وزارة الصناعة والتكنولوجيا المتقدمة
Ministry of Industry & Advanced Technology (MOIAT)

UNITED ARAB EMIRATES
MINISTRY OF INDUSTRY
& ADVANCED TECHNOLOGY

الإمارات العربية المتحدة
وزارة الصناعة
والتكنولوجيا المتقدمة

المواصفات القياسية الإماراتية

UAE.S 5010 -4 :20xx

بطاقة البيان . بطاقة بيان كفاءة الطاقة للأجهزة الكهربائية -
الجزء الرابع: سخانات المياه الكهربائية

Labeling – Energy Efficiency Label for Electrical Appliances
Part 4: Electric Water heater

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صفة الإصدار	لائحة فنية

المواصفات القياسية لدولة الإمارات العربية المتحدة

Standards of United Arab Emirates

تاريخ النشر بالجريدة الرسمية	
تاريخ بدء الإلزام	

تقـــديم

وزارة الصناعة والتكنولوجيا المتقدمة هي الوزارة المسئولة عن أنشطة التقييس بالدولة ومن مهامها إعداد المواصفات القياسية الإماراتية أو اللوائح الفنية بواسطة لجان فنية متخصصة.

وقد قامت الوزارة ضمن برنامج عمل اللجنة الفنية "برنامج كفاءة الطاقة للأجهزة الكهربائية بتحديث المواصفة القياسية الإماراتية رقم 4 - 5010 لعام 202x "بطاقة بيان كفاءة الطاقة للأجهزة الكهربائية - الجزء الرابع : سخانات المياه الكهربائية".

وقد اعتمدت هذه المواصفة كمواصفة قياسية إلزامية (لائحة فنية) وذلك بموجب قرار مجلس الوزراء رقم ( ) بتاريخ / / هـ ، الموافق / / 20 م.

Foreword

Ministry of Industry & Advanced Technology (MOIAT) has national responsibility for standardization activities. One of MOIAT's main functions is to issue Emirates Standards /Technical regulations through specialized technical committees (TCs).

MOIAT, through the technical program of committee "Technical committee for program of Energy Efficiency for Electrical *Appliances* has Updated the Standard no. 5010-4 *Labeling – Energy efficiency label for Electrical Appliances - Part four: Electrical water heater.* This standard has been approved as (Technical Regulation) by Decree of UAE Cabinet No. ( ), held on / / H , / /2020.

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Labeling – Energy Efficiency Label for Electrical Appliances

Part 4 – Electrical water heater

1. Scope

This Standard specifies the Energy Performance Standard and testing requirements of electric storage water heaters and Instantaneous electric water heaters
It shall apply to water heaters with power under or equal to 70 kW.
It shall apply to products with a capacity up to 2,000 liters for all types of water heaters.

2. Normative References

2.1 UAE.s IEC 60379 – Methods for measuring the performance of electric storage water-heaters for household purposes

2.2 UAE.s IEC 63159-1 – Household electric instantaneous water heaters - Methods for measuring the performance - Part 1: General aspects

2.3 UAE.s IEC 63159-2-1 – Household electric instantaneous water heaters - Methods for measuring the performance - Part 2-1: Multifunctional electric instantaneous water heaters

2.4 UAE.s IEC 63159-2-2 – Household electric instantaneous water heaters - Methods for measuring the performance - Part 2-2: Efficiency of single point of use electric instantaneous water heaters

3. Terms and Definitions

For the purpose of this document, the following terms and definitions apply:
The following normative standards apply for certification purposes. In all cases, the most recent edition of the document is considered the preferred version.

3.1 Back-up immersion heater

a Joule effect electric resistance heater that is part of a hot water storage tank and generates heat only when the external heat source is disrupted (including during maintenance periods) or out of order, or that is part of a solar hot water storage tank and provides heat when the solar heat source is not sufficient to satisfy required comfort levels.

