SOLZAIMA

BIOMASS HEATING SOLUTIONS

Wood Fired *Boiler*

Instruction Manual

English

Model

Wood Fired Boiler SZM W 35 kW

Carefully read these instructions before installing, using and servicing the unit.

This instruction manual is provided with the product.

Mod. 515-D

Thank you for purchasing a SOLZAIMA appliance.

Please read this manual carefully and retain it for future reference.
* All products detailed herein meet the requirements of the EU Construction Products Regulation UE 305/2011), and bear the EC compliance marking;

* This Wood Fired Boiler is designed in compliance with the EN12809:2001 standard;

* SOLZAIMA disclaims any responsibility for damages to the unit if installed by non-qualified personnel;

* SOLZAIMA is not responsible for any damage to units not installed and used in compliance to the instructions included in this manual;

* All local regulations, including but not limited to national and European standards, must be observed when installing, operating and servicing the unit;

* For assistance, please contact your unit's supplier or installer. Please note that you need to be ready to provide the serial number of your unit, detailed on the identification plate located on the back panel of the unit and on the sticker attached to the plastic cover of this manual;

*The technical service must be performed by the unit Installer or Supplier, except on situations where the assessment performed by the installer or service engineer determines that SOLZAIMA should be contacted, when required.

Contacts for technical support:

www.solzaima.pt
apoio.cliente@solzaima.pt
Tel. 00 351 234 650 650
Address: Rua dos Outarelos; nº 111;
3750-362 Belazaima do Chão
Águeda – Portugal

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Solzaima

Solzaima's vision has always been to provide a clean, renewable and most cost-effective energy. This is why for more than 35 years we've been dedicated to manufacturing biomass heating units and solutions.

As a result of the persistence and unconditional support from our partner network, Solzaima is currently the leader manufacturer of biomass heating solutions, in the back boiler fire for central heating segment, and with its range of free standing fires and wood fired boilers.

We provide annually approximately 20,000 households with biomass heating solutions. This effectively demonstrates consumers' interest in more ecological and economic solutions.

Solzaima has an ISO 9001:2008 quality certification and an ISO 14001:2004 environmental certification.

1. Package content

Solzaima ships this unit with the following components:

- Wood Fired Boiler SZM W 35kW;
- Instruction manual;
- Poker.

1.1 Unpacking the boiler

To unpack the boiler, please remove the retractable plastic bag and wrapper that protect the unit.

2. Safety precautions

Solzaima is not liable for any damages to the unit if the specified precautions, warnings and operating procedures are not followed.

The units manufactured by Solzaima are easy to operate, and include components carefully designed to protect both the user and the installer against possible accidents.

The unit must be installed by authorised personnel only. A declaration of conformity of the installation must be provided by the installer to the client, stating that the installer takes full responsibility for the final installation and, consequently, for the smooth operation of the unit.

This unit is designed for its intended use only. Any contractual and extra-contractual obligations of the manufacturer are hereby excluded regarding injuries caused to people or animals or damages to property resulting from faulty installation, maintenance or misuse of the unit.

After removing the packaging materials, inspect the package contents for integrity and completion. If the package contents does not match the items listed under 1. Package contents, please contact your local reseller from whom you purchased the unit.

All the components that make up the unit and that guarantee its operability and energy efficiency should only be replaced with original parts, provided by an authorised technical support centre.

The unit must be subjected to maintenance at least once a year, by a qualified engineer.
This manual is provided with the product. Please make sure you keep it beside the unit at all times.

For your safety, we provide the following recommendations:

- This wood fired boiler is a biomass heating appliance. Please make sure you read and understand the instructions in this manual before using it.
- Before turning on the Wood Fired Boiler, please make sure its hydraulic circuit is properly connected to the water supply.
- The boiler is not intended to be used by children, mentally and physically challenged people, people with sensory disability or inexperienced users, except under proper supervision and instructions.
- Do not touch the boiler when barefoot, or when any part of your body is wet or humid;
- Do not modify the boiler features without the manufacturer's previous consent.
- Do not cover or reduce the size of the vents at the installation area.
- The Wood Fired Boiler unit requires an adequate fresh air supply for proper combustion, so the air tightness of the room or simultaneous operation with other air extraction devices may prevent the unit to work properly.
- A proper combustion requires the availability of ventilation holes. This appliance must be installed in a well air-ventilated area to guarantee adequate air exchange. Air vents should be placed at locations where they do not become obstructed, to provide for an adequate fresh air supply and ensure a proper draught.
- Do not leave the packing materials near children.
- During normal operation, the unit's door must be kept closed at all times and may only be opened for supplying wood.
- Avoid direct contact with parts of the unit that tend to become hot during operation.
- Check for the existence of any obstructions on the fume duct before turning on the unit after a long period of inactivity.
- This Wood Fired Boiler is designed for residential use in a protected environment.

