

LabelPack A+



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649905



“Common understanding of the heating energy labelling concept, key elements”

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EXECUTIVE SUMMARY

This document presents the “common understanding of the energy labelling concept, key elements” and aims at setting the common framework within which the Label Pack A+ consortium develops its activity. It is a working document aimed at the consortium members, in order to guide their activities, namely the pilot actions to establish at the national levels and assure a common line of work and communication with the market actors.

The document briefly addresses the Ecodesign and Energy Labelling Directives and the contextualization of the Regulated Acts No.811 and 812/2013 within these. The most relevant and innovative aspect introduced by these regulations lies on the introduction of a new concept in the energy labelling requirements, **the package labelling**, meant for the labelling of **heating systems composed by more than one appliance**, in an overall system evaluation perspective. To address the specifics of this new label, the distinction between individual products and package systems is presented, and both regulations are analysed in order to understand the different energy labelling application frameworks. The added value of solar packages is also addressed, as the combination of conventional heaters with solar systems has the potential to maximize the package's energy efficiency, providing a high energy class heating system.

The document also looks into the challenges addressing the end-consumer and the initiatives to disseminate and raise the community's awareness on the new energy labelling system. One of the most pressing issues is the definition of the consumer's hot water demand profiles as it affects the selection of the appliance's output range.

Regarding the documentation, this new legislation does not restrict itself to the calculation and presentation of the energy label in the considered heating appliances, and a wide set of documents should compulsory be displayed, or available upon request, namely the product fiche, technical documentation, detailed information and advertisement and promotional material.

The heating market chain is thoroughly addressed, identifying the various models possible and the responsibilities for issuing the package label in the different scenarios. The ultimate difference relies on the labelling of customized solutions when the responsibility for issuing and presenting the energy label to the end-consumer relies on the system distributor, which can either be the retailer or the installer integrator, depending on who assembles the customized system.

The competences of the different stakeholders along the value chain are discussed, from the public authorities, to the industry associations and consumer defence organizations, addressing also the market surveillance entities and their role in assuring the adequate implementation of the legislation.

Finally, a wide set of Frequently Asked Questions are listed and answered to help all the market agents to comply with their responsibilities and assure a successful approach to the market.



1 Introduction

The **Ecodesign and Energy Labelling Directives** express the European Commission's goal towards reducing the energy consumed by products, at the design and manufacture stage, Ecodesign Directive, and at the operation stage, Energy Labelling Directive.

The Ecodesign Directive, Directive 2009/125/EC, established the framework for setting mandatory requirements for energy related products. The Directive targets equipment manufacturers, establishing minimum performance criteria for putting new products on the market.

The Energy Labelling Directive, Directive 2010/30/EU, aims at providing the end-consumers with more information regarding the products energy performance, in order to better decide on the acquisition stage. It established the binding obligation for energy labelling and standard product information on the consumption of energy and other resources by energy-related products.

The technical specifications for each of the products covered by these regulations are set via Delegated Regulations, non-legislative acts of general application to supplement or amend certain non-essential elements of a legislative act, used where uniform conditions for implementing legally binding Union acts are required.

The regulations for space, water and combination heaters, Commission Delegated Regulation (EU) No 811/2013 and No 812/2013 were published in 2013 and are to enter in force on the 26th of September 2015.

Within this context, the **Label Pack A+** project was set, in the auspicious of the Horizon 2020 Programme, aiming to support the implementation of the energy labelling of heating appliances and boosting its impact on solar thermal products by using the "package label".

This document presents the "Common understanding of the energy labelling concept, key elements" and aims at setting the common framework within which the Label Pack A+ consortium develops its activity. It's targeted at the consortium members, in order to guide their activities, namely the pilot actions to establish at the national levels and assure a common line of work and communication with the market actors, assuring the success of the communication provided.



2 Energy labelling of heating appliances

The **Ecodesign and Energy Labelling Directives** were published respectively in **2009 and 2010**. These regulations express the European Commission's commitment towards energy efficiency, compelling the market to offer more efficient energy consuming products, in a "from design to operation" perspective.

The delegated regulations set for space, water and combination heaters were published in 2013.

Commission Delegated Regulation (EU) **No 811/2013** of 18 February 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the **energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device**

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

Commission Regulation (EU) **No 813/2013** of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters

Commission Regulation (EU) **No 814/2013** of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water heaters and hot water storage tanks

<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2013:239:FULL&from=EN>

The most relevant and innovative aspect introduced by these regulations lies on the introduction of a new concept in the energy labelling requirements, **the package labelling**, meant for the labelling of **heating systems composed by more than one equipment**, in an overall system evaluation perspective.

2.1 Definitions

Individual products: individual heater (space or water), individual combination heater (space and water) temperature control, solar device.

Package: a system that is offered to the end-user combining one or more heaters (water, space or combi) with one or more temperature controls (in the case of space and combi packages) and one or more solar devices.

Packages:

Standard package – a package of products, pre-assembled by the supplier as a standard solution, constituted by a set of products supplied by the same supplier.

Custom-made package – a package of products locally assembled by the dealer or installer, who combines a set of products (not necessarily with the same brand or within the offer of brands supplied by one exclusive supplier) commercialized by the dealer and assembled at the moment of sale to meet the demand of one precise client.

For further definitions, please check the ANNEXES.



3 Space heating appliances

3.1 Scope

No 811/2013 - space heaters and combination heaters with a rated heat output ≤ 70 kW, packages of space heater ≤ 70 kW, temperature control and solar device and packages of combination heater ≤ 70 kW, temperature control and solar device.

3.2 Heating equipment's

The Energy labelling regulating covers products with a rated output up to 70kW.

3.2.1 Individual products:

- Space heater ≤ 70 kW ;
 - Fuel boiler space heaters
 - Electric boiler space heaters
 - Cogeneration space heaters
 - Heat pump space heaters
 - Heat pump space heaters with fuel driven combustion unit
- Combination heaters;
 - Fuel boiler combination heaters
 - Electric boiler combination heaters
 - Cogeneration combination heaters
 - Heat pump combination heaters
 - Heat pump combination heaters with fuel driven combustion unit

Note – Regarding heat pumps, heaters designed for using gaseous or liquid fuels from biomass are excluded. A specific legislation covering these equipment's will be issued. Other pieces of legislation, such as the Gas Appliances Directive might apply to them as far as appliances burning gaseous fuels are concerned.

3.2.2 Packages of Space Heating Equipment's:

- Packages of space heater, temperature control and/or solar device
 - Hot water storage tank
 - Solar device
 - Solar collector
 - Solar hot water storage tank, "Thermosyphon system", or pump in the collector loop



3.2.3 Packages of Combination (Space and Water) Heating Equipment's:

- Packages of boiler combination heater (space and water), temperature control and solar device
- Packages of heat pump combination heater (space and water), temperature control and solar device

3.3 - Quick guide to Regulated Act No 811/2013

The Regulated Acts present the energy efficiency classes, the templates for the different labels, product fiches, technical documentation and other necessary documentation, for each equipment and combination of equipment for the package label.

3.3.1 For individual products

September 2015				
811 - Space heaters	Label	Product fiche	Technical docs	Alternative info
Individual space heaters				
Boiler space heaters	Annex III, 1.1.1	Annex IV, 1	Annex V, 1	Annex VI, 1
Cogeneration space heaters	Annex III, 1.1.2			
Heat pump space heaters	Annex III, 1.1.3			
Low temperature heat pumps	Annex III, 1.1.4			
Individual combination heaters				
Boiler combination heaters for space and water heating	Annex III, 2.1.1	Annex IV, 2	Annex V, 2	Annex VI, 2
Heat pump combination heaters for space and water heating	Annex III, 2.1.2			
Temperature controls		Annex IV, 3	Annex V, 3	
Solar devices		Annex IV, 4	Annex V, 4	

3.3.2 For space heating packages

September 2015				
811 - Space heaters	Label	Product fiche	Technical docs	Alternative info
packages of space heater, temperature control and solar device	Annex III, 3	Annex IV, 5	Annex V, 5	Annex VI, 3

3.3.1 For combination heating (space and water) packages

September 2015				
811 - Space heaters	Label	Product fiche	Technical docs	Alternative info
Packages of combination (space and water) heater, temperature control and solar device	Annex III, 4	Annex IV, 6	Annex V, 6	Annex VI, 4



4 Water heating appliances

4.1 Scope

No 812/2013 - water heaters with a rated heat output ≤ 70 kW, hot water storage tanks with a storage volume ≤ 500 litres and packages of water heater ≤ 70 kW and /or storage volume ≤ 500 litres and solar device.