3.2 Conversion coefficient (CC)
a coefficient representing the weighting of the electric energy compared when combined with other energies: the value of the conversion coefficient is CC = 1,0.

3.3 Heat generator
part of a water heater that generates the heat using one or more of the following processes:
- use of the Joule effect in electric resistance heating elements;
- capture of ambient heat from an air source, water source or ground source, and/or waste heat;

where by a heat generator designed for a water heater and a water heater housing to be equipped with such a heat generator shall be also considered a water heater.

3.4 Rated heat output
declared heat output of the water heater when providing water heating at standard rating conditions, expressed in kW.

3.5 Rated value
value or quantity assigned by the manufacturer and marked on the appliance when relevant.

3.6 Standard rating conditions
operating conditions of water heaters for establishing the rated heat output, water heating energy efficiency and sound power level for establishing the standing loss.

3.7 Storage capacity (C)
rated capacity of a hot water storage tank, expressed in liters.

3.8 Tested value
the value or quantity determined by test or measurement.

3.9 Water heater
device that:
- is connected to an external supply of water;
- generates and transfers heat to deliver hot water at given temperature levels, quantities and flow rates during given intervals;

3.10 Water heating energy efficiency (ηwh)
the ratio between the useful energy provided by a water heater and the energy required for its generation, expressed in percentage (%).

3.11 Water heater housing
part of a water heater designed to have a heat generator fitted.

3.12 Annual electricity consumption (AEC)
annual electricity consumption of a water heater under the declared load profile and under given climate conditions, expressed in kWh in terms of final energy.

3.13 Daily electricity consumption (Qelec)
consumption of electricity over 24 consecutive hours under the declared load profile and under given climate conditions, expressed in kWh in terms of final energy.

3.14 Declared load profile
load profile applied when determining water heating energy efficiency.

3.15 Energy content of hot water
product of the specific heat capacity of water, the average temperature difference between the hot water output and cold-water input, and the total mass of the hot water delivered.

3.16 Load profile
output performance (in terms of a sequence of flow-rates, temperatures, tapping pattern,…) of a water heater when fulfilling its primary function under specific ambient conditions.

3.17 Maximum load profile
load profile with the greatest reference energy that a water heater is able to provide while fulfilling the temperature and flow rate conditions of that load profile.

3.18 Mixed water quantity at 40°C (V40)
quantity of mixed water at 40°C.

3.19 Peak temperature (Tp)
minimum water temperature, expressed in degrees Celsius, to be achieved during water draw-off, as specified in Annex A.

3.20 Reference energy (Qref)
sum of the useful energy content of water draw-offs, expressed in kWh, in a particular load profile, as specified in Annex A.

3.21 Second-order coefficient (a^2)
coefficient measuring the temperature dependence of the first order coefficient, expressed in $W/(m^2. K^2)$.

3.22 Smart control
means a device that automatically adapts the water heating process to individual usage conditions with the aim of reducing energy consumption.

3.23 Smart control compliance (smart)
measure of whether a water heater equipped with smart controls fulfils the criterion set out in Annex B and C.

3.24 Smart control factor (SCF)
water heating energy efficiency gain due to smart control under the conditions set out in Annex B and C.

3.25 Standby heat loss (Pstby)
heat loss of a heat pump water heater in operating modes without heat demand, expressed in kW.

3.26 Standby power
the power necessary to maintain the water contained in the storage at a set temperature of 65°C according to the testing standard, expressed in W.

3.27 Thermal losses (QPR)
the thermal energy necessary to maintain the water contained in the storage at a set temperature of 65°C according to the testing standard during 24h, expressed in (kWh).

3.28 Useful energy content (Qtap)
energy content of hot water, expressed in kWh, provided at a temperature equal to, or above, the useful water temperature, and at water flow rates equal to, or above, the useful water flow rate, as specified in Annex A.

3.29 Useful water flow rate (f)
minimum flow rate, expressed in liters per minute, for which hot water is contributing to the reference energy, as specified in Annex A.

