "solar water heater" means a water heater, which uses solar heat for heat generation;
- (5) "storage water heater" means a combination of storage tank and heat generator contained in a single housing;
- (6) "load profile" means a certain sequence of water draw-offs, as specified in Annex II, Table 1;
- (7) "water draw-off" means a certain combination of useful water flow rate, useful water temperature, useful water energy content and peak temperature, as specified in Annex II, Table 1;
- (8) "useful water flow rate", f , means the flow rate in litres per minute for which hot water is contributing to the reference heat, as specified in Annex II, Table 1;
- (9) "useful water temperature", T_m , means the water temperature for which hot water is contributing to the reference heat, as specified in Annex II, Table 1;
- (10) "useful energy content", Q_{tap} , means the energy content of water provided at temperature equal to, or above, the useful temperature, and at flow rates equal to, or above, the useful water flow rate, as specified in Annex II, Table 1;
- (11) "energy content of hot water" means the product of the specific heat capacity of water, the average temperature difference between the cold water input and hot water output, and the total mass of the hot water delivered;
- (12) "peak temperature", T_p , means the minimum water temperature in degrees Celsius to be achieved during water draw-off, as specified in Annex II, Table 1;
- (13) "reference energy", Q_{ref} , means the sum of the energy content of water draw-offs in a specific load profile, as specified in Annex II, Table 1;
- (14) "maximum load profile" means the load profile with the largest reference energy Q_{ref} defined in Table 1 of Annex II which a water heater is capable to provide under

the thermostat settings specified in point 2(c) of Annex II and fulfilling the minimum temperature and flow rate conditions of that load profile;

- (15) "electricity consumption", Q_{elec} , means the consumption of electricity during 24 consecutive hours under a particular load profile, expressed in kWh;
- (16) "fuel consumption", Q_{fuel} , means the consumption of fuels during 24 consecutive hours under a particular load profile in terms of the gross calorific value of the fuel;
- (17) "gross calorific value" means the heat released when a certain fuel is burned completely with oxygen at a constant pressure, and when the products of combustion are returned to ambient temperature, in kWh;
- (18) "average flue gas temperature", T_{flue} , means the dry bulb temperature of combustion gases, in degrees Celsius;
- (19) "combustion efficiency", $etacomb$, means the efficiency taking into account only heat loss in flue gases;
- (20) "envelope volume" means the volume of the smallest rectangular-shaped or cylindrical envelope fitting the water heater envelope, in m³;
- (21) "rated input power" means the maximum design fossil fuel input rate, in kWh gross calorific value of the fuel per hour;
- (22) "back-up heater" means the conventional water heater or the heat pump water heater that is part of a solar water heater;
- (23) "back-up heater energy efficiency", $etawh_{bu}$, means the energy efficiency of a back-up heater;
- (24) "smart control" means a device that automatically adapts the water heating process to the individual usage conditions with the aim to reduce energy consumption;
- (25) "smart control qualifying/non-qualifying", $smart$, means that a water heater equipped with smart controls fulfils/does not fulfil the criterion set out in point 6 of Annex III;
- (26) "fuel consumption with smart controls", $Q_{fuel,week,smart}$, and "electricity consumption with smart controls", $Q_{elec,week,smart}$, mean the weekly fuel and electricity consumption, respectively, with smart control function enabled, measured under the conditions set out in point 3 of Annex II, in kWh;
- (27) "fuel consumption without smart controls", $Q_{fuel,week}$, and "electricity consumption without smart controls", $Q_{elec,week}$, mean the weekly fuel and electricity consumption, respectively, with smart control function disabled, measured under the conditions set out in point 3 of Annex II, in kWh;
- (26) "storage volume", V , means the volume of a storage tank or a storage water heater, in litres;