4.2 Equipment's

4.2.1 Individual products:

- Water heater with a rated heat output ≤ 70 kW;
 - Conventional water heater (fossil fuel based)
 - Electric water heater
 - Solar water heater (thermos syphon system (with electric backup));
 - Heat pump water heater;
 - Heat pump water heaters with fuel driven combustion unit
- Hot water storage tanks with a volume ≤ 500 l

Solar device – Solar devices, according to the relevant definitions in the Regulations, are made of a solar collector, a solar hot water storage tank or a pump in the collector loop. This means that a solar device always contains a solar collector. The components of these systems are not to be labelled individually, as most of are not energy consuming products.

4.2.2 Packages of Water Heating Equipment:

- Packages of water heater and solar device

4.3 Load Profiles for water heaters (and for combination heaters)

One important feature when selecting the adequate water heater is the load profile. Load profiles are defined in distribution tables containing the time, the energy, kWh, the temperature, °C, and types (shower, dish washing, hand washing) of each "tapping". It represents a daily sequence of water draw-offs, a combination of useful water flow rate, useful water temperature, useful energy content and peak temperature.

The Regulated Act No 812/2013 presents eight load profiles, from XXS to XXL and each water heater meets at least one load profile.

The load profile is characterized by:

- The reference energy, Q_{ref} , which accounts for sum of the useful energy content of the water draw-offs, expressed in kWh;
- The useful water flow rate, f , the minimum flow rate, in liters per minute, for which the water is contributing to the reference energy;
- The useful water temperature, T_m , the water temperature in degrees Celsius
- The peak water temperature, T_p , the minimum water temperature in degrees Celsius.



The Qref for various load profiles is presented, with a calculation example for quantification of the profile in hot showers per day:

Profile	3XS	XXS	XS	S	M	L	XL	XXL
Qref (kWh)	0,345	2,100	2,100	2,100	5,845	11,655	19,07	24,53
Showers	0	1	1	1	2-3	3-4	7-9	11-12

Calculation: 40 liters/day. dwelling, water at 60°C, T water grid =15 °C => 2.1kWh/day

Heater load profile	Hot water needs associated to the profile	Application
3XS	Seldom hand wash	Small offices
XXS	Household washes	Small offices
XS	Kitchen (small dish wash) and household washes simultaneously	Offices
S	Kitchen (small dish wash) household washes	Offices
M	Kitchen, household washes and 2 showers	Residential (1-2 <u>pax</u>)
L	Kitchen, household washes, showers or bath	Residential (3 – 5 <u>pax</u>)
XL	Kitchen, household washes, showers and/or baths	Residential (5 – 8 <u>pax</u>)
XXL	Kitchen, several household washes, showers and bath simultaneously	Residential (9 and more <u>pax</u>)

Figure 1 – Hot water needs associated to the heater's load profile

4.4 – Quick guide to Regulated Act No 812/2013

4.4.1 For individual products:

	September 2015			
812 –Water heaters	Label	Product fiche	Technical docs	Alternative info
Individual water heater				
Conventional water heaters	Annex III, point 1.1.1	Annex IV, point 1	Annex V, point 1	Annex VI, point 1
Heat pump water heater	Annex III, point 1.1.3			
Storage tank	Annex III, point 2.1	Annex IV, point 2	Annex V, point 2	Annex VI, point 2
Solar water heaters	Annex III, point 1.1.2	Annex IV, point 3	Annex V, point 3	
Solar device		Annex IV, point 3	Annex V, point 3	



4.4.2 For water heating packages

September 2015				
812 - Water heaters	Label	Product fiche	Technical docs	Alternative info
Package: water heater and solar device	Annex III, point 3	Annex IV, point 4	Annex V, point 4	Annex VI, point 3

5 Solar solutions

Per se, solar devices do not require energy labels.

The exception to this are *thermosiphon* systems with integrated electrical resistance (the regulated acts define these equipment as solar water heaters). According to the regulation's calculation procedures solar water heaters best energy class is limited to A, given that electrical water heaters have a predefined efficiency of 40%, and as so, an electrical water heater will be classified between C and D, enhanced to A with solar.

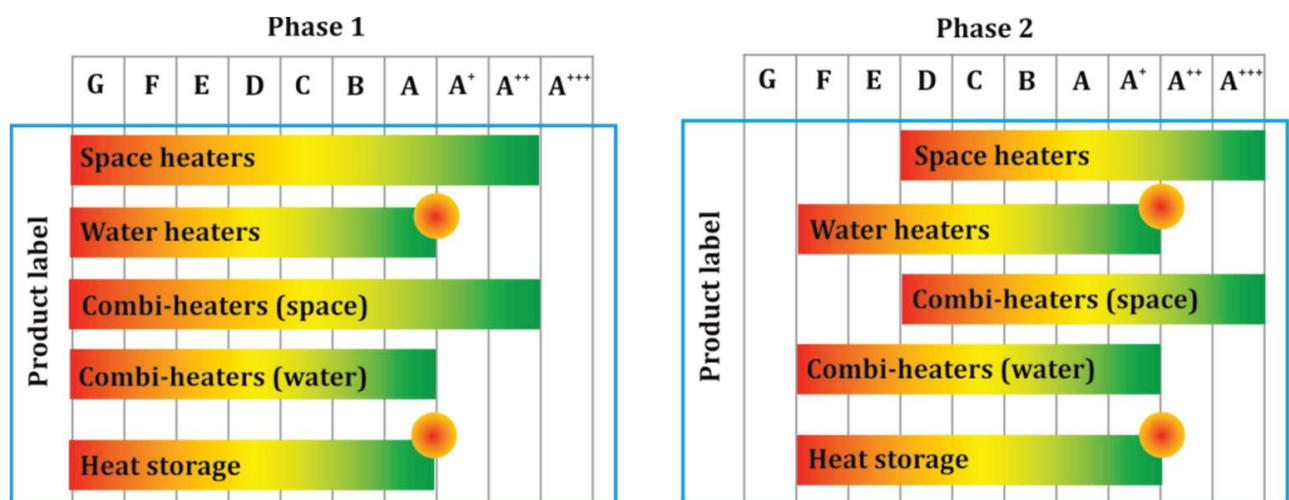


Figure 2 – Product labels energy class range, highlighting the solar enhanced solutions. (Source: “Ecodesign and the Energy label for solar thermal related products – Part 1., 2015, vAconsult)

To benefit from this new legislation, the solar industry should focus on pushing for solar driven heating solutions, that is “enlarging the solar industry’s pie” in the heating market, by attracting new clients who wish to purchase efficient, high energy class solutions.

This option is particularly interesting in package solutions, where the combination with solar systems has the potential to maximize the package’s energy efficiency.

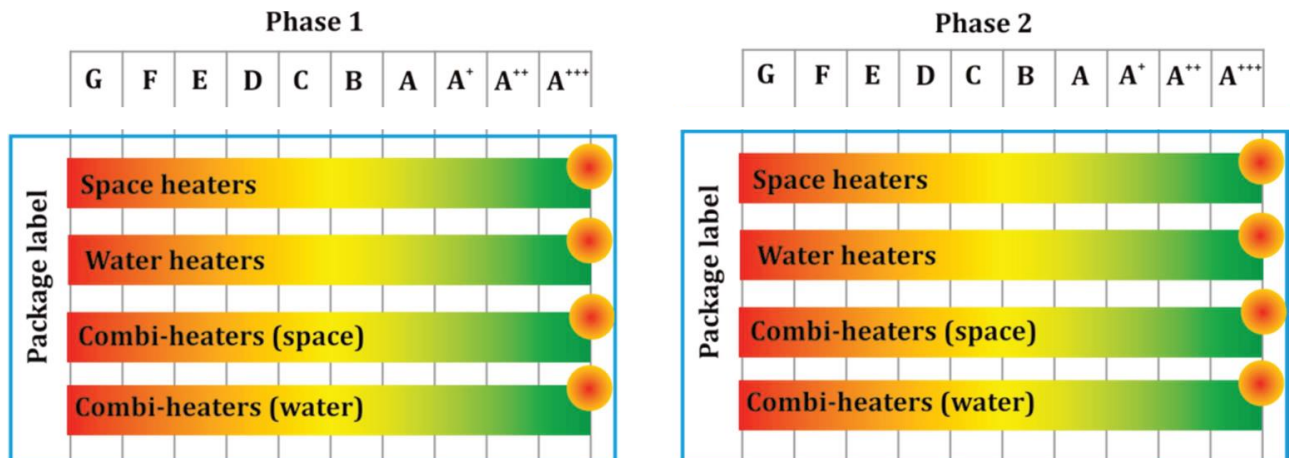


Figure 3 – Package labels energy class range, highlighting the solar enhanced solutions. (Source: “Ecodesign and the Energy label for solar thermal related products – Part 1., 2015, vAconsult)

When high class backup heaters are part of the heating package, the distinction in the added value of solar devices is limited to the range A to A⁺⁺⁺. The space for distinction between brands and types will be short, and the differences will mainly focus on the system size than on the system’s efficiency. Additionally, the end-user perception on the differences between the A to A⁺⁺⁺ class is not clear, and the real added value of A⁺⁺⁺ classes is not correctly valued.