3.30 Useful water temperature (Tm)
water temperature, expressed in degrees Celsius, at which hot water starts contributing to the reference energy, as specified in Annex A.

3.31 Water draw-off
means a given combination of useful water flow rate, useful water temperature, useful energy content and peak temperature, as specified in Annex A.

3.32 Weekly electricity consumption with smart controls (Qelec;week;smart)
weekly electricity consumption of a water heater with the smart control function enabled, expressed in kWh in terms of final energy.

3.33 Weekly electricity consumption without smart controls (Qelec;week)
weekly electricity consumption of a water heater with the smart control function disabled, expressed in kWh in terms of final energy.

4. General Requirements

4.1 Criteria for Applying the Energy Performance Standard

4.1.1 Declaration of rated values:

4.1.1.1 The declaration of the rated capacity shall be expressed only in terms of liters (L) according to the following rules:
- Rated capacity lower or equal to 14 liters as multiples of 1 liter.
- Rated capacity from 15 liters as multiples of 5 liters.

4.1.1.2 The declaration of the rated power shall be expressed only in terms of watt (W) as multiples of 50 W.

4.1.1.3 The declaration of the energy efficiency in percentage as a multiple of 0.1%.

4.1.1.4 The rated annual energy as a multiple of 5 kWh.

4.1.2 Determining the Energy Performance:

The energy performance is based on the Water Heating Energy Efficiency (see Annex C), which is established from the declared load profile.

4.1.2.1 General

The energy performance is based on the Water Heating Energy Efficiency (see Annex C), which is established from the declared load profile.

4.1.2.2 Declaration of the Load Profile

For each water heater the manufacturer shall declare a load profile as described in Annex A. The declared load profile shall be the maximum load profile achievable by the water heater.

For capacities of storage water heaters with declared load profiles of 3XS, XXS, XS and S:

a) Storage water heaters with declared load profile 3XS shall not exceed 7 liters in capacity.
b) Storage water heaters with declared load profiles XXS and XS shall not exceed 15 liters in capacity.
c) Storage water heaters with declared load profile S shall not exceed 36 liters in capacity.

For storage water heaters with declared load profile M, L, XL, XXL, 3XL and 4XL, the requirements of mixed water at 40 °C shall not fall below the following values:

Table 1
Requirements of mixed water at 40 °C

Declared load profile	M	L	XL	XXL	3XL	4XL
Mixed water at 40 °C	65 Liters	130 Liters	210 Liters	300 Liters	520 Liters	1040 Liters

4.1.2.3 Energy Performance Standard for Water Heaters

The water heater energy performance values are presented in Table 2.

Table 2
Minimum Energy Efficiency (ηwh) in %

Declared load profile	3XS	2XS	XS	S	M	L	XL	XXL	3XL	4XL
Water heaters energy efficiency (with or without smart controls)	53	55	63	63	73	73	79	79	79	79

4.1.3 Acceptance Criteria for Labelling and Market Surveillance

The energy label shall be accepted as valid when a sample unit(s) tested meets the following criteria:

a) Tested Power…… ≥ 0.90 × rated power
b) Tested Power…… ≤1.05 × rated power
c) Tested thermal losses (QPR) …… ≤ 1.05 rated $Q_{PR, rated}$
d) Tested Standing loss power (S)…… ≤ 1.05 rated S
e) Tested Capacity …… ≥ 0.95 × rated Capacity
f) Tested mixed quantity of water (V40)…… ≥ 0.97 × rated V_{40}
g) Tested Energy……≤ 1.05 × rated energy

Note: for market surveillance, the verification of compliance with the requirements is determined using the same identical standard adopted at the point of registration.

5. Label and Classification

5.1 Determining the Energy Efficiency Class

The energy efficiency for the maximum load profile shall be used to determine the classification as outlined in table 4 and 5.

5.2 Design and Placement of the Label

The energy efficiency classes are categorized in star Levels in this standard, but the label shall comply to the requirements of MoIAT requirements.