3. Technical specifications

The Wood Fired Boiler SMZ W 35 kW is intended for heating water for domestic use and to provide central heating. This requires the pre-installation of a central heating system and a hot water tank equipped with a heat exchanger (if you wish to use the appliance to supply domestic hot water).

The Wood Fired Boiler W35 is equipped with a large wood capacity combustion chamber (Fig. 1a and 1b), sturdy and user-friendly. This is an atmospheric (natural draught) boiler.

The boiler is equipped with three doors:

- Lower door: provides access to the area where the ashes fall through the grids, for cleaning purposes. It is equipped with a lid for the connection of the combustion auto-regulator. This regulator controls de water temperature inside the appliance, preventing it to become too hot when the removed heating power is lower than the produced heating power.
- Mid door: provides access to the wood supply channel and it is where the combustion occurs.
- Upper door: provides access to the fume outlet pipe for periodic cleaning.

a) b)

Figure 1 – Section views of the combustion chamber of the wood fired boiler

Features	Wood Fired Boiler W 35 kW	Units
Weight	301	Kg
Height	1280	mm
Width	604	mm
Depth	950	mm
Diameter of the fume discharge pipe	140	mm
Maximum heating capacity	727	m^3
Wood log maximum length	700	mm
Maximum thermal power (water)	32	kW
Fuel consumption	10,5	Kg/h
Thermal yield at rated thermal power	77	%
Max. gas temperature	256	ºC
Max operating pressure	3	bar
Draught in the chimney	25	Pa
Water volume	80	W

Table 1 – Technical specifications

Tests were performed using beech wood with a energy density of 4.2 kWh/kg. The information above are the findings of product certification tests performed by independent laboratories accredited to perform biomass combustion appliance testing.

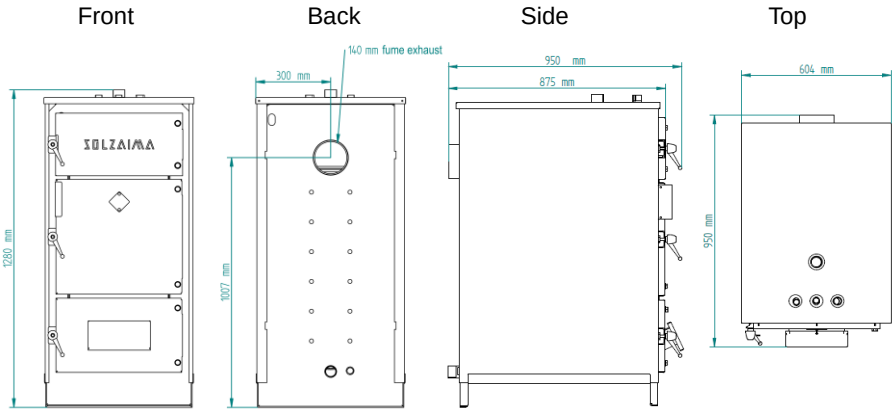


Figure 2 – Dimensions of the Wood Fired Boiler

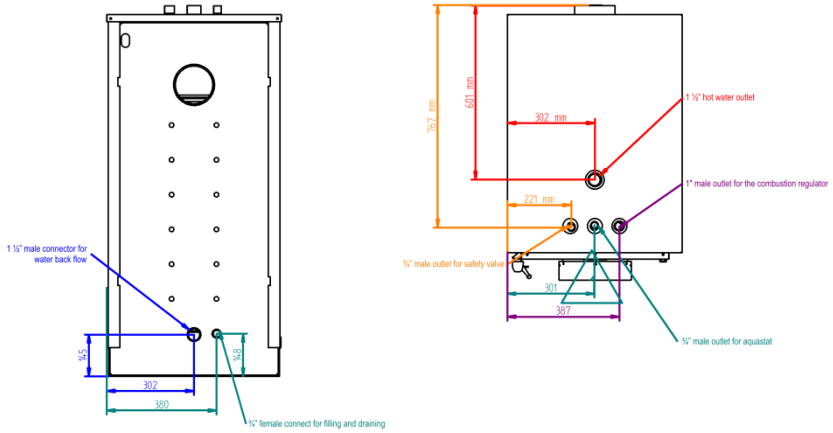


Figure 3 – Hydraulic circuit connections of the wood boiler

4. Installing the wood fired boiler

Before installing, please perform the following steps:

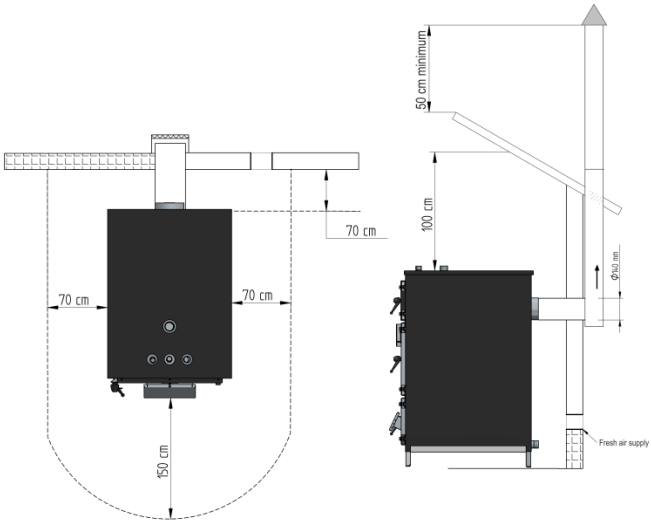
- Upon reception, check the product for completeness and to determine that it does not show any sign of damage. Any damages or defects should be checked and accounted for before the unit is installed.
- Remove the instruction manual from the package and hand it over to the client.
- Connect the combustion gas outlet and the external fume exhaust system (for instance, a flue) using a pipe with a diameter of at least 140 mm.
- Perform the hydraulic connection (see section 12).

5. Installation requirements

See figure 4 to obtain the minimum separation distance between the wood fires boiler and any neighbouring flammable surface.

The top of the boiler must be at a distance of at least 100cm from the ceiling, especially in rooms with ceilings made of flammable materials.

The base supporting the boiler cannot be made of flammable material, and requires adequate protection at all times.



a) b)

Figure 4 – Minimum separation distance between surfaces: a) top view of the unit installation; b) side view of the unit installation

Figures 5, 6a and 6b illustrate the basic requirements for installing the boiler flue. The bottom part of the tube installation must include a T fitting to facilitate periodic inspection and maintenance operations, as shown in the figure below. Double-walled stainless steel insulated pipes must be used and properly attached to avoid condensation.

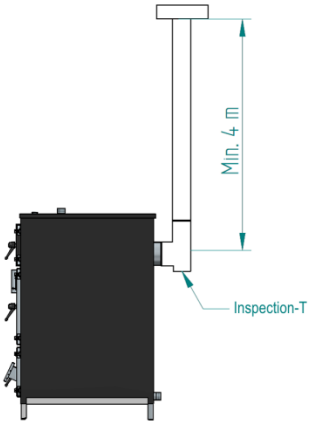


Figure 5 – Side view of the installation, showing the inspection point.

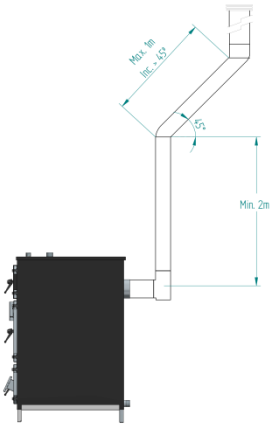


Figure 6 – Example of standard installations.

WARNING!

Keep combustible and flammable materials at a safe distance.

6. Installation of ducts and fume extraction systems:

- The exhaust pipe must be designed for this specific purpose, in compliance with local requirements and applicable regulations.
- ⚠ Important notice! The outlet end of the wood fired boiler exhaust pipe must be attached to a T-pipe with hermetic lid, to allow for the periodic inspection or discharge of heavy dust and condensates.
- The exhaustion path must have inspection points fitted along the duct to facilitate any required periodic cleaning and maintenance operations.
- In normal operating conditions, the combustion gas flow should create a draught of 25 Pa, at 1,5 m above the chimney neck.
- The chimney should be used to exclusively service the boiler, and not shared with other appliances.
- External chimneys must be made of stainless steel double-walled insulated pipes, with an inner diameter of 140 mm.
- **The fume exhaust pipe may generate condensation, so we recommend that the appropriate systems for collecting condensates are installed.**

⚠ Failure to comply with these requirements may prevent the proper operation of the unit. Be sure to follow all the instructions presented on the diagrams.

⚠ The boilers operate with the combustion chamber in depression, which is why it is absolutely necessary that they include a fume exhaust pipe to adequately extract combustion gases.

Fume duct material: The tubing must consist of 0.5 mm thick rigid stainless steel, with fastening joints attaching the different sections and accessories.

Insulation: The fume ducts must be double-walled and insulated to make sure the fumes do not cool down going outwards, which could cause an inadequate circulation and condensation that may damage the unit.