5.1 Solar systems data and the SOLCAL methodology

A package is a system that is offered to the end-user combining one or more heaters (water, space or combi) with one or more temperature controls (in the case of space and combi packages) and one or more solar devices.

While calculating the system energy efficiency and class several elements regarding the solar system are requested, such as the solar collector area and efficiency.

In the water-heating packages, meaning packages using water heaters or combi heaters, the energy efficiency of the system is based on:

- the value of the water heating energy efficiency of the water heater, expressed in %, taken from the water-heater product fiche.
- the value of a mathematical expression combining the reference energy volume (Q_{ref}) associated to each load profile, and the annual non-solar heat contribution (Q_{nonsol}) corresponding to annual contribution of electricity (expressed in kWh in “terms of primary energy”) and/or fuels (expressed in kWh in Gross Calorific Value) to the useful heat output of a solar water heater or a package of water heater and solar device, taking into account the annual amount of heat captured by the solar collector and the heat losses of the solar hot water storage tank.
- **Q_{aux}**, auxiliary electricity consumption, which is the annual electricity consumption of a solar water heater or a solar-only system that is due to the pump power consumption and the standby power consumption, expressed in kWh in terms of final energy.

Both Q_{nonsol} and Q_{aux} are to be calculated in an auxiliary tool, the vAConsult spread sheet SOLCAL.



The sheet is available for free download at http://www.vaconsult.net/Downloads/SOLCAL%202015%2007%2028%20V3_7.xlsm and for its ease of use it should be made available via the online tool webpage.

The SOLCAL methodology requires for the calculation of Q_{nonsol} :

Collector

- A_{sol} (m^2)- The collector area;
- η_0 – The zero loss efficiency coefficient;
- a_1 ($W/ m^2.K$) – The first order heat loss coefficient;
- a_2 ($W/ m^2.K^2$) – The second order heat loss coefficient;
- IAM – The incident angle modifier coefficient.

Heat storage

- V_{nom} (litres) – The nominal volume
- V_{bu} (litres) – The backup volume (the volume above the lowest part of the heat exchanger, an approximate value should be half of the nominal volume)
- Backup control – select if the backup control is permanently on (on a thermostat basis); only at night (controlled by a watch that sets the on hours) or only in emergency situations (manual on/off switch).
- P_{bsol} – The heat loss coefficient of the storage (this value corresponds to the standing value in W , presented in the tank energy label, divided by 45, which is the assumed temperature difference between the interior and the exterior of the tank)
- StoLOC – the location of the storage, inside or outside



For the calculation of Q_{aux} the SOLCAL methodology requires the elements that characterize the pump and control system:

Pump & Control

- S_{olpump} – The pump power (in the case of pumps with variable power the average power should be used)
- S_{olsb} – The controller's power



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Subject: Calculation sheet SOLCAL method
 Device: Solar water heater or solar device for water heating
 Document: Transitional document 2014/C 207/03
 Part: Annex IV, paragraph 3

vAConsult
 28.07.2015
 V3.7

Input specifications of the applied components

Collector		Heat storage	
Asol =	3,00 m ² ...Collector area	Vnom =	150,0 litres ...Nominal volume
η ₀ =	0,856 - ...Zero loss efficiency	Vbu =	0,0 litres ...Backup volume
a1 =	3,69 W/(m ² K) ...First order heat loss	Backup control:	Permanent powered
a2 =	0,021 W/(m ² K ²) ...Second order heat loss	psbsol =	1,6 W/K ...Heat loss storage
IAM =	0,96 - ...Incidence angle modifier	StoLoc:	Inside ...Storage location
		Pump & control	
		solpump =	6,00 W ...Pump power
		solsb =	1,00 W ...Controller power

Calculation results. Input for the fiche

Load profile:	M	L	XL	XXL	
Lwh =	1523	2799	4427	5626	kWh/a Heat demand
Qnonsol =	749	1427	2682	3724	kWh/a Non-solar heat contribution
Qaux =	21				kWh/a Parasitic electricity consumption

The results are displayed for the M to XXL classes.

Only after calculating these elements should the user access the online tool and complete the system's energy efficiency and labelling class calculation.

6 Accessory Equipment for heating packages

The Energy Labelling directive covers all products that consume energy, also including controls, which are defined using 'classes'. These run from Class I (a simple on/off room stat) to Class VIII (multi-sensor room control for use with modulating heating appliances). Each control class equates to a certain percentage uplift in system efficiency e.g. A class VI weather compensating control and room thermostat will add 4% efficiency to the heating system.

- Temperature controls (according to "Guidelines Accompanying Regulations (EU) No 811 & 812/2013 and 813 & 814/2013, January 2015")
 - Class I - On/off Room Thermostat: A room thermostat that controls the on/off operation of a heater. Performance parameters, including switching differential and room temperature control accuracy are determined by the thermostat's mechanical construction.
 - Class II - Weather compensator control, for use with modulating heaters: A heater flow temperature control that varies the set point of the flow temperature of water leaving



the heater dependent upon prevailing outside temperature and selected weather compensation curve. Control is achieved by modulating the output of the heater.

- Class III - Weather compensator control, for use with on/off output heaters: A heater flow temperature control that varies the set point of the flow temperature of water leaving the heater dependent upon prevailing outside temperature and selected weather compensation curve. Heater flow temperature is varied by controlling the on/off operation of the heater.
- Class IV - TPI room thermostat, for use with on/off output heaters: An electronic room thermostat that controls both thermostat cycle rate and in-cycle on/off ratio of the heater proportional to room temperature. TPI control strategy reduces mean water temperature, improves room temperature control accuracy and enhances system efficiency.
- Class V - Modulating room thermostat, for use with modulating heaters: An electronic room thermostat that varies the flow temperature of the water leaving the heater dependent upon measured room temperature deviation from room thermostat set point. Control is achieved by modulating the output of the heater.
- Class VI - Weather compensator and room sensor, for use with modulating heaters: A heater flow temperature control that varies the flow temperature of water leaving the heater dependent upon prevailing outside temperature and selected weather compensation curve. A room temperature sensor monitors room temperature and adjusts the compensation curve parallel displacement to improve room comfort. Control is achieved by modulating the output of the heater.
- Class VII - Weather compensator and room sensor, for use with on/off output heaters: A heater flow temperature control that varies the flow temperature of water leaving the heater dependent upon prevailing outside temperature and selected weather compensation curve. A room temperature sensor monitors room temperature and adjusts the compensation curve parallel displacement to improve room comfort. Heater flow temperature is varied by controlling the on/off operation of the heater.
- Class VIII – Multi-sensor room temperature control, for use with modulating heaters: An electronic control, equipped with 3 or more room sensors that varies the flow temperature of the water leaving the heater dependent upon the aggregated measured room temperature deviation from room sensor set points. Control is achieved by modulating the output of the heater.



7 Documents

The equipment covered by the space and water heating regulations should compulsory present, or have available upon request, a set of documents. The most relevant information set in these documents regards the identification of the energy class on the label, but also all the relevant technical information that allows for the package label to be issued.

7.1 Label

The energy label is the most visible document in the heating appliance, which presents the energy class. The label also states information on the equipment supplier, the model and more detailed information on the appliance's technical characteristics like the rated heat power and the sound power level.