- (27) "annual electricity consumption", *AEC*, means the annual electricity consumption of a water heater under the maximum load profile, in kWh;
- (28) "annual fuel consumption", *AFC*, means the annual gas or oil consumption of a water heater under the maximum load profile, in kWh;
- (29) "conversion factor", *prim*, means the EU average of the amount of primary energy used for providing one unit electricity to the end-user;
- (30) "distribution loss", Q_{distr} , means the heat loss due to the distribution of hot water inside a dwelling, in kWh;
- (31) "reference distribution loss", $Q_{distref}$, means the average distribution loss of the EU stock of water heaters, in kWh;
- (32) "recoverable waste heat", Q_{waste} , means the heat generated by the water heater that is not transferred to water or flue gases, in kWh;
- (33) "recovered fraction of waste heat", *qrecov*, means the fraction of the waste heat Q_{waste} that contributes to useful space heating;
- (34) "flue gas heat", $Q_{fluegas}$, means the average sensible heat contained in the flue gasses of water heaters using fuels emitted during a particular load profile, in kWh;

[NB: "solar parameters" related to the methods pursuant to EN 13203, EN 15316-4-3 and ISO 9459-5:2007]

- (35) "global solar irradiance" means the rate of total incoming solar energy, both direct and diffuse, on a collector plane with an inclination of 45 degrees and southward orientation at the Earth's surface;
- (36) "collector aperture area", *Asol*, means the solar collector maximum projected through which un-concentrated solar radiation enters the collector, in m²;
- (37) "zero-load efficiency", *eta0*, means the zero-loss collector efficiency;
- (38) "first order coefficient", *a1*, means the heat loss coefficient, in Watts/(m² K);
- (39) "second order coefficient", *a2*, means the coefficient measuring the temperature dependence of the first order coefficient, in Watts/(m² K);

[NB: further "solar parameters" related to the methods pursuant to EN 15316-4-3 and ISO 9459-5:2007]

- (40) "pump power consumption", *solpump*, means the rated electrical power consumption of the pump of a solar water heater tested under the conditions set out in points 4(b) and 4(c) of Annex II, in Watts;
- (41) "standby power consumption", *solstandby*, means the electrical power consumption a solar water heater tested under the conditions set out in points 4(b) and 4(c) of Annex II when the pump and the back-up heater are inactive, in Watts;

- (42) "auxiliary energy consumption", Q_{aux} , means the annual energy consumption of a solar water heater that is due to the pump power consumption and the standby power consumption, in kWh;
- (43) "solar heat contribution", Q_{sol} , means the annual contribution of solar thermal energy of solar water heaters tested under the conditions set out in points 4(b) and 4(c) of Annex II, taking into account the auxiliary energy consumption and heat losses of the storage tank, in kWh;

[NB: further "solar parameter" related to the method pursuant to EN 15316-4-3]

- (44) "incidence angle modifier", IAM , means the ratio of the output of the solar collector of a solar water heater tested under the conditions set out in point 4(b) of Annex II at a certain incidence angle, and its output at an incidence angle of 90 degrees;
- (45) "incidence angle" means the angle between the direction to the sun and the direction perpendicular to the solar collector aperture;
- (46) "storage tank loss", Q_{buf} , means the annual standing loss of a storage tank of a solar water heater tested under the conditions set out in points 4(b) of Annex II.

2. Ecodesign requirements for water heaters

(1) Energy efficiency

- (a) From [date to be inserted: one year after this Regulation has come into force] the energy efficiency of water heaters shall not fall below the following values:

Load profile	3XS	XXS	XS	S	M	L	XL	XXL	3XL	4XL
Energy efficiency	22%	22%	26%	26%	30%	30%	30%	32%	32%	32%

- (b) From [date to be inserted: three years after this Regulation has come into force] the energy efficiency of water heaters shall not fall below the following values:

Load profile	3XS	XXS	XS	S	M	L	XL	XXL	3XL	4XL
energy efficiency	32%	32%	32%	32%	36%	37%	40%	40%	40%	40%

- (c) From [date to be inserted: five years after this Regulation has come into force], the energy efficiency of water heaters shall not fall below the following values:

Load profile	XXL	3XL	4XL
energy efficiency	60%	64%	64%

(2) Storage volume of storage water heaters with load profiles XXS and XS

From [date to be inserted: one year after this Regulation has come into force]:

For storage water heaters with load profiles XXS and XS, the storage volume V shall not exceed 15 litres and 36 litres, respectively.