Output “T-tube”: Always attach a regulator "T-tube" to the output of the boiler.

Wind shield terminal: A wind shield terminal must be installed to avoid fume back flow.

Chimney draught: The installation must ensure the generation of a draught of 25 Pa (0,25 mbar) when the unit is hot and operating at its maximum power.

7. Hydraulic installation

* Chapter 12 (installation diagrams) contains the optional connection diagrams for central heating installation, with or without hot water system for domestic use;

***** The minimum temperature at which the circulator pump is activated should be 60°C. We recommend that an anti-condensation valve is installed to prevent the risk of condensation build up inside the chamber;

***** The pump must be mounted at the recirculation circuit where the temperature is lower;

***** A boiler thermostat, or aquastat, should be used and mounted at the hot water outlet pipe, as with the combustion regulator;

***** Solzaima recommends that the installation uses an open expansion vessel, with a 20-cm diameter pipe as a minimum, to connect the vessel to the boiler's recirculation circuit. No vents are required;

***** If the installer chooses to perform the installation using a closed expansion vessel, the vessel dimensions must consider the size of the installation, using 3-bar safety valves (adequate for temperatures up to 90°C). Additionally, we recommend the additional installation of a pressure and temperature safety valve (3bar / 90°C).

***** To drain the boiler, a tap should be attached to one of the outlets provided for this purpose at the bottom of the unit;

***** The heat transfer fluid to be used should be water with an additive corrosion inhibitor, non-toxic product, in the quantity recommended by the product manufacturer;

***** The combustion auto-regulator prevents the water temperature inside the appliance to get too hot, when the removed heating power is lower than the produced heating power. This is achieved by reducing the primary air admission which reduces the combustion speed. This is an important safety feature that prevents the water to boil and/or the pressure to get too high, by triggering the emergency safety features. The regulator must be attached to the screw thread provided for this purpose, as shown

in the diagram, and should be set to close the primary air admission door when the temperature reaches 80°C – **for an optimal performance of any of the appliances mentioned in this manual, the installation of the combustion auto-regulator is required**.

***** If the room where the unit is installed or the transfer fluid piping presents the risk of reaching a freezing temperature, the installer must add anti-freezing fluid in the proportion recommended by the manufacturer to prevent freezing at the minimum absolute temperature expected.

***** Before turning on the boiler, make sure the hydraulic circuit is filled with fluid and in full operation.

***** It is critical to be able to access the different components of the hydraulic installation throughout the life span of the unit, to facilitate periodic maintenance, assistance and replacement operations of the required parts over time.

7.1 Calculting the minimum volume for the inertia deposit

Pursuant to the EN-303-5:2012 standard, the calculation of the minimum volume for the inertia deposit is based on the following formula:

VSP = 15*TB*QN*(1-0,3*QH/Qmin)

where:
VSP = inertia deposit minimum volume (l)
TB= combustion time (h)
QN= rated power (kW)
QH= installation requirement (kW)
Qmin= minimum power for the boiler (kW)

Inertia deposit example:
Combustion time: 2 h (time required for the combustion of a firewood load)
Boiler's rated power: 32 kW
Boiler's minimum power: 32 kW
Building's heat load: 25 kW
Minimum volume required =15*2*32*(1-0,3*25/32) ≈ 735 l

7.2 Calculation method for the expansion vessel volume

The volume for a closed diaphragm (membrane) expansion vessel for heating system installation is calculated as follows:

$$V = \frac{e \cdot C}{1 - \frac{P_i}{P_f}}$$

where:

V = vessel's volume (l);

e = water expansion ratio. Calculated based on the maximum difference between the water temperature when idle and the maximum working temperature. **Typically, for a heating system, the standard value of 0,035 should be used**;

C = the total water contents of the installation (l);

Pi= initial absolute pressure (bar), at the vessel installation height, represented by the hydrostatic pressure + 0,3 bar + atmospheric pressure (1 bar). Typically, this is the pre-charge pressure of the vessel plus 1 bar;

Pf= final absolute pressure (bar) represented by the maximum working pressure of the installation + atmospheric pressure (1 bar). Typically, this is the safety valve setting plus 1 bar.