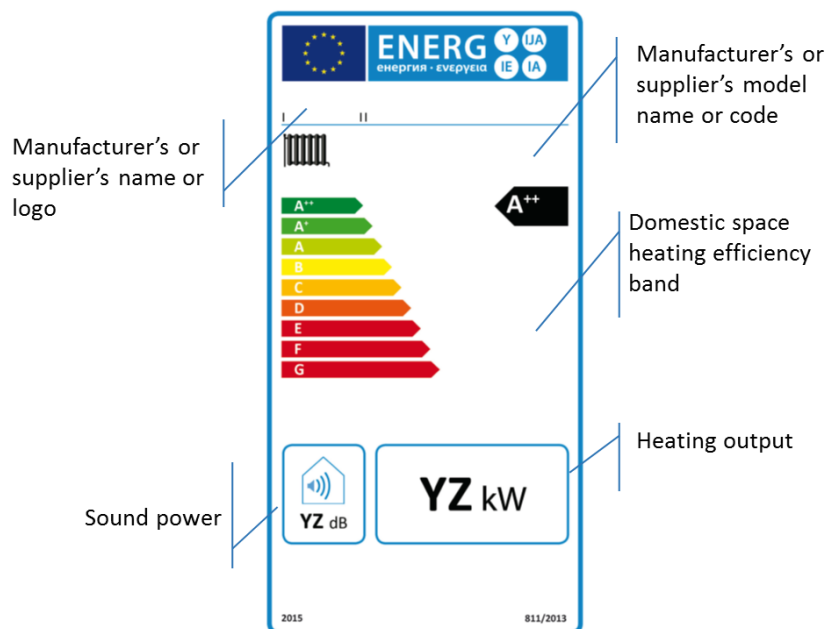


Figure 4 - Example of heating label: Boiler space heaters in seasonal space heating energy efficiency classes A ++ to G



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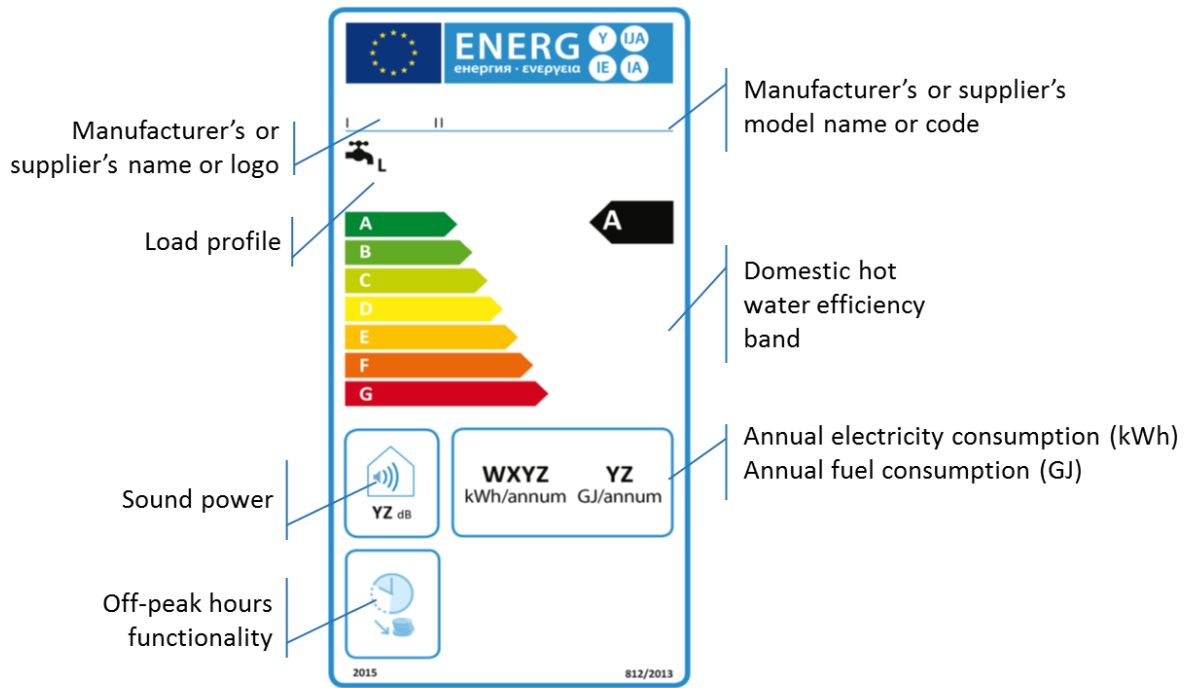


Figure 5 - Example of water heating label: Conventional water heaters in water heating energy efficiency classes A to G.

For packages an additional label should be issued identifying which appliances constitute the final solution. It's important to underline that this label does not replace the individual labels. For example, when installing a water heating system with a conventional water heater and a forced circulation solar thermal system, with a storage tank decoupled from the solar thermal collector, three labels must be issued: a label for the conventional water heating appliance, a label for the hot water storage tank and a label for the package of water heater and solar device. (See example in Figure 3)



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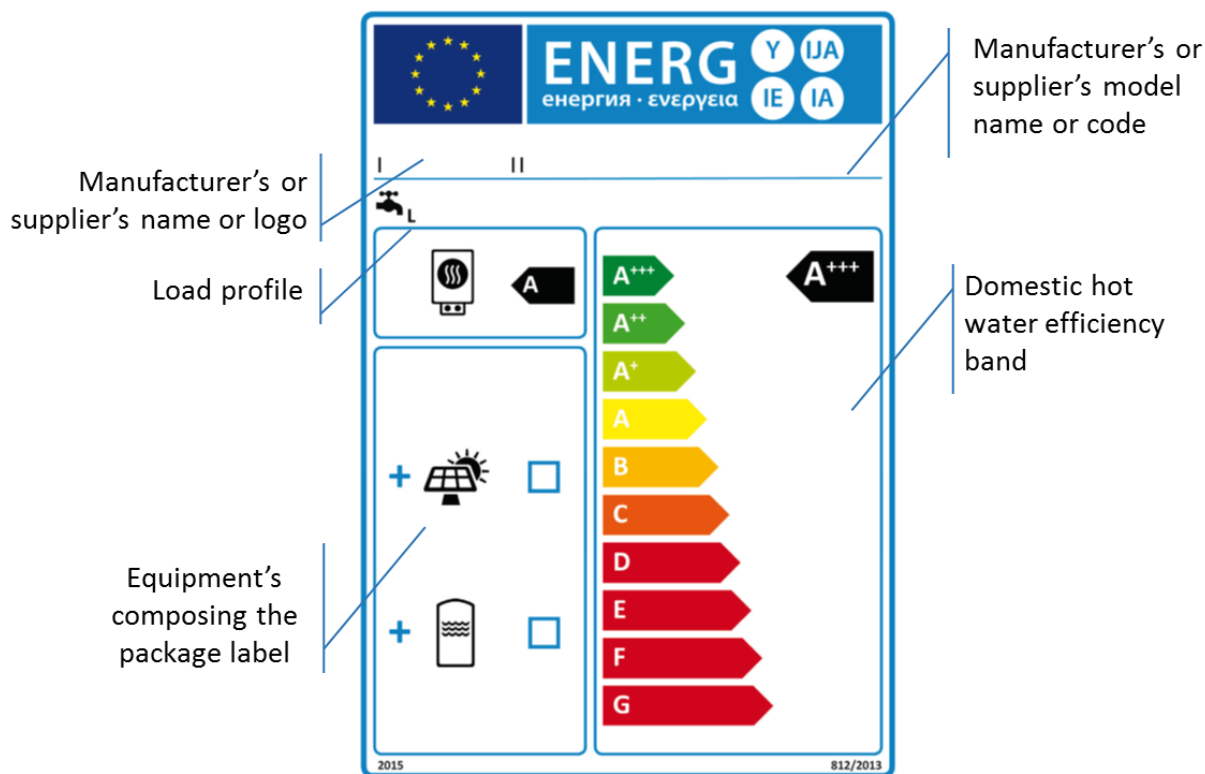


Figure 6 – Example of water heating label: Label for packages of water heater and solar device in water heating energy efficiency classes A +++ to G

7.2 Product Fiche

The product fiche contains detailed technical information on the appliance and it should be supplied with each appliance, included in the product brochure or other literature provided with the product.

Specific information according to the appliance type, namely load profile for which it was tested, heating energy efficiency, electricity consumption (when applicable), sound power L_{WA} indoors, standby power consumption, standing loss (for storage tanks) and indication of specific precautions that shall be taken when the appliance is assembled, installed or maintained are some of the information's listed in the product fiche.

