



**Institute for Building Energetics,  
Thermotechnology and Energy Storage**  
Research and Testing Center for Thermal Solar  
Systems (TZS)  
**University of Stuttgart**



# **Test Report**

## **Hot Water Store**

### **Determination of heat losses according to EN 12977-3:2018**

Test Report No.: 23STO443OEM01

Stuttgart, February 14<sup>th</sup>, 2024

Claimant: THERMIC S.P.L.L.C.  
LOUTSAS & MESOLOGGIU  
19600 MANDRA, ATTICA  
GREECE

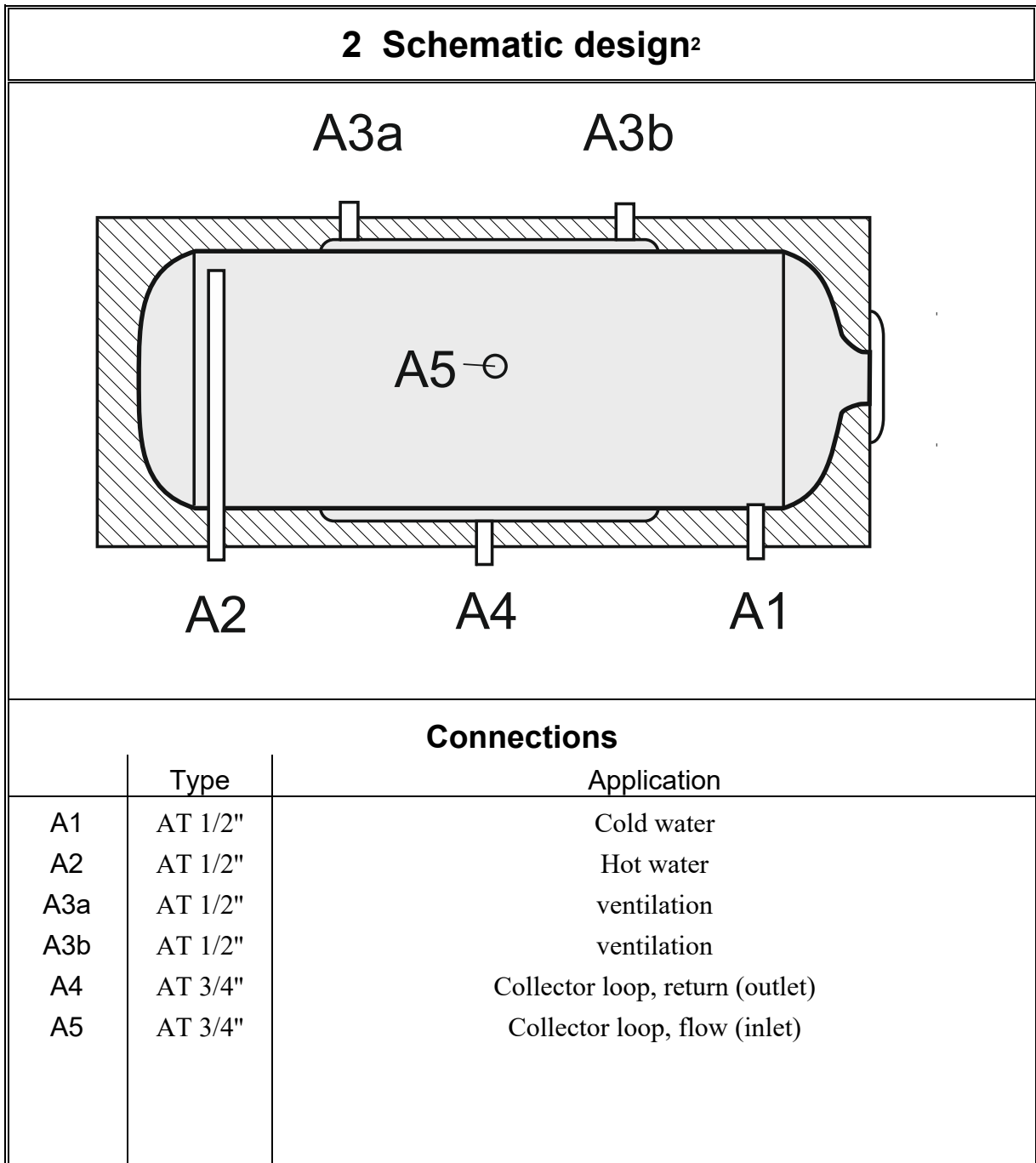
Manufacturer: THERMIC S.P.L.L.C.  
Store Type: BLT.ECOGL.120.DE  
Construction Year: 2023