T (°C)	coef. "e"
0	0,00013
10	0,00025
15	0,00085
20	0,00180
25	0,00289
30	0,00425
35	0,00582

T (°C)	coef. "e"
40	0,00782
45	0,00984
50	0,01207
55	0,01447
60	0,01704
65	0,01979
70	0,02269

T (°C)	coef. "e"
75	0,02575
80	0,02898
85	0,03236
90	0,03590
95	0,03958
100	0,04342

Table 2 – Water expansion rates

The expansion vessel should be sized for a heating system installation with the following characteristics:

C =water content = 600 l

Phid = hydrostatic pressure at the installation location = 1 bar

Pseg= safety valve pressure setting = 3 bar

Solution:

The above formula applies, where:

e =0,035 standard value

Pi = Phid + 0,3 + Patm = 1 + 0.3 + 1 = 2.3 bar

Pf = Pseg + Patm = 3 + 1 = 4 bar

therefore: V = (0.035 · 600) ÷ [1 - (2.3 ÷ 4)] ≈ 49.41 l

You need to check the expansion vessel manufacturer's catalogue to chose a vessel with a volume similar or higher than the calculated volume.

8. Fuel

*Notice:The installation of this unit needs to meet the requirements of **all** applicable standards and regulations*.

* This appliance uses dry firewood ONLY. It may not be used as an incinerator, nor should use other materials such as coal, painted wood, varnishes, thinners, liquid fuels, glues or plastics. Also avoid burning common combustible materials such as cardboard and straw.
* The firewood should have a low water content (less than 20%) to ensure efficient combustion, avoid creosote build-up in the smoke duct, and reduce oxidation of the overall equipment;
* See Table 3 (on the next page), to get the list of some of the types of wood that can be used in these units;

Table 3 – List of types of firewood to be used with SOLZAIMA appliances, their geographical location and calorific value/behaviour.

Common name	Scientific name	Distribution (total: 18 districts)	Notes	Features				
				Smoke	Heat	Lighting	Combustion Speed	Hardness
Pine	Pinus	Bragança, Castelo Branco, Coimbra, Guarda, Leiria, Viana do Castelo, Vila Real and Viseu	Predominant species	Little	High	Easy	Fast	Soft
Cork Oak (+)	Quercus suber	Évora, Faro, Portalegre, Santarém and Setúbal	Predominant species	Little	Very High	Easy	Regular	Hard
Eucalyptus	Eucalyptus	Aveiro, Porto and Lisbon	Predominant species	A lot	Regular	Difficult	Slow	Hard
Holm Oak (+)	Quercus ilex	Beja and Évora	Predominant species	Little	Very High	Difficult	Slow	Hard
Olive tree	Olea	Entire country except mountainous regions	Less predominant than above	Little	Very High	Difficult	Slow	Hard
Oak	Quercus	*Entire country, with range of subspecies*	Less predominant than above	Little	High	Difficult	Slow	Hard
Ash	Fraxinus	*Riverbank areas (Lower Vouga)*	Small numbers distributed around the country	Regular	High	Difficult	Slow	Hard
Birch	Betula	*High ground (Serra da Estrela)*	Smaller numbers distributed around the country	Little	Very High	Easy	Fast	Soft
Beech	Fagus	*Cold and very wet regions (North of Portugal – Serra do Gerês)*	Smaller numbers distributed around the country	Little	High	Difficult	Slow	Hard
Elm	Ulmus	*Entire country except mountain regions (wet regions)*	Smaller numbers distributed around the country	Regular	High	Difficult	Slow	Hard
Maple /Sycamore tree - Plane tree	Acer	*Minho, Beira Litoral and Serra de Sintra*	Smaller numbers distributed around the country	Little	Regular	Regular	Slow	Soft
Poplar	Populus	*Entire country, but mainly in the Centre*	Smaller numbers distributed around the country	Little	High	Easy	Fast	Soft
Chestnut	Castanea	*Northern and centre part of Portugal, and mountain regions*	Smaller numbers distributed around the country	Regular	High	Difficult	Slow	Hard

(+): mostly available from firewood sellers

WARNING!

This appliance may NOT be used as an incinerator.

9. First time use

Before starting up the unit, please check the following:

* Ask the installer to light up the unit to ensure its overall proper operating conditions;

* When the unit is used for the first time, the paint goes through a curing process which may generate additional fume in the room. If this happens, you should allow for a fresh air supply by opening external windows and doors.

 The boiler's combustion chamber and panel doors are made of iron plate painted with high temperature resistant paint which releases fume during the initial burn due to the paint curing process.

Ensure that the hydraulic circuit is correctly assembled and connected to the water supply;

You must make sure the room where the unit is installed has adequate air circulation; otherwise, the unit will not work properly. To make sure the unit operates properly, you should refrain from using any other air-consuming appliances existing in the same room (e.g. gas appliances. diesel boilers, etc.), simultaneously with this unit.

