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

in cooperation with

Test Report
Hot Water Store
Determination of heat losses according to EN 12977-3:2018

Test Report No.: 23STO445OEM01

Stuttgart, October 16th, 2023

Claimant:	Dimas SA 2nd km Argos-Nafplio 21200 Argos Greece
Manufacturer:	Dimas SA
Store Type:	RT 250 - 3 kW heater
Construction Year:	2023

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Contents

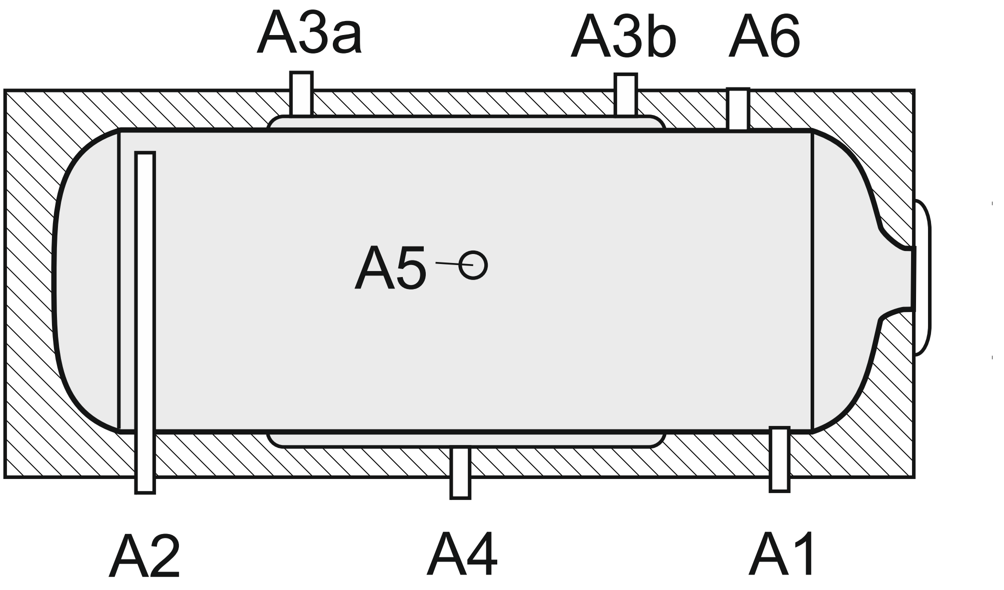
1 Technical Data[1]

Manufacturer:			Type:
Dimas SA			RT 250 - 3 kW heater
Year: 2023	Serial No.: 02449/23	Nominal volume: 247 liters	Design: Horizontal thermosiphon solar domestic hot water store
Heat output or coefficient of performance: not specified		Test acc. to DIN 4753: not specified	Weight (empty): not specified

Water volume:	
Corrosion protection:	Enamel Powder Coated, Magnesium Anode
Max operation pressure:	8 bar
Max operation temperature:	95 °C
Thermal insulation:	Polyurethane: 50 mm
Mantle Heat exchanger	
Max operation pressure [bar]:	3.0
Max operation temperature [°C]:	95
Volume of heat exchanger [liters]:	9.9
Area [m^2]:	1.19

[1] as stated by the manufacturer

2 Schematic design[2]



Connections

	Type	Application
A1	AT 3/4"	Cold water
A2	AT 3/4"	Hot water
A3a	AT 1/2"	Ventilation
A3b	AT 1/2"	Ventilation
A4	AT 3/4"	Collector loop, return (outlet)
A5	AT 3/4"	Collector loop, flow (inlet)
A6	IT 1/2"	Ventilation

AT = outside thread IT = inside thread

[2] as stated by the manufacturer

3 Test results

3.1 Geometrical Data

Maximum lenght:	Max.diameter:	Height of water volume:	Diameter of water volume:
1.64 m	0.58 m	0.48 m	0.48 m

3.2 Volumes

Domestic hot water volume:	Heat exchanger:
251.3 liters	11.0 liters

3.3 Thermal parameters

Heat loss capacity rate (standby):	Standing loss power S [3]:	Thermal losses Q_{PR} [3]
1.77 W/K	79.7 W	1.91 kWh/24h

Table 1: Equivalent Energy efficiency classes for a hot water store with a rated capacity of 247.0 l according to SASO 2884:2017

Equivalent energy efficiency class	Daily thermal losses limit value [kWh/24h]
A	0.82
B	1.13
C	1.39
D	2.20
E	2.75
F	3.60
G	> 3.60

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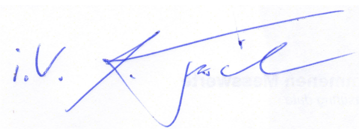
The nomenclature of SASO 2884:2017 and EN 12977-3:2018 was used.

Arrival of test sample:	07.03.2023
Testing period:	13.03. bis 16.03.2023
Test location:	Stuttgart, Pfaffenwaldring 10
Identification of test sample:	Adhesive label: 23STO445
Test engineer:	Dipl.-Ing. S. Bachmann

Stuttgart, October 16th, 2023



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 lenght*** 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 (ρ = 992.42 kg/m^3) and the specific heat capacity (c_p = 4.181 kJ/(kg·K)), averaged over the common range of the operating temperature (15°C – 60°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 2.5 kW and a volume flow of approx. 300 l/h until the outlet temperature reached 60 °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 °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°C located in a room with a temperature of 20°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^2, collector area 5 m^2, η = 80 %). However the heat losses occur for 24 hours a day, and so the store is loosing 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.