(3) Emissions of nitrogen oxides

From [date to be inserted: five years after this Regulation has come into force]:

The mass of nitrogen oxides emissions, expressed in mg per kW of rated input power, shall not exceed the following limits:

- (i) water heaters using gaseous fuels, with less than 12 kW rated input power: 105 mg/kW
 - (ii) water heaters using gaseous fuels, with 12 kW or more rated input power: 70 mg/kW
 - (iii) water heaters using liquid fuels, with less than 12 kW rated input power: 120 mg/kW
 - (iv) water heater using liquid fuels, with 12 kW or more rated input power: 105 mg/kW
- (4) Information to be provided by manufacturers
- (a) For the purposes of conformity assessment pursuant to Article 5, the technical documentation for water heaters shall contain the following elements:
 - (i) the parameters specified in point 5 of Annex II;
 - (ii) the parameters specified in point 2 of Annex III;
 - (iii) any specific precautions that must be taken when the water heater is assembled, installed or maintained;
 - (iv) the intended positioning of heat generator(s) and storage tank(s) of a water heater, i.e. inside or outside of a building;
 - (v) in addition for water heaters using fossil fuels the air-intake system, i.e. open or closed, and the rated input power.
 - (b) The booklet of instructions and free access websites of manufacturers, their authorised representatives, or importers shall contain the following elements:
 - (i) the elements specified in point (a);
 - (ii) information relevant for disassembly, recycling or disposal at end-of-life.
 - (c) The following information shall be durably marked on the water heater:
 - (i) the energy efficiency;
 - (ii) the maximum load profile.

3. Storage tanks

(1) Standing loss

From [date to be inserted: three years after this Regulation has come into force]:

The standing loss of storage tanks with storage volume V expressed in litres shall not exceed the following limit:

$16,66 \text{ Watts} + 8,33 \cdot V^{0,4} \text{ Watts/litre}$

(2) Information to be provided by manufacturers

- (a) For the purposes of conformity assessment pursuant to Article 5, the technical documentation shall contain the following elements:
 - (i) the parameters specified in point 6 of Annex II;
 - (ii) any specific precautions that must be taken when the storage tank is assembled, installed or maintained.
- (b) The booklet of instructions and free access websites of manufacturers, their authorised representatives, or importers shall contain the following elements:
 - (i) the parameters specified in point (a);
 - (ii) information relevant for disassembly, recycling or disposal at end-of-life.

ANNEX II Measurements

1. For the purposes of compliance and verification of compliance with the requirements of this Regulation, measurements shall be made using a reliable, accurate, and reproducible method, which takes into account the generally recognised state of the measurement methods, including methods set out in documents the reference numbers of which have been published for the purpose in the Official Journal of the European Union.

2. General conditions for testing water heaters

- (a) measurements shall be carried out using the load profiles set out in Table 1;
- (b) measurements shall be carried out using a 24-hour measurement cycle as follows:
 - (i) 00:00 hours to 06:59 hours: no water draw-off;
 - (ii) from 7:00 hours: water draw-offs according to the declared load profile;
 - (iii) from end of last water draw-off until 24:00 hours: no water draw-off;
- (c) the mean temperature between the thermostat temperature setting which starts the water heating, and the thermostat temperature setting which stops the water heating, shall not fall below 55°C;
- (d) the load profile applied for conformity assessment shall be the maximum load profile.