10. Lighting

* Open the mid door of the unit;

* Lay a few pine cones (preferred) or fire lighters on the ash grate;

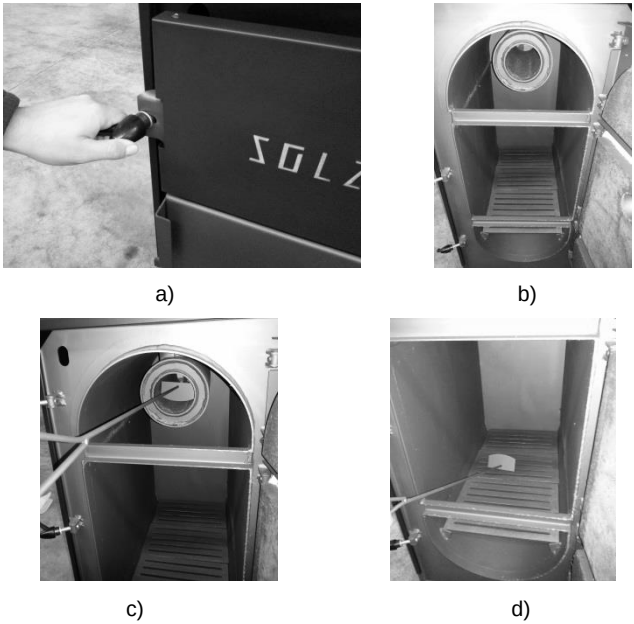
* Put kindling on the top of the pile;

* The firing period is completed when the unit chassis reaches a stable temperature - the air admission setting is automatically controlled by the combustion regulator;

* The combustion air is retrieved from the room where the unit is installed, therefore consuming oxygen from the room. You should ensure that any ventilation grids or other fresh air intake mechanisms remain unobstructed at all times.

11. Maintenance and cleaning

The main concern with this appliance is to periodically clean the ashes that accumulate inside the unit and fume duct. To access the interior of the combustion chamber, you need to open the doors (Fig. 7a and 7b). For the fume duct, you need to scrape the chamber´s inside surface using the poker (Fig. 7c). The ashes are collected at the bottom of the unit (Fig. 7d).



a) b)

c) d)

Figure 7 – Cleaning the combustion chamber.

Note: However, before startint to clean, you must allow the unit to cool down completely to prevent a burning accident.

12. Installation diagrams

Central heating installation diagram

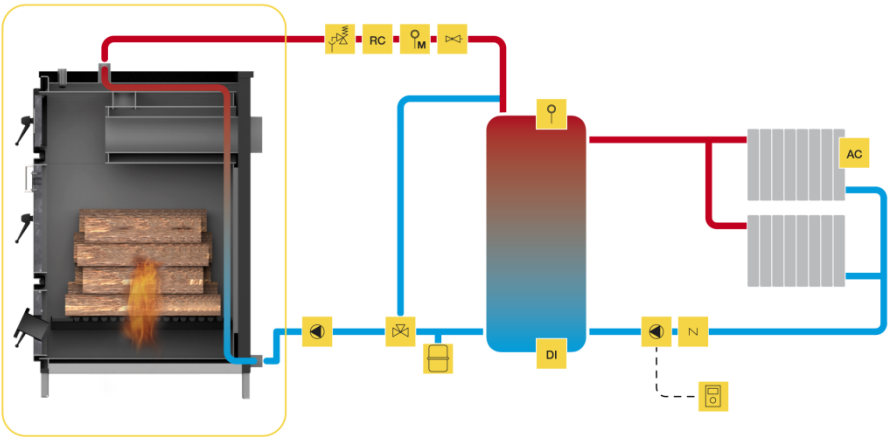


Figure 8 – Central heating installation diagram.

Central heating installation diagram and RHW

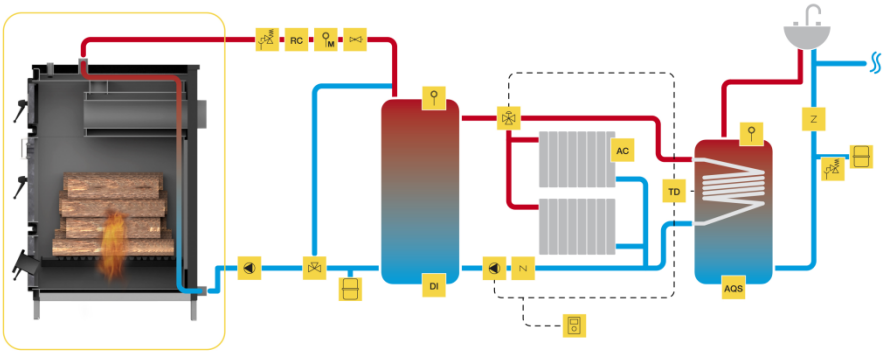


Figure 9 – Central heating and RHW installation diagram

Installation diagram for central heating, RHW and solar panel with a backup pellet boiler