Table 4
Energy Efficiency Classification as per Declared Load Profile

Energy class	Load profile									
	3XS	**2XS**	**XS**	**S**	**M**	**L**	**XL**	**XXL**	**3XL**	**4XL**
5 star	95	100	105	105	210	300	300	300	300	300
4 star	87	89	97	97	140	180	180	180	180	180
3 Star	77	79	87	87	93	95	98	110	110	110
2 star	61	63	71	71	80	80	86	86	86	86
1 Star	53	55	63	63	73	73	79	79	79	79

Table 5
Energy Efficiency Classes for Hot Water Storages

Equivalent energy efficiency class	Daily thermal losses limit value (kWh)
5 star	$Q_{PR,rated} \leq \frac{132 + 76 \times C_{rated}^{0.4}}{1000}$
4 star	$\frac{132 + 76 \times C_{rated}^{0.4}}{1000} < Q_{PR,rated} \leq \frac{204 + 102 \times C_{rated}^{0.4}}{1000}$
3 Star	$\frac{204 + 102 \times C_{rated}^{0.4}}{1000} < Q_{PR,rated} \leq \frac{384 + 200 \times C_{rated}^{0.4}}{1000}$
2 star	$\frac{384 + 200 \times C_{rated}^{0.4}}{1000} < Q_{PR,rated} \leq \frac{504 + 248 \times C_{rated}^{0.4}}{1000}$
1 Star	$\frac{504 + 248 \times C_{rated}^{0.4}}{1000} < Q_{PR,rated}$

6. Marking Requirements

6.1 General Information

The following information shall be marked on the nameplate of the water-heater in (English) or (Arabic and English). The marking shall not be on a detachable part of the unit and shall be indelible, durable, and easily legible.

Any information related to energy performance added on any part of the water heater unit or packaging shall not have any ambiguity or lead to misunderstanding of the performance of the unit.

6.2 Nameplate Information

The nameplate information shall include, for comply to this standard, but not limited to (e.g. safety requirements), the following information:

- Manufacturer's name and trademark.
- Country of orgin;
- Manufacturer's model or type reference and serial number of the unit;
- Rated voltage or rated voltage range in volts (V);
- Rated frequency in hertz (Hz);
- Rated power input in Watt (W) or Kilowatts (kW);
- Rated capacity in liter (L);
- Annual standby losses (kWh/year) or daily standby losses (kWh/24h), when applicable.

6.3 An instruction sheet or manual in both Arabic and English, shall be delivered with each water heater, including the following information:
Tables, drawings, and circuit diagrams may be depicted in English only.

Table 6
Content of the Instruction Sheet or Manual

Information	Applicable to	
	Electric storage	Instant-aneous
a) Supplier's name or trademark;	✓	✓
b) Supplier's model number;	✓	✓
c) The declared load profile, expressed by the appropriate letter and typical usage in accordance with Annex A;	✓	✓
d) The energy efficiency class of the model, determined in accordance with Annex C and Clause 5;	✓	✓
e) The water heating energy efficiency in %, rounded to the nearest integer and calculated in accordance with annex C;	✓	✓
f) The annual electricity consumption in kWh under average climate conditions for UAE;	✓	✓
g) If applicable, other load profiles for which the water heater is suitable to use, and the corresponding water heating energy efficiency and annual electricity consumption as set out in points (e) and (f);	✓	✓
h) The thermostat temperature settings of the water heater, as placed on the market by the supplier;	✓	✓
i) Any specific precautions that shall be taken when the water heater is assembled, installed, or maintained;	✓	✓
j) Where Smart Control Compliance is declared as being enabled (i.e. 'smart = 1'), an	✓	✓

indication that the information on water heating energy efficiency, and annual electricity, as applicable, relate to enabled smart control settings only;		
k) The annual electricity consumption in kWh (or mass of butane equivalent when applicable), rounded to the nearest integer and calculated in accordance with annex D;	✓	✓
l) The storage capacity in liters, rounded to the nearest integer;	✓	
m) The standing loss in W, rounded to the nearest integer.	✓	