The same product fiche may cover a wide number of appliance models provided by the same supplier.



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PF-SWH

Product fiche

Group: Water heaters & storage tanks
 Section: Solar devices
 Reference: CDR 812/2013, annex IV, point 1

Date: 31/12/2013

1.1 (a) Suppliers name or trademark:				Informative section
1.1 (b) Suppliers model identifier:				
Brand:	vAConsult			
Type:	Solar Water			
Model:	Mark IX			
Technical parameters:				
Description:	Symbol:	Value:	Unit:	
1.1 (c) Declared load profile:		L	-	Annex VII, table 3
1.1 (d) Water heating efficiency class (average climate):		0	-	Annex II, point 1
1.1 (e) Water heating energy efficiency (average climate):	$\eta_{wh} =$	163	%	Annex VIII, point 3
1.1 (f) Annual electricity consumption (average climate):	AEC =	25	kWh	Annex VIII, point 4
1/1 (g) not implemented				
1.1 (h) Thermostat temperature setting:		n.a.	°C	
1.1 (i) Sound power level:	L _{wa} =	15	dB	Technical doc
1.1 (j) Only off-peak hours operation:		n.a.	Yes/No	
1.1 (k) Special precautions:				
1.1 (l) Only applicable with smart control enabled:		n.a.	Yes/No	
1.1 (m) Water heating energy efficiency (colder climate):		149	%	Annex VIII, point 3
Water heating energy efficiency (warmer climate):		178	%	Annex VIII, point 3
Annual electricity consumption (colder climate):		28	kWh	Annex VIII, point 4
Annual electricity consumption (warmer climate):		23	kWh	Annex VIII, point 4
1.1 (o) Collector aperture area:	A _{sol} =	5.00	m ²	Technical doc
1.1 (p) Zero loss collector efficiency:	$\eta_o =$	0.800	-	Technical doc
1.1 (q) First order heat loss coefficient:	a ₁ =	3.50	W/(K.m ²)	Technical doc
1.1 (r) Second order heat loss coefficient:	a ₂ =	0.000	W/(K ² .m ²)	Technical doc
1.1 (s) Incidence angle modifier:	IAM =	0.94	-	Technical doc
1.1 (t) Storage nominal volume:	V =	150	litres	Technical doc
Backup designated part of storage:	V _{bu} =	0	litres	Technical doc
1.1 (u) Pump power consumption:	solpump =	30	W	Technical doc
1.1 (v) Standby power consumption:	Solstandby =	5.00	W	Technical doc

Load profiles:
M
L
XL
XXL

Label classes:
A
B
C
D
E
F
G

Compliments: Solar Certification Fund (4C16-EcoDes-12)

vAConsult 2014

Figure 7 – Illustration of the product fiche of a solar water heater
 (Source: “Ecodesign and the Energy label for solar thermal related products – Part 2., 2015, vAconsult)



7.3 Technical Documentation

The technical documentation is not a commercial document, and is only to be made available upon request to the authorities of the Member States and to the European Commission.

The technical documentation details data such as references of the harmonized standards applied other technical standards and specifications used, and the results of measurements and calculations on specific technical parameters. Any specific precautions that shall be taken when the heating appliance is assembled installed or maintained is also to be stated in the technical documentation.

TD-SWH

Technical documentation

Group: Water heaters and hot water storage tanks
 Section: [Solar] water heater
 Reference: CDR 812/2013, annex V, point 1 Date: 31/12/2013

V.1(b) Description of the device:
 Brand: vAConsult
 Type: Solar Water
 Model: Mark IX

Ref.	Description:	Symbol	Value	Unit	Determined according to:	Status ¹	Reference
V.1(f)	From annex VII:						
V17(a)	Daily electricity consumption:	$Q_{el,d}$	0.100	kWh	HS		PUB 2014/C 207/03
V17(b)	Declared load profile:		L	-			CDR 812/2013 annex VII, table 7
V17(c)	Sound power level:		15	dB	Reg		Default. No moving parts
V17(d)	Daily fuel consumption:	$Q_{fuel,d}$	6.000	kWh (GCV)	HS		PUB 2014/C 207/03
V17(e)	Weekly fuel consumption:	$Q_{fuel,week}$	n.a.	kWh (GCV)	HS		PUB 2014/C 207/04
V17(f)	Weekly electricity consumption:	$Q_{el,week}$	n.a.	kWh (GCV)	HS		PUB 2014/C 207/05
V17(g)	Weekly fuel consumption:	$Q_{fuel,week}$	n.a.	kWh (GCV)	HS		PUB 2014/C 207/06
V17(h)	Weekly electricity consumption:	$Q_{el,week}$	n.a.	kWh (GCV)	HS		PUB 2014/C 207/07
	Water heater eff. (nonsolar):	$\eta_{th,nonsolar}$	0.90	-	HS		PUB 2014/C 207/07
V17(i)	Collector aperture area:	A_{col}	5.00	m ²	HS		EN12975-2
V17(j)	Zero loss collector efficiency:	η_{zlc}	0.800	%	HS		EN12975-2
V17(k)	First order heat loss coefficient:	a_1	3.50	W/(K.m ²)	HS		EN12975-2
V17(l)	Second order heat loss coefficient:	a_2	0.000	W/(K ² .m ²)	HS		EN12975-2
V17(m)	Incidence angle modifier:	IAM	0.94	-	HS		EN12975-2
	Storage nominal volume:	V	150	litres			
	Backup designated part of storage:	V _{bu}	0	litres			
V17(n)	Pump power consumption:	solpump	30.00	W	Reg		PUB 2014/C 207/03, point 4.10
V17(o)	Standby power consumption:	solstandby	5.00	W	?		Product specifications
V17(p)	Annual auxiliary energy consumption:	Q _{aux}	103.8	kWh			Calculation
V.1(g) From annex VIII:							
			Average	Colder	Warmer		
V18(a)	Water heating energy efficiency:	η_{wh}	163	149	178	%	CDR 812/2013 annex VIII
V18(b)	Annual electricity consumption:	AEC	25	28	23	kWh	CDR 812/2013 annex VIII
V18(c)	Annual fuel consumption:	AFC	1511	1651	1382	kWh	CDR 812/2013 annex VIII
V18(d)	Annual non solar heat contribution:	Q _{nsolar}	1170	1300	1050	kWh	HS EN 12976

¹ HS: Harmonised standard. If not available, specify method according to PUB 2014/C 207/02 or /03 and specify subsection.

V.1(h) Precautions to be taken when assembling:

V.1(i) Supplier (name and address):

V.1(j) Empowered person:
 Name:
 Position:

Signature:

Compliance: Solar Certification Fund (4C-IE-Solar-02) vAConsult 2014

Figure 8 – Illustration of the technical document of a solar water heater

(Source: “Ecodesign and the Energy label for solar thermal related products – Part 2., 2015, vAconsult)



7.4 Detailed information

The detailed information package is a responsibility of the dealer and is to be provided to the consumers in the cases when they cannot be expected to see the product displayed. An example of such a situation is the presentation of equipment via catalogues or via advertising material, when the product is not physically accessible.

The information assembled is a compilation of the information displayed in the energy label and in the product fiche.

6.9.2013	EN	Official Journal of the European Union	L 239/121
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ANNEX VI

Information to be provided in cases where end-users cannot be expected to see the product displayed

1. WATER HEATERS

1.1. The information referred to in Article 4(1)(b) shall be provided in the following order:

- (a) the declared load profile, expressed by the appropriate letter and typical usage in accordance with Table 3 of Annex VII;
- (b) the water heating energy efficiency class of the model, under average climate conditions, in accordance with point 1 of Annex II;
- (c) the water heating energy efficiency in %, under average climate conditions, rounded to the nearest integer and calculated in accordance with point 3 of Annex VIII;
- (d) the annual electricity consumption in kWh in terms of final energy and/or the annual fuel consumption in GJ in terms of GCV, under average climate conditions, rounded to the nearest integer and calculated in accordance with point 4 of Annex VIII;
- (e) the sound power level, indoors, in dB, rounded to the nearest integer (for heat pump water heaters, if applicable);

in addition, for solar water heaters and heat pump water heaters:

- (f) the water heating energy efficiency in %, under colder and warmer climate conditions, rounded to the nearest integer and calculated in accordance with point 3 of Annex VIII;
- (g) the annual electricity consumption in kWh in terms of final energy and/or the annual fuel consumption in GJ in terms of GCV, under colder and warmer climate conditions, rounded to the nearest integer and calculated in accordance with point 4 of Annex VIII;

in addition, for solar water heaters:

- (h) the collector aperture area in m², to two decimal places;
- (i) the storage volume in litres, rounded to the nearest integer;

in addition, for heat pump water heaters:

- (j) the sound power level, outdoors, in dB, rounded to the nearest integer.

