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

in cooperation with SWT

Test Report
Solar Water Heater
Determination of energy efficiency according to SASO 2884:2017

Test Report No.: 23SU145OEM01

Stuttgart, February 14th, 2024

Claimant:	THERMIC S.P.L.L.C. LOUTSAS & MESOLOGGIOU 19600 MANDRA, ATTICA GREECE
Manufacturer:	THERMIC S.P.L.L.C.
System:	THERMIC DELTA 1.5
Store:	BLT.ECOGL.120.DE
Collector:	DELTA 1.5
Construction Year:	2021

Contents

1 Technical data of store[1]

Manufacturer:			Product type:
THERMIC S.P.L.L.C.			BLT.ECOGL.120.DE
Model year:	Serial No.:	Rated capacity:	Design:
2023	02450/23	110 liters	Horizontal Thermosiphon Tank
Country of manufacture:	Length[2]:	Diameter[2]:	Weight (empty):
Europe	1.04 m	0.50 m	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]:	6.6
Area [m^2]:	0.625

[1] as stated by the manufacturer
[2] with insulation

2 Technical data of collector[3]

Manufacturer:			Type:
THERMIC S.P.L.L.C.			DELTA 1.5
Year:	Serial No.:	Weight (empty):	Design:
2021	10533821001318	20.0 kg	Flat plate collector
Gross area			1.51 m^2
Absorber area			1.35
Length			1.503 m
Width			1.007 m
Height			0.085 m
Max. operating pressure			10 bar
Absorber volume			1.16 liters
Stagnation temperature[4]			230 °C

[3] as stated by the manufacturer
[4] determined by test laboratory

3. Calculation of the water heating energy efficiency η_{WH}

The water heating energy efficiency η_{WH} of the solar water heater is determined according to SASO 2884:2017, chapter C3.2.

3.1 Parameters of the storage tank

Type:	BLT.ECOGL.120.DE
Rated capacity:	110 l
Tested capacity $V_{sto,tot}$:	110.0 l
Back-up capacity $V_{sto,bu}$:	55.0 l
Heat loss rate of the whole store $H_{sto,los,tot}$:	1.12 W/K
Rated thermal losses Q_{PR}:	1.21 kWh/24h
For further details see:	Test report: 23STO443OEM01, dated 14.02.2024 Test Institute: IGTE Universität Stuttgart

3.2 Parameters of the solar collector

Type:	DELTA 1.5
Gross area A_G:	1.51 m^2
Zero-loss efficiency η_0:	0.725
First-order coefficient a_1:	3.623
Second-order coefficient a_2:	0.01
Incidence angle modifier $K_{hem}(50°)$	0.96
For further details see:	Test report: 21COL1632OEM26, dated 14.02.2024 Test Institute: IGTE Universität Stuttgart

3.3 Further parameters

Daily hot water load (tapping profile) Q_{ref}: "M"	5.85 kWh
Conversion coefficient CC according to SASO 2884:2017:	1
Auxiliary electric consumption Q_{aux} (no controller):	0 kWh
Heat generator water heating energy efficiency $\eta_{WH,nonsol}$ (electric heating element):	1
Monthly average cold water temperature $\vartheta_{w;low}$ according to EN 15316-4-3:2017:	10 °C
Hot water temperature $\vartheta_{w;high}$ according to EN 15316-4-3:2017:	40 °C
Power collector loop pump $P_{sol;pmp}$ (no pump, thermosiphon system):	0 W
Number of collectors	1
Correction coefficient for the orientation of the collector f_{col}: according to table A.9, EN 15316-4-3:2017	1.0
Type of system according to EN 15316-4-3:2017 (SOL_TYPE):	parallel
Efficiency factor of the collector loop η_{loop} according to EN 15316-4-3:2017, F.2	0.97

Correction coefficient f_{app} according to EN 15316-4-3:2017, table B.19	1.08
Correlation factor a according to EN 15316-4-3:2017, table A.18	1.029
Correlation factor b according to EN 15316-4-3:2017, table A.18	-0.065
Correlation factor c according to EN 15316-4-3:2017, table A.18	-0.245
Correlation factor d according to EN 15316-4-3:2017, table A.18	0.0018
Correlation factor e according to EN 15316-4-3:2017, table A.18	0.0215
Correlation factor f according to EN 15316-4-3:2017, table A.18	0
Factor describing the effect of insulation of the auxiliary heating loop $f_{bu;ins}$ according to EN 15316-4-3:2017, table B.14	0.02
recoverable heat losses of the solar system $Q_{x;sol;ls;rbl,m}$ (without solar space heating system):	0 kWh
Annual operation time for solar loop pump t_{aux} according to EN 15316-4-3:2017, table B.13	2000 h
Annual global irradiation $I_{glob,ref}$ according to SASO 2884:2017, table B2	1848 kWh/m^2
Auxiliary energy consumption of the auxiliary heat generator $W_{x;bu;aux;nom,m}$:	0 kWh
Heat losses of the auxiliary heat generator $Q_{x;bu;ls;nom,m}$:	0 kWh

3.4 Results

Table 1: Monthly Contribution of the auxiliary heater to the heat demand $Q_{w;bu;out,m}$ [kWh]

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
152.2	129.9	96.6	68.6	47.9	42.8	35.1	39.2	67.7	100.1	140.7	161.6

The annual non-solar heat contribution $Q_{non,sol}$ is calculated according to equation 1:

$$Q_{non,sol} = \sum_{m=1}^{12} Q_{w,bu,out,m} = 1082.4 \text{ kWh} \quad (1)$$

The annual energy consumption Q_{tota} is calculated according to equation 2:

$$Q_{tota} = \frac{Q_{non,sol}}{1.1 \times \eta_{WH,nonsol} - 0.1} + Q_{aux} \times CC = 1082.4\ kWh \quad (2)$$

The water heating energy efficiency η_{WH} is calculated according to equation 3:

$$\eta_{WH} = \frac{220 \times Q_{ref}}{Q_{tota}} = 118.8\ \% \quad (3)$$

Table 2: Energy efficiency classification for load profile "M" according to SASO 2884:2017:

Energy class	A	B	C	D	E	F	G
η_{WH} [%]	210	140	93	87	80	73	65

4 Test occurrences

No special incidents

5 General

The determined results are only valid for the tested versions of the test samples.
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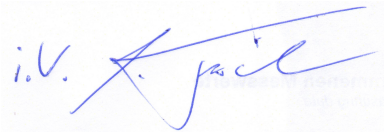
The nomenclature of SASO 2884:2017 and EN 15316-4-3:2014/2017 was used.

Arrival of test samples:	26.08.2021 (collector), 07.03.2023 (store)
Testing period:	Collector: 08.09. - 21.10.2021
	Store: 07.03. – 10.03.2023
Test location:	Stuttgart, Pfaffenwaldring 10
Identification of test samples:	Adhesive label: C1632, 23STO443
Test engineers:	Dipl.-Ing. S. Bachmann,
	F. Sansonnens, Dipl.-Ing. (FH) C. Twerdy

Stuttgart, February 14th, 2024



Dr.-Ing. Harald Drück

- Head Solar Testing –

Authentication: Test report available by the following link