Annex A

Load Profiles of Water Heaters (The load profiles 3XS, 2XS XS, S, M, L, XL, XXL,3XL and 4XL are described in table A1 to A3)

Table A1 – Load profiles 3XS to S

h	3XS			2XS			XS			S			
	Q_{tap}	f	T_m	Q_{tap}	f	T_m	Q_{tap}	f	T_m	Q_{tap}	f	T_m	T_p
	kWh	l/min	°C	kWh	l/min	°C	kWh	l/min	°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	0												
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										
09:30	0.015	2	25	**0.105**	2	25				**0.105**	3	25	
10:00													
10:30													
11:00	0	2	25										
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	25	
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**	3	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	
21:35	0.015	2	25	**0.105**	2	25							
21:45	0.015	2	25	**0.105**	2	25							
Q_{ref}	**0.345 kWh**			**2.100 kWh**			**2.100 kWh**			**2.100 kWh**			

Table A2 – Load profiles M to XL												
h	M				L				XL			
	Q_{tap}	f	T_m	T_p	Q_{tap}	f	T_m	T_p	Q_{tap}	f	T_m	T_p
	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	25		**0.105**	3	25		**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	25		**0.105**	3	25		**0.105**	3	25	
18:30	**0.105**	3	25		**0.105**	3	25		**0.105**	3	25	
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
21:35												
21:45												
Q_{ref}	**5.845 kWh**				**11.655 kWh**				**19.070 kWh**			

Table A3 – Load profiles XXL to 4XL												
h	XXL				3XL				4XL			
	Q_{tap}	f	T_m	T_p	Q_{tap}	f	T_m	T_p	Q_{tap}	f	T_m	T_p
	kWh	l/min	°C	°C	kWh	l/min	°C	°C	kWh	l/min	°C	°C
07:00	0.105	3	25		11.200	48	40		22.400	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		5.040	24	25		10.080	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		1.680	24	25		3.360	48	25	
09:30	0.105	3	25									
10:00	0.105	3	25									
10:30	0.105	3	25		0.840	24	10	40	1.680	48	10	40
11:00	0.105	3	25									
11:30	0.105	3	25									
11:45	0.105	3	25		1.680	24	25		3.360	48	25	
12:00												
12:30												
12:45	0.735	4	10	55	2.520	32	10	55	5.040	64	10	55
14:30	0.105	3	25									
15:00	0.105	3	25									
15:30	0.105	3	25		2.520	24	25		5.040	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	25									
18:30	0.105	3	25		3.36	24	25		6.720		25	
19:00	0.105	3	25									
19:30												
20:00												
20:30	0.735	4	10	55	5.880	32	10	55	11.760	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	12.040	48	40		24.080	96	40	
21:35												
21:45												
Q_{ref}	24.530 kWh				46.760 kWh				93.520 kWh			

ANNEX B

Tests Procedures and Measurements

B.1 Tests Methods Applicable

For the purposes of compliance and verification of compliance with the requirements of this Regulation, measurements shall be made using standards listed in Clause 2. They shall meet the conditions and technical parameters set out in this standard.

B.2 General Conditions for Testing Water Heaters

Measurements shall be carried out using the load profiles set out in Annex A.
Measurements shall be carried out using a 24-hour measurement cycle as follows:

- 00:00 to 06:59: no water draw-off,
- from 07:00: water draw-offs according to the declared load profile,
- from end of last water draw-off until 24:00: no water draw-off.

The declared load profile shall be the maximum load profile.