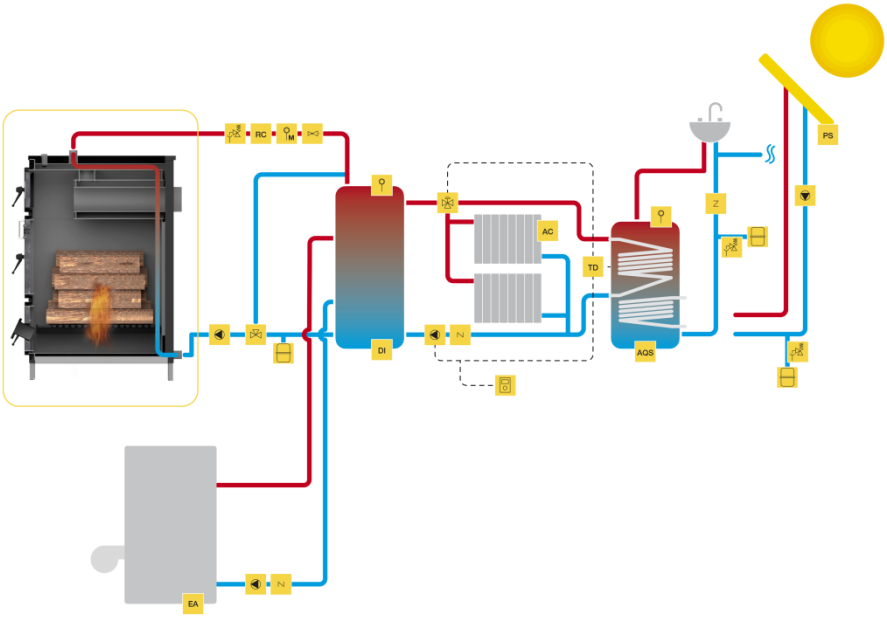


Figure 10 – Installation diagram for central heating, RHW and solar panel with a backup pellet boiler.

Installation diagram for central heating, RHW, radiant heated floor and solar panel with a backup pellet boiler

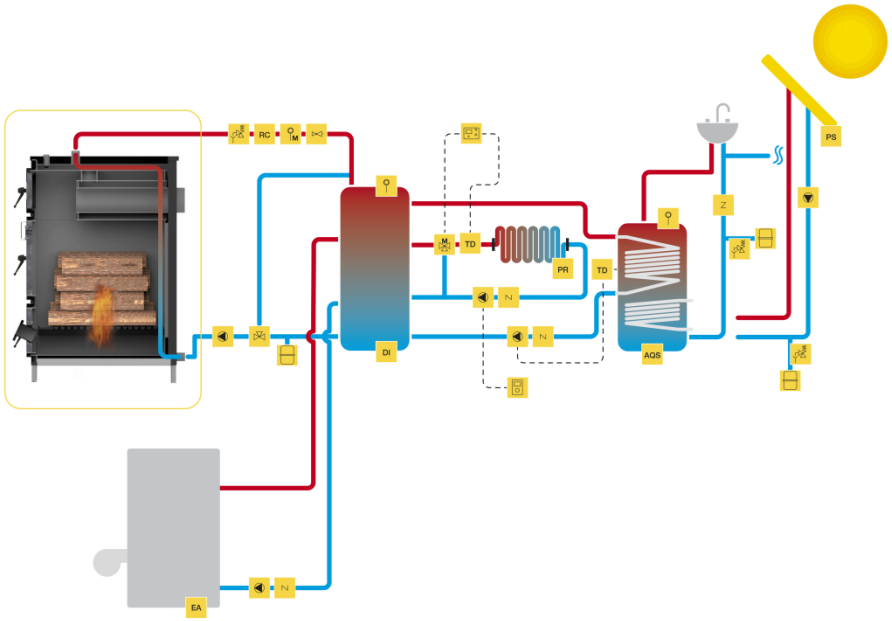


Figure 11 – Installation diagram for central heating and household water heating using a hot water tank

Symbols

EA	Backup equipment (gas, diesel)
DI	Inertia deposit
AQS	Residential hot water
PS	Solar panel
AC	Central heating
P	Pressure sensor
TD	Differential thermostat
PR	Radiant heated floor

Z	Anti-recirculation valve
	Circulating pump
	3-way motor valve
	Automatic drain
M	Manual drain
	Closed expansion vessel
	Drain valve
M	Recirculation mixer

	Anti-condensation valve
	Thermal safety valve
	Pressure safety valve
	Radiant heated floor controller
	Room thermostat
	Hot water
	Cold water
	Electrical connections

Figure 12 – Symbols

13. Life cycle of the wood fired boiler

Around 90% of the materials used to manufacture these appliances are recyclable, for a reduced environmental impact and a more sustainable planet. End-of-life units should be processed by licensed waste operators. We advise contacting your local council to ensure they are properly collected and handled.