1.2. Where other information contained in the product fiche is also provided, it shall be in the form and order specified in point 1 of Annex IV.

1.3. The size and font in which the information referred in points 1.1 and 1.2 is printed or shown shall be legible.

Figure 9 – Example for a detailed information for water heaters.



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7.5 Advertisement and promotional material

Any advertisement and technical promotional material should reference the equipment energy efficiency class.




Figure 10 – Example of a hot water storage tank with the energy label

This is particularly important as advertising, and knowing the energy efficiency class of the products under consideration, is crucial in the decision making process.

This also applies to web advertising and sales, where the energy class should also be displayed.

Gas Tankless Water Heaters



Highest performance, efficiency and flow rate

Specifications	
Condensing/Non-Condensing	Condensing
Application	Residential or Commercial
Max Input (BTU)	225,000
Max Input (BTU)	25,000
Capacity at 35°F Rise (GPH)	12.1
Capacity at 55°F Rise (GPH)	7.2
Intelligent Composting	Up to 24 Units
Max Flow Rate	0.5 GPM
Temp Range (°F)	100-140
Temp Stability (°F)	±1.2
Default Temp (°F)	120
Energy Factor	99%
Thermal Efficiency	94%
Installation Options	Indoor or Outdoor (for outdoor, MB required)
Dimensions (w x h x d)	17.7" x 30.1" x 11.1"
Weight (lbs.)	74
Inlet Connection	1/2" NPT
Outlet Connection	1/2" NPT
Gas Connection	3/4" NPT

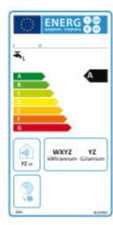


Figure 11 – Example of a water heater display online



8 Actors and Responsibilities

The heating solutions supply market involves several actors: the manufacturer, or supplier as defined in the legislation; the dealer or retailer who distributes the equipment's, the installer who can act as dealer and installer or exclusively as responsible for installing the heating solution at the end-consumer's residency and the end-consumer who assures that the heating equipment he has just acquired bears the energy label. Additional to this, the market chain can also integrate the system designer who is responsible for designing and conceiving the heating system, typically more complex systems, namely package systems. In this case, the system designer should also be aware of the energy labelling legislation and provide the most efficient solutions.

8.1 Actors

8.1.1 Supplier

Suppliers are understood as the one's responsible for the manufacturing of the product. According to the regulation "Supplier" means the manufacturer or its authorised representative in the Union or the importer who places or puts into service the product on the Union market."

Article 3 – **Responsibilities of suppliers** placing space heaters on the market and or putting them into service, including those integrated in packages of space heater, temperature control and solar device, shall ensure that each piece of equipment is provided with:

- (a) a printed label
- (b) a product fiche
- (c) the technical documentation
- (d) advertisement includes a reference to the seasonal space heating energy efficiency class
- (e) technical promotional material includes a reference to the seasonal space heating energy efficiency

The supplier must present all the documentation regarding each individual piece of equipment. If it is the case when the supplier is also offering a pre-assembled heating package solution, it is the supplier's responsibility to also ensure the calculation and presentation of the package's energy label, which provides the combined energy efficiency rating.

8.1.2 Dealer

The dealer should ensure that individual equipment and pre-assembled packages are displayed for sale bearing the energy label, and that the advertising complies with the guidelines defined in the legislation. If the dealer is to propose a custom-made package to the customer he is responsible for issuing the package label. In any of the cases, he must assure that the end-user receives all the documentation regarding the energy efficiency and technical characteristics of the individual heating equipment.

8.1.3 System Designer

In more complex heating systems designers may be contracted to outline the system, assuring the compatibility between the buildings heating needs and the most adequate solutions. The system designer does not have a direct responsibility in the labelling provision but, can be an important player in the global chain, namely in the definition of the guidelines for the procurement process, identifying in the procurement technical documents the requirements to be met by the equipment's, namely the



energy class. To this, the system designer should simulate, in the project definition stage, the energy class of the heating system and present this energy label simulation to the customer as part of the system's technical project. This information is to be delivered to the installer, who installs the system and issues the final energy label. This provision of an energy class simulation by the system designer is essential to make the customer aware of the proposed system's energy class and prevent any discontents with this regard after the system is installed.

8.1.4 Installer

The new Energy Label will be supplied with each individual and pre-assembled package heating system by the manufacturer.

It will be the installer's responsibility to ensure that the customer has received the energy label, and additional documentation of the heating appliance, at the point of sale.

8.1.5 Installer Integrator

If the heating system contains different products, whoever is responsible for the packaging, is responsible for providing a package label when combining a heating appliance with a temperature control and/or solar device, hot water storage tank or a supplementary heating appliance.

The professional who puts the package together is the one responsible for producing a package label. That package label will need to provide the combined energy efficiency rating of the whole system rather than only the ratings of each individual component. This could be the manufacturers' responsibility if they supply a pre-assembled package, **or the installer's if the items are bought individually, as separate parts, and the installer is the system integrator**. If this is the case, the installer is responsible for calculating the overall package efficiency, this information must be recorded, regarding each product on a document known as a fiche, and systematized in the energy label that provides the combined energy efficiency rating.

8.1.6 End-user

The end user should be aware for the correct presentation of the energy labelling and correspondent documentation. He should require the presentation of the energy label, being aware of the additional labels if a package is provided, and inquire the commercial responsible for the sale if the documentation is not available. In case of doubt the consumer can contact the consumer protection agencies and/or report to the market surveillance authorities in case of detecting non-compliance.

8.2 The market chain

The market chain in the supply of heating solutions can be presented in two distinct models:

- Individual equipment or standardized combined packages
- Custom-made packages

In the first solution, the energy label, and all the additional documentation are a responsibility of the manufacturer. The manufacturer is responsible for providing all the technical information, all the documents presented in detail in chapter 7, regarding individual equipment and complete package, to the dealer, be it a commercial dealer or an installer integrator. The dealer or installer integrator, the one making the sale to the final customer is responsible for providing the documentation to the end-consumer. Recall that in the case of standardized or custom made packages, the end-user should receive the energy labels from the individual equipment and the label for the package.



When the dealer is the one making the sale, the installation is usually contracted by the dealer itself, or the dealer suggests a network of installers with whom it usually works and that offer guarantees to the good installation of the heating equipment.

In the second solution, of custom-made packages, several situations can occur:

- The dealer assembles a custom-made package;
- The installer integrator assembles a custom-made package;
- The dealer or the installer propose changes to a standardized package;
- The heating systems are designed by a system designer.

The **dealer is responsible for assembling a custom made** solution and, as so, is responsible for providing the package label, beyond the individual documentation each piece of equipment must carry. In this case the installer has no responsibility regarding the emission of the package energy label.

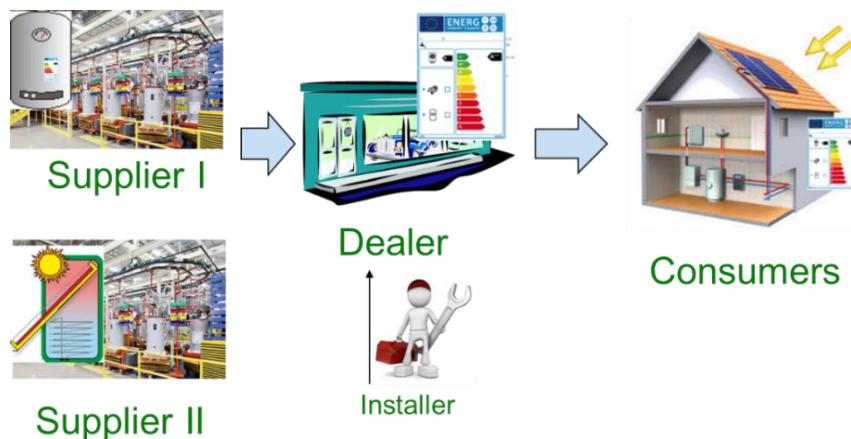


Figure 11 - Supply chain when the dealer is responsible for the custom made package

When the **installer offers a custom made package system** and the installer is the system integrator he is the one responsible for providing the package documentation, namely the package energy label.