B.3 Conditions for Testing the Smart Control Compliance ('Smart') of Water Heaters

If the manufacturer wants to declare the value of 'smart' as being ‘1’, measurements of the weekly electricity with or without smart controls shall be carried out using a two-week measurement cycle as follows:

- days 1 to 5: random sequence of load profiles chosen from the declared load profile and the load profile one below the declared load profile, and smart control disabled,
- days 6 and 7: no water draw-offs, and smart control disabled,
- days 8 to 12: repetition of the same sequence applied for days 1 to 5, and smart control enabled,
- days 13 and 14: no water draw-offs, and smart control enabled,
- the difference between the useful energy content measured during days 1 to 7 and the useful energy content measured during days 8 to 14 shall not exceed 2 % of Qref of the declared load profile

The 'smart' is declared equal to 1 if conditions expressed in Clause C.4 are met.

B.5 Technical Parameter of Water Heaters

The following parameters shall be established for water heaters:

a) the daily electricity consumption Q_{elec} in kWh, rounded to three decimal places;
b) the declared load profile, expressed by the appropriate letter in accordance with Table A1 to A3;
c) the daily fuel consumption Q_{fuel} in kWh in terms of GCV, rounded to three decimal places;

In addition, for water heaters for which the value of 'smart' is declared as being '1':

d) the weekly electricity consumption with smart controls $Q_{elec,week,smart}$ in kWh, rounded to three decimal places;
e) the weekly fuel consumption without smart controls $Q_{fuel,week}$ in kWh in terms of GCV, rounded to three decimal places;
f) the weekly electricity consumption without smart controls $Q_{elec,week}$ in kWh, rounded to three decimal places; in addition, for storage water heaters with declared load profiles 3XS, XXS and XS;
g) the storage capacity in liters, rounded to one decimal place;

ANNEX C – Calculation of the Energy Efficiency

C.1 Application Methods

For the purposes of compliance and verification of compliance with the requirements of this Standard, tests and calculations (if any) shall be made using the standards listed in clause 2. They shall meet the technical parameters and calculations set out in Annexs.

C.2 Technical Parameters of Water Heaters

The following parameters shall be calculated for water heaters under reference testing conditions according to the relevant standards listed in Clause 2:

(a) the water heating energy efficiency η_{WH} in %, rounded to one decimal place.

(b) the annual non-solar heat contribution Q_{nonsol} in kWh rounded to one decimal place;

(c) the heat generator water heating energy efficiency $\eta_{WH;nonsol}$ in %, rounded to one decimal place;

(d) the annual auxiliary electricity consumption Q_{aux} in kWh, rounded to one decimal place.

C.3 Calculation of the Energy Efficiency Coefficient η wh

C3.1 Conventional Water Heaters

The water heating energy efficiency is calculated as follows:

$$\eta_{WH} = \frac{Q_{ref}}{(Q_{fuel} + CC.Q_{elec})(1 - SCF.smart) + Q_{cor}} \qquad \text{Eq. (C1)}$$

C.4 Smart Control Factor 'SCF'

The smart control factor (SCF) is calculated as follows:

$$SCF = 1 - \frac{Q_{fuel;week;smart} + CC \times Q_{elec;week;smart}}{Q_{fuel;week} + CC \times Q_{elec;week}} \qquad \text{Eq. (C4)}$$

If SCF ≥ 0.07, the value of 'smart' shall be 1. In all other cases, the value of 'smart' shall be 0.

C.5 Determination of the Ambient Correction Term Q_{cor}

The ambient correction term is calculated as follows:

(a) for conventional water heaters using electricity:

$$Q_{cor} = -k \,.\, (CC.\big(\, Q_{elec}.\,(1 - SCF.smart) - Q_{ref}\big)) \qquad \text{Eq. (C5)}$$

Where the k values are given in Table C1 for each load profile

Table C1 – k values used for the calculation of Q_{cor}

Declared load profile	3XS	XXS	XS	S	M	L	XL	2XL	3XL	4XL
k	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.00	0.00	0.00

C.6 Determination of the mixed quantity of water V40

Mixed water at 40 °C (V40) is the quantity of water at 40 °C, which has the same heat content (enthalpy) as the hot water which is delivered above 40 °C at the output of the water heater, expressed in litres.