H	3XS			XXS			XS			S			
	Qtap	F	Tm	Qtap	f	Tm	Qtap	F	Tm	Qtap	f	Tm	TP
	kWh	l/mn	°C	kWh	l/mn	°C	kWh	l/mn	°C	kWh	l/mn	°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	4	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	4	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							1,05	4	35	0,42	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			2,1			2,1			2,1			

h	M				L				XL				
	Qtap	F	Tm	TP	Qtap	f	Tm	TP	Qtap	f	Tm	TP	
	kWh	l/mn	°C	°C	kWh	l/mn	°C	°C	kWh	l/mn	°C	°C	
07.00	0,105	3	25		0,105	3	25		0,105	3	25		
07.05	1,4	6	40		1,4	6	40						
07.15									1,82	6	40		
07.26									0,105	3	25		
07.30	0,105	3	25		0,105	3	25						
07.45					0,105	3	25		4,42	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									4,42	10	10	40	
21.00									3,605	10	10	40	
21.15	0,105	3	25						0,105	3	25		
21.30	1,4	6	40		0,105	3	25		4,42	10	10	40	
21.30													
21.45													
Qref	5,845				11,655				19,07				

h	XXL				3XL				4XL				
	Qtap	f	Tm	TP	Qtap	f	Tm	TP	Qtap	f	Tm	TP	
	kWh	l/mn	°C	°C	kWh	l/mn	°C	°C	kWh	l/mn	°C	°C	
07.00	0,105	3	25		11,2	48	40		22,4	96	40		
07.05													
07.15	1,82	6	40										
07.26	0,105	3	25										
07.30													
07.45	6,24	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	6,24	16	10	40									
21.00													
21.15	0,105	3	25										
21.30	6,24	16	10	40	12,04	48	40		24,08	96	40		
21.30													
21.45													
Qref	24,53				46,76				93,52				

3. Conditions for testing *smart* of water heaters

Where the supplier deems appropriate to declare the value of *smart* as being "1", measurements of the weekly electricity consumption shall be carried out using a two-week measurement cycle as follows:

- (i) days 1 to 5: random sequence of load profiles chosen from the declared load profile and the load profile below the declared load profile, and smart control disabled;
- (ii) days 6 and 7: no water draw-offs, and smart control disabled;
- (iii) days 8 to 12: repetition of the sequence applied for days 1 to 5, and smart control enabled;
- (iv) days 13 and 14: no water draw-offs, and smart control enabled.

4. Conditions for testing solar water heaters

Solar water heaters shall be tested under one of the following conditions:

[NB: measurements and calculations pursuant to EN 13203-3:]

- (a) The solar collector shall be tested separately. The remaining parts of the solar water heater shall be tested with an additional heat generator that simulates the daily solar energy captured by the solar collector under the conditions set out in Table 2. The results shall be used for the calculations set out in point 4(a) of Annex II.

[NB: measurements and calculations pursuant to EN 15316-4-3:]

- (b) Solar collector, storage tank, solar pump and back-up water heater shall be tested separately. The back-up water heater shall be tested under the conditions set out in point 2. The results shall be used for the calculations set out in point 4(b) of Annex II under the conditions set out in Tables 3 and 4.

[NB: measurements and calculations pursuant to ISO 9459-5:]

- (c) Where solar collector and storage tank cannot be tested separately their combination shall be tested. The back-up water heater and the solar pump shall be tested separately, and the back-up water heater shall be tested under the conditions set out in point 2. The results shall be used for the calculations set out in point 4(b) of Annex II under the conditions set out in Tables 3 and 4.

5. Conditions for testing heat pump water heaters

- (a) Heat pump water heaters which do not use ventilation exhaust air as heat source shall be tested under the conditions set out in Table 5.
- (b) Heat pump water heaters which use ventilation exhaust as heat source shall be tested under the conditions set out in Table 6. Where the supplier deems appropriate outdoor air may be used as additional heat source under the conditions set out in Table 6.