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| <b>1 Technical Data<sup>1</sup></b>        |             |  |  |
|--|-------------|--|--|
| Manufacturer:                              |             | Type:                                    |  |
| THERMIC S.P.L.L.C.                         |             | BLT.ECOGL.120.DE                         |  |
| Year:                                      | Serial No.: | Nominal volume:                          | Design:  |
| 2023                                       | 02450/23    | 110 liters                               | Horizontal thermosiphon solar domestic hot water store |
| Heat output or coefficient of performance: |             | Test acc. to DIN 4753                    | Weight (empty):  |
| not specified                              |             | not specified                            | not specified  |
| <b>Water volume:</b>                       |             |  |  |
| Corrosion protection:                      |             | Enamel Powder Coated,<br>Magnesium Anode |  |
| Max operation pressure:                    |             | 8 bar                                    |  |
| Max operation temperature:                 |             | 95 °C                                    |  |
| <b>Thermal insulation:</b>                 |             | Polyurethane: 50 mm                      |  |
| <b>Mantle Heat exchanger</b>               |             |  |  |
| Max operation pressure [bar]:              |             | 3.0                                      |  |
| Max operation temperature [°C]:            |             | 95                                       |  |
| Volume of heat exchanger [liters]:         |             | 6.6                                      |  |
| Area [m <sup>2</sup> ]:                    |             | 0.625                                    |  |

<sup>1</sup> as stated by the manufacturer



AT = outside thread

IT = inside thread

<sup>2</sup> as stated by the manufacturer

### 3 Test results

|                                    |                                      |   |                           |
|------------------------------------|--------------------------------------|---|---------------------------|
| <b>3.1 Geometrical Data</b>        |                                      |   |                           |
| Maximum length:                    | Max.diameter:                        | Height of water volume:                     | Diameter of water volume: |
| 1.04 m                             | 0.50 m                               | 0.40 m                                      | 0.40 m                    |
| <b>3.2 Volumes</b>                 |                                      |   |                           |
| Domestic hot water volume:         |                                      | Heat exchanger:                             |                           |
| 106.0 liters                       |                                      | 4.0 liters                                  |                           |
| <b>3.3 Thermal parameters</b>      |                                      |   |                           |
| Heat loss capacity rate (standby): | Standing loss power S <sup>3</sup> : | Thermal losses Q <sub>PR</sub> <sup>3</sup> |                           |
| 1.12 W/K                           | 50.4 W                               | 1.21 kWh/24h                                |                           |

Table 1: Equivalent Energy efficiency classes for a hot water store with a rated capacity of 110.0 l according to SASO 2884:2017

| Equivalent energy efficiency class | Daily thermal losses limit value [kWh/24h] |
|------------------------------------|--|
| A                                  | 0.63                                       |
| B                                  | 0.87                                       |
| C                                  | 1.09                                       |
| D                                  | 1.69                                       |
| E                                  | 2.13                                       |
| F                                  | 2.77                                       |
| G                                  | > 2.77                                     |

<sup>3</sup> at a temperature difference of 45 K

## 4 Test occurrences

No special incidents

## 5 General

The thermal testing of the store was performed according to EN 12977-3:2018 '*Thermal solar systems and components, Custom built systems, Part 3: Performance test methods for solar water heater stores*'.