Immediately following measurement according to reheat following withdraw of the quantity of water corresponding to the declared load profile and maintain of the conditions for 12 hours, a quantity of water is withdrawn through the outlet by supplying cold water. The flow of water from open outlet water heaters is controlled by the inlet valve. The flow in any other type of water heaters is controlled by means of a valve fitted in the outlet or the inlet. The measurement is ended when the outlet temperature drops below 40 °C.

The rate of flow is adjusted to the maximum value according to the declared load profile

The normalized value of the average temperature is calculated according to equation C8:

$$\theta_p = (T_{set} - 15) \times \frac{(\theta'_p - \theta_c)}{(T_{set} - \theta_c)} + 15 \qquad \text{Eq. (C8)}$$

Where:

T_{set} in °C is the water temperature, without withdrawal of water, measured with a thermocouple placed inside the upper section of the tank. For metal tanks the thermocouple may be placed on the outer surface of the tank as well. This value is the water temperature measured after the last cut-out of the thermostat during the step set out in point (f),

θ_c in °C is the average temperature of inlet cold water during the test,

θ'_p in °C is the average temperature of outlet water and its normalized value is named θp in °C.

Temperature readings are preferable taken continuously. Alternatively, they may be taken at equal intervals evenly spread over the discharge, for example every 5 litres (maximum). If there is a sharp drop in temperature, additional readings may be necessary in order to correctly calculate the average value θ'_p.

Outlet water temperature is always ≥ 40 °C which is to be taken into account for the calculation of θp.

Quantity of hot water V40 in litres delivered with a temperature of at least 40 °C will be calculated equation C9:

$$V_{40} = V_{40;exp} \times \frac{(\theta_p - 15)}{(40 - 15)} \qquad \text{Eq. (C9)}$$

Where:

— the volume V40_exp in litres corresponds to the quantity of water delivered at least 40 °C during the test.

ANNEX D – Calculation of the Annual Energy Consumption

D.1 Principle for Calculation of the Annual Energy Consumption (AEC_{WH})

The annual energy is based on the energy efficiency ratio η_{WH} used for Classification and the reference energy Q_{ref} used to characterise the water heaters.

The values for annual energy consumption are derived from a conventional energy consumption using weather data below and calculated according to Clause D.3.

Annual energy consumption AEC_{WH} will be calculated according to the following information and procedures.

D.2 Weather Data

For the purpose of the annual energy consumption, the following data are applied, in addition to the data used for test of the water heaters (tables D1 and D2),

Table D1 Average daytime temperature (Dry bulb ^{0}C)

	January	February	March	April	May	June	July	August	September	October	November	December
Average climate conditions	16	18	22	26	30	33	34	34	31	27	21	17

The average external temperature is considered as equal to 26°C

Table D2 Average global monthly irradiation ($I_{glob;}$ - W/m^2)

	January	February	March	April	May	June	July	August	September	October	November	December
Monthly Global Horizontal Irradiation	137	155	187	200	229	236	233	216	196	178	136	129

D.3 Calculation and Presentation of the Annual Energy Consumption (AEC_{WH})

D.3.1 For Conventional Water Heaters

Principle: thermal losses are considered as proportional to the average temperature differences between the ambient temparature and the storage standard temperature (65^0C).

For conventional water heaters:

$$AEC_{WH} = 220 \times Q_{ref}/\eta_{WH} \qquad \text{Eq. (D4)}$$

With

$$\eta_{WH;KSA} = \frac{1}{1 + \left(\frac{1-\eta_{WH}}{\eta_{WH}}\right) \times \left(\frac{65 - \vartheta_{amb;test}}{65 - \vartheta_{amb}}\right)}$$

With:

Ambient temperature for test: $\vartheta_{amb:test} = 20^0$C

Ambient temperature for label: $\vartheta_{amb} = 24^0$C