Table 2: Global solar irradiance in W/m²

6h-7h	7h-8h	8h-9h	9h-10h	10h-11	11h-12h	12h-13h	13h-14h	14h-15h	15h-16h	16h-17h	17h-18h
95	171	237	303	351	393	436	474	512	455	218	47

Table 3 : Average daytime temperature in degrees Celsius

January	February	March	April	May	June	July	August	September	October	November	December
2,8	2,6	7,4	12,2	16,3	19,8	21,0	22,0	17,0	11,9	5,6	3,2

Table 4 : Average global solar irradiance in W/m²

January	February	March	April	May	June	July	August	September	October	November	December
70	104	149	192	221	222	232	217	176	129	80	56

Table 5 : Ambient heat source temperatures for heat pump water heaters (air source: dry bulb temperature) and humidity by heat transfer medium

Heat source	outdoor air	Brine	Water
Temperature	10,0°C	2,5°C	11,5°C
Humidity	5,5 g/m ³	not applicable	

Table 6 : Maximum ventilation exhaust air available in m³/h³

Load profile	XXS	XS	S	M	L	XL	XXL	3XL	4XL
Ventilation waste heat	109	136	128	159	190	870	1021	2943	8830

5. Technical parameters of water heaters

The following parameters shall be established:

- (i) the daily electricity consumption Q_{elec} in kWh, measured to three decimal places;
- (ii) the maximum load profile;
- (iii) the envelope volume in m³, measured to two decimal places;
- (iv) the noise in dB(A) re 1pW, measured to the nearest integer;

in addition, for water heaters depending on the energy input of fossil fuels:

- (v) the daily gas or oil consumption Q_{fuel} in kWh measured to three decimal places
- (vi) the combustion efficiency, measured to three decimal places
- (vii) the average flue gas temperature T_{flue} in °C, measured to the first decimal place;
- (viii) the emissions of Nitrogen oxides in mg per kW rated input, to the nearest integer;

in addition, for water heaters for which the value of *smart* is declared as being "1":

- (ix) the weekly fuel consumption $Q_{fuel,week,smart}$ with smart control function enabled in kWh, measured to three decimal places;
- (x) the weekly electricity consumption $Q_{elec,week,smart}$ in kWh with smart control function enabled in kWh, measured to three decimal places;
- (xi) the weekly fuel consumption $Q_{fuel,week}$ with smart control function disabled in kWh, measured to three decimal places;
- (xii) the weekly electricity consumption $Q_{elec,week}$ with smart control function disabled in kWh, measured to three decimal places;

in addition, for storage water heaters with load profiles XXS and XS the following parameter shall also be measured:

- (xiii) the storage volume in litres, measured to one decimal place;

³ at temperature of 20°C and humidity of 5,5 g H₂O/m³

in addition, for solar water heaters the following parameters shall also be determined:

- (xiv) the solar collector aperture area A_{sol} in m^2 , measured to two decimal places;
- (xv) the zero-load efficiency η_{a0} , measured to three decimal places;
- (xvi) the first order coefficient a_1 , measured to two decimal places;
- (xvii) the second order coefficient a_2 , measured to two decimal places;

[NB: measurements and calculations pursuant to EN 15316-4-3 and ISO 9459-5:]

in addition, for solar water heaters tested under the conditions set out in points 4(b) and 4(c) of Annex II:

- (xviii) the back-up heater energy efficiency η_{awhbu} , measured to one decimal place;
- (xix) the pump power consumption sol_{pump} in Watts, measured to two decimal places;
- (xx) the standby power consumption $sol_{standby}$ in Watts, measured to two decimal places

[NB: measurements and calculations pursuant to EN 15316-4-3:]

in addition, for solar water heaters tested under the conditions set out in point 4(b) of Annex II:

- (xxi) the incidence angle modifier IAM , to one decimal place.

6. Technical parameters of storage tanks

The following technical parameters shall be established for storage tanks:

- (i) the storage tank volume V in litres, measured to one decimal place;
- (ii) the standing loss S in Watts, measured to one decimal place.