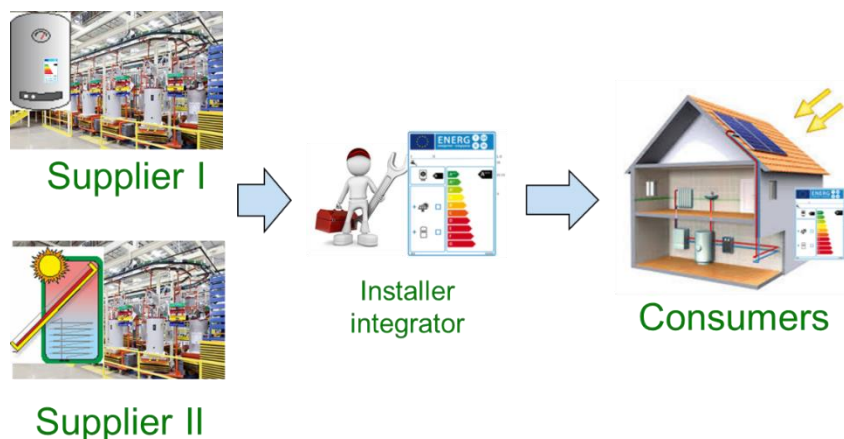


Figure 12 - Supply chain when the installer integrator is responsible for the custom made package



There's a third possibility, when the dealer or installer propose additional equipment to a standardized package, for example a more intelligent controller, a second hot water storage tank, among other possibilities, and, in this case, the installer should issue a new label for the final solution installed.

The expectancy is that the manufacturers will most likely provide all kinds of pre-assembled packages to prevent this kind of situations.

In the event of a more complex package system, designed by a system designer, and although the package labelling is not the designer's responsibility, he should, as a good practice and to make the client aware, simulate the expected energy efficiency class of the system. As a requisite, this expected energy class should be presented in the procurement process and validated by the final dealer or installer of the solution, according to whom the labelling issuing responsibility stands.

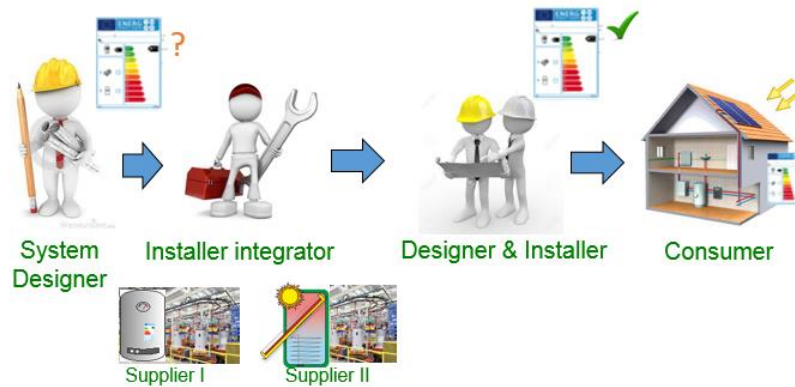


Figure 13 - Supply chain when the system designer is responsible for the heating package solution.

8.3 Market Surveillance authorities

Market surveillance authorities are responsible for economic surveillance activities, monitoring the enforcement of the regulation and preventing the misappropriation of legal acts.

Surveillance authorities are mandated to operate in public spaces, public commercial spheres where economic transactions take place. Regarding the energy labelling of equipment's the main task of the surveillance entities is to assure the presence of the energy label in the equipment at the moment of sale, verifying also the format of the label, to assure that the right label is provided to the final consumer.

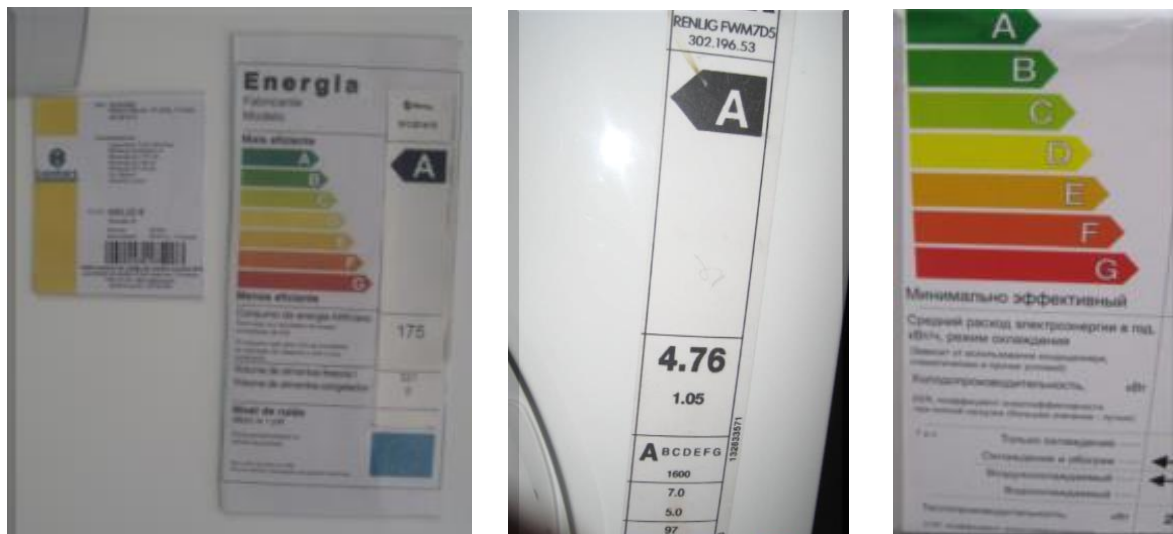


Figure 14 – Examples of non-complying energy labels (first and second figures: the energy class and the energy consumption data are not embedded in the same label, as a second tape is added; third figure: the label format is incorrect and is not presented in the country's national language)

Regarding the package label, market surveillance authorities can only access and verify the compliance with the legal requirements, namely in terms of the energy labelling displaying in complete packages available in the market. The process to verify the compliance with the directive in the cases where the installer is the system integrator, assembling the system in the final consumer's house, are still unclear, as the surveillance entities do not have a direct way to validate if the consumer was informed of the package's energy class and if the customer received all the compulsory documentation.

Some measures could be implemented to facilitate the market surveillance activity in this task, namely:

- collaboration with national installer associations and local authorities, especially with regard to the implementation of the package label;
- manufacturers could support the authorities with product related information, namely uploaded in the Label Pack A+ platform;
- when inspecting the installer integrator activity the market surveillance authority can request a copy of the energy labels issued according to the sales registry;

Either way, the final consumer's awareness for the package label is essential and in the act of non-compliance the final user can complain to the market surveillance authority. In this sense, the creation of focus groups and the interaction with consumers associations is extremely important.

8.3.1 ICSMS

The ICSMS - internet-supported information and communication system for the pan-European market surveillance, creates the basis for an effective and efficient cooperation between the market surveillance bodies in Europe.

Supported by the internet, it enables a comprehensive exchange of information between all the market surveillance bodies. (<https://webgate.ec.europa.eu/icsms/>). This platform can be an important tool for the exchange of experiences regarding the surveillance of the package label.



8.4 Relevant Stakeholders

Industry Associations – are essential actors to promote the direct contact with the manufacturers. Manufacturers are an essential link as they possess all the information regarding the equipment and should be called to cooperate with the Label Pack A+ project, namely uploading product information in the platform for the emission of package labels in the case of custom made packages, and access to pre-defined labels.

Installers Associations – Installers are the central figure of this legislation. Installers associations are essential in the validation of contents for the training activities and in the contacts with installers to disseminate the training sessions and foster partnerships with relevant events and other initiatives.

Training Centres – several training centres offer training courses for the installation of heating equipment, namely for the installation of solar thermal systems. These training centres are a crucial contact point with installers, new to the heating market, who should receive, at the earliest stage of their entering in the market, information on the energy label, and in particular the package label. Synergies can be built with these entities to provide training in loco, based on the materials developed within Label Pack A+.

Consumer Protection Entities – consumer protection entities are key partners in the contact with the end-consumer, providing information on new legislation and offering support to clarify issues addressing the market and receiving complaints on the market activity. The Label Pack A+ consortium can benefit largely from the contact with these entities, providing training to the actors in direct contact with the consumers and receiving information on non-compliance activities, identifying key areas for additional action.