14. Sustainability

Solzaima designs and manufactures biomass solutions and equipment as a primary energy source. This is our contribution for the sustainability of our planet – an economically viable and environmentally-friendly alternative, following environmental best management practices to ensure an efficient carbon cycle management.

Solzaima makes all efforts to learn and to know the national forest park while efficiently responding to energy demands, taking permanent care to maintain its biodiversity and natural wealth that are essential for the quality of life on our Planet.

SOLZAIMA is a member of the Portuguese **Green Dot Scheme (Sociedade Ponto Verde)**, which manages packaging waste from products that the company places on the market, so you can take the packaging waste from your unit, such as plastic and cardboard, to your nearest recycling point.

15. Glossary

Ampere (A): SI unit of measurement of electric current

bar: unit of pressure equal to exactly 100,000 Pa. This pressure is very close to standard atmospheric pressure.

cal (Calorie): it is the amount of heat required to increase one degree centigrade the temperature of one gram of water.

cm (centimetre): unit of measurement.

CO (carbon monoxide): A lightly flammable, colourless, odourless gas that is very dangerous due to its high toxicity.

CO_2 (carbon dioxide): Gas needed by plants for photosynthesis on the one hand, and emitted into the atmosphere on the other, contributing to the greenhouse effect.

Combustion: a process that releases energy. Combustion is basically a chemical reaction that requires three items in order to take place: fuel, oxidiser and ignition temperature.

Combustive agent: the chemical substance that feeds combustion (essentially oxygen), that must be present for the combustion to take place.

Combustible: property of any material that can ignite; wood, in this example.

Creosote: chemical compound created by combustion. This compound is sometimes deposited on the glass and flue of an insert fire.

Circuit breaker: Electromechanical device that protects a given electrical appliance.

Energetic efficiency: capacity to generate large quantities of heat with the least amount of energy possible, causing the least environmental impact and reducing the energy budget.

CO Emissions:emission of carbon monoxide gas into the atmosphere.

CO emissions (13% of O_2): monoxide content corrected to 13% of O_2.

Differential switch: protects people and property against grounding failures, preventing electric shocks and fires.

kcal (kilo calorie): multiple of the unit of measurement calorie. Equivalent to 1000 calories.

kW (kilowatt): unit of measurement equal to 1,000 watts.

mm (millimetre): unit of measurement.

mA (milliamp): unit of measurement of electric current.

Pa (Pascal): standard IS unit for pressure and tension. This unit is named after Blaise Pascal, eminent French mathematician, physicist and philosopher.

Heating capacity : also known as specific combustion heat. It represents the amount of heat released when a certain amount of fuel is completely burned. Calorific value is expressed in calories (or kilo calories) per unit of weight of fuel.

Rated power: Electric power consumed from the energy source. Measured in watts.

Rated net heating value: heating capacity, i.e. the heat energy the unit transfers from energy present in the firewood – measured for a standard load of firewood over a given period of time.

Power output: a manufacturer's recommendation from tests on the equipment with firewood loads within a reasonable operating range. This power output range will show different firewood consumptions per hour.

Plumb: the vertical distance to measure the highest point of the installation.

Output: expressed as a percentage of “useful energy” that can be extracted from a given system, considering the “total energy” of the used fuel.

Ignition temperature: temperature above which the fuel can enter into combustion.

Heat-resistant: resistant to high temperatures and thermal shock.

Glass ceramic: highly resistant ceramic material produced from the controlled crystallisation of vitreous materials. Widely used in industrial applications.

W (Watt): the IS unit used used to measure power.

16. Warranty

All SOLZAIMA boilers have a 2 (two) year warranty, starting from the invoice issue date. In order for your warranty to be valid, you must keep the invoice or receipt of purchase throughout the warranty period.

The warranty applies only to defects in materials or manufacture.

Exclusions:

The type of fuel used and how the unit is handled are beyond SOLZAIMA's control, so any parts in direct contact with the flame, such as the ash grates, as well as the refractory coating wear, are not covered by this warranty;

The sealing ring is not included in the warranty;

The installer bears full responsibility for all problems and/or defects resulting from the installation process;

Costs incurred from moves, transport, labour, packaging, disassembly and immobilisation of the unit incurred during warranty operations shall be borne by the purchaser;

Any malfunctioning caused by mechanical or electrical parts not supplied by SOLZAIMA and which are prohibited under the instructions governing heating appliances are not covered by this warranty;