ANNEX III Calculations

1. For the purposes of compliance and verification of compliance with the requirements of this Regulation, calculations shall be made using a reliable, accurate, and reproducible method, which takes into account the generally recognised state-of-the-art calculation methods, including methods set out in documents the reference numbers of which have been published for the purpose in the Official Journal of the European Union.

2. Technical parameters of water heaters

(a) The following parameters shall be calculated for all water heaters:

- (i) the energy efficiency $etawh$ in percent, to one decimal place;
- (ii) the annual electricity consumption AEC in kWh, to the nearest integer;
- (iii) the distribution losses Q_{distr} in kWh, to three decimal places;
- (iv) the reference distribution losses $Q_{distref}$ in kWh, to three decimal places;
- (v) the recoverable waste heat Q_{waste} in kWh, to three decimal places;
- (vi) the recovered fraction of waste heat q_{recov} , to two decimal places.

(b) In addition, for water heaters depending on the energy input of fossil fuels, the following parameters shall be calculated:

- (vii) the annual fossil fuel consumption AFC in kWh Gross Calorific Value of the fuel, to the nearest integer;
- (viii) the flue gas heat $Q_{fluegas}$ in kWh sensible heat, to the nearest integer.

(d) in addition for solar water heaters tested under the conditions set out in points 4(b) and 4(c) of Annex II, the following parameters shall be calculated:

- (ix) the solar energy Q_{sol} ;
- (x) the annual auxiliary energy consumption Q_{aux} .

(d) in addition for solar water heaters tested under the conditions set out in point 4(b) of Annex VI, the following parameters shall be calculated:

- (xi) the annual standing losses of the storage tank Q_{buf} .

3. Conversion factor $prim$

The value of the conversion factor shall be $prim = 2,5$.

4. Calculation of the energy efficiency $etawh$

(a) Conventional water heaters, heat pump water heaters and solar water heaters tested under the conditions set out in point 4(a) of Annex II:

The energy efficiency is calculated as follows:

$$etawh = \frac{Q_{ref}}{(Q_{fuel} + prim \cdot Q_{elec})(1 - 0,07 \cdot smart) + Q_{distr} - (qrecov \cdot Q_{rwaste})}$$

- (b) Solar water heaters tested under the conditions set out in points 4(b) and 4(c) of Annex II:

The energy efficiency is calculated as follows:

$$etawh = 0,6 \cdot 366 \cdot Q_{ref}/Q_{tota},$$

where

$$Q_{tota} = \{0,6 \cdot 366 \cdot (Q_{ref} + Q_{distref}) - Q_{sol}\} / \{etawhbu - (0,1 \cdot etawhbu - 0,1)\}$$

5. Calculation of the annual electricity consumption and the annual fuel consumption

- (a) Conventional water heaters, heat pump water heaters and solar water heaters tested under the conditions set out in point 4(a) of Annex II:

- (i) The annual fuel consumption *AFC* in kWh GCV of the fuel is calculated as:

$$AFC = 0,6 \cdot 366 \cdot \left(Q_{fuel} \cdot (1 - 0,07 \cdot smart) + \frac{Q_{fuel}}{Q_{fuel} + prim \cdot Q_{elec}} \cdot (Q_{distr} - qrecov \cdot Q_{rwaste}) \right)$$

- (ii) The annual electricity consumption *AEC* is calculated as:

$$AEC = 0,6 \cdot 366 \cdot \left(Q_{elec} \cdot (1 - 0,07 \cdot smart) + \frac{prim \cdot Q_{elec}}{Q_{fuel} + prim \cdot Q_{elec}} \cdot (Q_{distr} - qrecov \cdot Q_{rwaste}) \right)$$

- (b) Solar water heaters tested under the conditions set out in points 4(b) and 4(c) of Annex II:

- (i) The annual electricity consumption is calculated as:

$$AEC = \frac{prim \cdot Q_{elec}}{Q_{fuel} + prim \cdot Q_{elec}} \cdot \left(\frac{Q_{tota}}{prim} \right)$$

- (ii) The annual fuel consumption is calculated as:

$$AFC = \frac{Q_{fuel}}{Q_{fuel} + prim \cdot Q_{elec}} \cdot Q_{tota}$$

6. Determination of the value of *smart*

The value of smart is "1", if:

$$(Q_{fuel,week,smart} + prim \cdot Q_{elec,week,smart}) / (Q_{fuel,week} + prim \cdot Q_{elec,week}) \leq 0,93.$$

In all other cases the value of smart is "0".