Market surveillance entities – the relation with market surveillance authorities is a synergetic one. The Label Pack A+ consortium can provide information, namely via the database platform, and training to the technicians operating on the field. The market surveillance authorities procedures for evaluating compliance with the delegated acts 811/2013 and 812/2013, can also be designed with the contribution of the Label Pack A+ consortium, since the custom made systems package label can be difficult to access.



ANNEXES

TERMINOLOGIES BY COUNTRY

EN	PT	DE	IT	FR
<p>Solar collector - means a device designed to absorb global solar irradiance and to transfer the heat energy so produced to a fluid passing through it;</p> <p>(811)</p>	<p>Coletor solar - um dispositivo concebido para absorver a radiação solar global e transferir a energia térmica assim produzida para um fluido que passa através dele;</p>	<p>„Sonnenkollektor“ bezeichnet eine Vorrichtung, die dazu ausgelegt ist, Gesamtsonneneinstrahlung zu absorbieren und die so erzeugte Wärmeenergie an ein durch den Kollektor strömendes Fluid weiterzugeben</p>	<p>Collettore solare - un dispositivo progettato per assorbire l'irraggiamento solare globale e trasferire l'energia calorifica così prodotta verso un fluido vettore;</p>	<p>Capteur solaire - un dispositif conçu pour absorber l'irradiation solaire globale et transférer l'énergie thermique ainsi produite à un fluide qui le traverse</p>
<p>Solar device - means a solar-only system, a solar collector, a solar hot water storage tank or a pump in the collector loop, which are placed on the market separately;</p> <p>(811&812)</p>	<p>Dispositivo solar - um sistema exclusivamente solar, um coletor solar, um reservatório de água quente solar ou uma bomba no circuito do coletor, comercializados separadamente</p>	<p>„Solareinrichtung“ bezeichnet eine reine Solaranlage, einen Sonnenkollektor, einen solarbetriebenen Warmwasserspeicher oder eine Pumpe im Kollektorkreislauf, welche separat in Verkehr gebracht werden</p>	<p>Dispositivo solare - un sistema esclusivamente solare, un collettore solare, un serbatoio per l'acqua calda di origine solare o una pompa del circuito del collettore, ciascuno commercializzato separatamente</p>	<p>Dispositif solaire - un système tout solaire, un capteur solaire, un ballon d'eau chaude solaire ou une pompe de boucle de captage, qui sont mis sur le marché séparément</p>
<p>Solar water heater - means a water heater equipped with one or more solar collectors, solar hot water storage tanks, heat generators and possibly pumps in the collector loop and other parts, a solar water heater is placed on the market as one unit;</p>	<p>Aquecedor de água solar - um aquecedor de água equipado com um ou vários coletores solares, reservatórios de água quente solares, geradores de calor e, eventualmente, bombas de calor no circuito dos coletores e outros componentes; um aquecedor de água</p>	<p>„solarbetriebener Warmwasserbereiter“ bezeichnet einen Warmwasserbereiter, der mit einem oder mehreren Sonnenkollektoren, solarbetriebenen Warmwasserspeichern, Wärmeezeugern und möglicherweise Pumpen im Kollektorkreislauf sowie mit sonstigen Bauteilen ausgestattet ist; solarbetriebene</p>	<p>Scaldacqua solare - uno scaldacqua munito di uno o più collettori solari, serbatoi per l'acqua calda di origine solare, generatori di calore ed eventuali pompe nel circuito del collettore nonché altre parti; uno scaldacqua solare è</p>	<p>Chauffe-eau solaire - un chauffe-eau équipé d'un ou de plusieurs capteurs solaires, ballons d'eau chaude solaires, générateurs de chaleur et éventuellement pompes de la boucle de captage et d'autres éléments; un chauffe-eau solaire est mis sur le</p>



	solar é colocado no mercado como uma só unidade;	Warmwasserbereiter werden als Einheit in Verkehr gebracht;	commercializzato come unità a sé stante	marché en tant que produit unitaire (812)
<p>Solar only systems - means a device that is equipped with one or more solar collectors and solar hot water storage tanks and possibly pumps in the collector loop and other parts, which is placed on the market as one unit and is not equipped with any heat generator except possibly one or more back-up immersion heaters; (811&812)</p>	<p>Sistema exclusivamente solar - um dispositivo equipado com um ou mais coletores solares e reservatórios de água quente solares e, eventualmente, bombas no circuito dos coletores e outros componentes, que é comercializado como uma só unidade e não está equipado com geradores de calor, com a eventual exceção de um ou mais aquecedores de imersão auxiliares;</p>	<p>„reine Solaranlage“ bezeichnet eine Vorrichtung, die mit einem oder mehreren Sonnenkollektoren und solarbetriebenen Warmwasserspeichern sowie möglicherweise mit Pumpen im Kollektorkreislauf und sonstigen Bauteilen ausgestattet ist, auf dem Markt als ein Gerät bereitgestellt wird und mit keiner Wärmequelle außer eventuell einem oder mehreren Hilfs-Tauchheizelementen ausgestattet ist;</p>	<p>Sistema esclusivamente solare - un dispositivo munito di uno o più collettori solari e serbatoi per l'acqua calda da energia solare ed eventuali pompe del circuito del collettore nonché altre parti, commercializzato come singola unità e privo di generatori di calore, fatta eventualmente eccezione per uno o più elementi riscaldanti ausiliari a immersione;</p>	<p>Système tout solaire - un dispositif comprenant un ou plusieurs capteurs solaires et ballons d'eau chaude solaires ainsi que, éventuellement, des pompes de boucle de captage et d'autres éléments, qui est mis sur le marché sous forme unitaire et n'est pas équipé de générateur de chaleur, à l'exception éventuelle d'un ou plusieurs thermoplongeurs de secours (811 & 812)</p>
<p>Package of water heater and solar device - means a package offered to the end-user containing one or more water heaters and one or more solar devices; (812)</p>	<p>Sistema misto de aquecedor de água e dispositivo solar - um sistema misto oferecido ao utilizador final que contém um ou mais aquecedores de água e um ou mais dispositivos solares;</p>	<p>„Verbundanlage aus Warmwasserbereiter n und Solareinrichtungen“ bezeichnet eine für den Endnutzer erhältliche Verbundanlage aus einem oder mehreren Warmwasserbereitern und einer oder mehreren Solareinrichtungen;</p>	<p>Insieme di scaldacqua e dispositivo solare - un insieme proposto all'utilizzatore finale contenente uno o più scaldacqua e uno o più dispositivi solari</p>	<p>Produit combiné constitué d'un chauffe-eau et d'un dispositif solaire - une combinaison proposée à l'utilisateur final contenant un ou plusieurs chauffe-eau et un ou plusieurs dispositifs solaires (812)</p>

SOLAR THERMAL TESTING NORMS

- EN 12975 – 1+A1: Thermal solar systems and components – Solar collectors – Part 1: General requirements, 2006; A1, 2010;
- EN ISO 9806 – Solar energy – Solar thermal collectors – Test methods, 2013;
- EN 12976 – 1: Thermal solar systems and components – Factory made systems – Part 1: General requirements, 2006;



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649905

- EN 12976 – 2: Thermal solar systems and components – Factory made systems – Part 2: Test methods, 2006;
- ISO 9459-2: Solar Heating – Domestic water heating systems – Part 2: Outdoor test methods for system performance characterization and yearly performance prediction of solar-only systems, First edition, 1995;
- ISO 9459-5: Solar heating – Domestic water heating systems – Part 5: System performance characterization by means of whole-system tests and computer simulation, 2007;
- EN 12977-1:2012: Thermal solar systems and components. Custom built systems. General requirements for solar water heaters and combisystems;
- EN 12977-2:2012: BS EN 12977-2:2012. Thermal solar systems and components. Custom built systems. Test methods for solar water heaters and combisystems;
- EN 12977-3:2012: BS EN 12977-3:2012. Thermal solar systems and components. Custom built systems. Performance test methods for solar water heater stores;
- EN 12977-4:2012: BS EN 12977-4:2012. Thermal solar systems and components. Custom built systems. Performance test methods for solar combistores;
- EN 12977-5:2012: BS EN 12977-5:2012. Thermal solar systems and components. Custom built systems. Performance test methods for control equipment.