The **bold** printed values were determined by means of parameter identification.

The determined results are only valid for the tested version of the test sample.

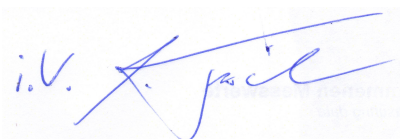
Water was used as heat transfer fluid.

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The nomenclature of SASO 2884:2017 and EN 12977-3:2018 was used.

|                                |                               |
|--------------------------------|-------------------------------|
| Arrival of test sample:        | 07.03.2023                    |
| Testing period:                | 07.03. bis 10.03.2023         |
| Test location:                 | Stuttgart, Pfaffenwaldring 10 |
| Identification of test sample: | Adhesive label: 23STO443      |
| Test engineer:                 | Dipl.-Ing. S. Bachmann        |

Stuttgart, February 14<sup>th</sup>, 2024



Dr.-Ing. Harald Drück

- Head Solar Testing-

**Authentication:** Test report available by the following [link](#)

## Appendix A: Explanations

The following pages contain additional explanations and information related to the store test report. For a better understanding, some facts will be explained by examples and complex correlations will be shown in a simplified way.

### Definition of terms

For the tested store the hot water is heated before draw off and then kept ready for use. According to DIN 4753 (water heaters and water heating installations for drinking water and service water) these stores or water heaters are named **store-water heaters**. For better readability of this text the term **store** is used in the following.

### 1 Schematic Design

Here the schematic design of the store as well as the positions of the connections and temperature sensors are shown according to the specifications of the manufacturer.

### 2 Test results

The *maximum length* and the *maximum diameter* have been measured at the test sample equipped with thermal insulation.

The *diameter of the water volume* was taken from the documentation.

The *height of the water volume* corresponds to the *diameter of the water volume*.

For the determination of all *thermal parameters* water was used as heat transfer fluid. Here the thermophysical properties for the density ( $\rho = 992.42 \text{ kg/m}^3$ ) and the specific heat capacity ( $c_p = 4.181 \text{ kJ/(kg}\cdot\text{K)}$ ), averaged over the common range of the operating temperature ( $15^\circ\text{C} - 60^\circ\text{C}$ ) are assumed to be constant.

The *heat loss capacity rate* describes the heat losses from store to ambient per Kelvin temperature difference (between store and ambient). For this purpose, the hot water store was charged via connections A5 (inlet) and A4 (outlet) with a capacity of 1.2 kW and a volume flow of approx. 150 l/h until the outlet temperature reached  $60^\circ\text{C}$ . This was followed by a standby phase of 48 h. After this, the hot water store was discharged via connections A1 (inlet) and A2 (outlet) at a constant inlet temperature of  $20^\circ\text{C}$  and a volume flow of approx. 150 l/h.

The meaning of the heat loss capacity rate is illustrated in the following example for a solar domestic hot water system.

*Example for the heat loss capacity rate of the store:*

If the entire store has a uniform temperature of  $60^\circ\text{C}$  located in a room with a temperature of  $20^\circ\text{C}$  the relevant temperature difference between the water in the store and the ambient is 40 K. Furthermore assuming a heat loss capacity rate of 2,5 W/K the flow of heat loss  $\dot{Q}_{loss}$  from the store to the ambient is calculated according to the following equation:

$$\dot{Q}_{loss} = 2,5 \text{ W/K} \cdot (60 - 20)\text{K} = 100 \text{ W}$$

100 W seems to be a marginal power compared to the power of the collector field which is about 2500 W (irradiation 800 W/m<sup>2</sup>, collector area 5 m<sup>2</sup>,  $\eta = 80\%$ ). However the heat losses occur for 24 hours a day, and so the store is losing 2,4 kWh each day. Compared with the daily hot water energy consumption of 8 kWh, (typical for a four person household), the energy loss is about 30%! As shown by this example, the heat loss capacity rate has an important influence on the performance of the system. Hence it should be as low as possible.