7. Calculation of Q_{waste} , $Q_{fluegas}$, q_{recov} , $Q_{distref}$, Q_{distr} , Q_{sol} , Q_{aux} , Q_{buf}

For the purposes of compliance and verification of compliance with the requirements of this Regulation, calculations of Q_{waste} , $Q_{fluegas}$, q_{recov} , $Q_{distref}$, Q_{distr} , Q_{sol} , Q_{aux} and Q_{buf} shall be made using a reliable, accurate, and reproducible method, which takes into account the generally recognised state-of-the-art calculation methods, including methods set out in documents the reference numbers of which have been published for the purpose in the Official Journal of the European Union.

Annex III
Verification procedure for market surveillance purposes

For the purposes of checking conformity with the requirements laid down in Annex I, Member State authorities shall test a single water heater or storage tank. If the measured parameters do not meet the values declared by the manufacturer, in accordance with Article 4(2), within the range defined in Table 2, the measurement shall be carried out on three additional water heaters or storage tanks. The arithmetic mean of the measured values of the latter shall meet the requirements laid down in Annex I within the range defined in Table 2.

Otherwise, the model shall be considered not to comply.

In addition to the procedure set out in Annex II, Member State authorities shall use reliable, accurate and reproducible measurement procedures, which take into account the generally recognised state-of-the-art measurement methods, including methods set out in documents the reference numbers of which have been published for that purpose in the Official Journal of the European Union.

Table 2: Verification tolerances

Measured parameter	Verification tolerance
daily electricity consumption Q_{elec}	the measured value shall not be higher than the rated value* by more than 5 %
envelope volume	the measured value shall not be higher than the rated value by more than 5 %
noise	the measured value shall not be higher than the rated value by more than 1,5 dB(A)
daily fuel consumption Q_{fuel}	the measured value shall not be higher than the rated value by more than 5 %
combustion efficiency η_{comb}	the measured value shall not be higher than the rated value by more than 5 %
average flue gas temperature T_{flue}	the measured value shall not be lower than the rated value by more than 5 %
emissions of nitrogen oxides	the measured value shall not be higher than the rated value by more than 5 %.
weekly fuel consumption with smart controls enabled or disabled $Q_{fuel,week}/Q_{fuel,week,smart}$	the measured value shall not be higher than the rated value by more than 5%.
weekly electricity consumption with smart controls enabled or disabled $Q_{elec,week}/Q_{elec,week,smart}$	the measured value shall not be higher than the rated value by more than 5%.
storage volume V	the measured value shall not be lower than the rated value by more than 5 %.
collector aperture area A_{sol}	the measured value shall not be lower than the rated value by more than 5%.
pump power consumption sol_{pump}	the measured value shall not be higher than the rated value by more than 5%.
standby power consumption $sol_{standby}$	the measured value shall not be higher than the rated value by more than 5%.

* "rated value means a value declared by the manufacturer

ANNEX IV

Indicative benchmarks for water heaters, storage tanks and their combinations

At the time of entry into force of this Regulation, the best available technology on the market in terms of energy efficiency, standing loss and nitrogen oxides emissions was identified as follows:

(a) Energy efficiency

Load profile	3XS	XXS	XS	S	M	L	XL	XXL	3XL	4XL
Energy efficiency	53	53	61	72	80	98	112	124	140	150

(b) Standing loss

$5 + 4,16 V^{0,4}$ Watts per litre storage volume;

(c) Emissions of nitrogen oxides

35 mg per kWh.