



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



Test Report

Solar Water Heater

Determination of energy efficiency according to SASO 2884:2017

Test Report No.: 23SU147OEM02

Stuttgart, February 19th, 2024

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

Manufacturer: THERMIC S.P.L.L.C.
System: THERMIC DELTA 1.5H
Store: BLT.ECOGL.250.DE
Collector: DELTA 1.5
Construction Year: 2021

Institute for Building Energetics, Thermotechnology and Energy Storage (IGTE) • Research and Testing Center for Thermal Solar Systems (TZS) Pfaffenwaldring 6 • 70569 Stuttgart

fon +49(0)711/685-63536 • fax +49(0)711/685-63503 • e-mail: tzs@itw.uni-stuttgart.de

Contents

	Seite
1 Technical data of store	3
2 Technical data of collector	4
3. Calculation of the water heating energy efficiency η_{WH}	5
3.1 Parameters of the storage tank.....	5
3.2 Parameters of the solar collector	5
3.3 Further parameters.....	5
3.4 Results	6
4 Test occurrences	7
5 General	7

1 Technical data of store¹			
Manufacturer:		Product type:	
THERMIC S.P.L.L.C.		BLT.ECOGL.250.DE	
Model year:	Serial No.:	Rated capacity:	Design:
2023	02449/23	247 liters	Horizontal Thermosiphon Tank
Country of manufacture:	Length ² :	Diameter ² :	Weight (empty):
Europe	1.64 m	0.58 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]:		9.9	
Area [m ²]:		1.19	

¹ as stated by the manufacturer

² with insulation

2 Technical data of collector³			
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.250.DE
Rated capacity:	247 l
Tested capacity $V_{sto,tot}$:	262.3 l
Back-up volume $V_{sto,bu}$:	131.2 l
Heat loss rate of the whole store $H_{sto,los,tot}$:	1.77 W/K
Rated thermal losses Q_{PR} :	1.91 kWh/24h
For further details see:	Test report: 23STO445OEM02, dated 19.02.2024 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 $K_{hem}(50^\circ)$:	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	2
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 $Q_{x;sol;ls;rb1,m}$ (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.
139.8	106.8	62.1	29.8	9.2	2.0	0.0	0.0	27.1	66.0	123.1	155.7

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

$$Q_{non,sol} = \sum_{m=1}^{12} Q_{w,bu,out,m} = 721.6 \text{ kWh} \quad (1)$$

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

$$Q_{tota} = \frac{Q_{non,sol}}{1.1 \times \eta_{WH,nonsol} - 0.1} + Q_{aux} \times CC = 721.6 \text{ kWh} \quad (2)$$

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

$$\eta_{WH} = \frac{220 \times Q_{ref}}{Q_{tota}} = 178.2 \% \quad (3)$$

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. - 25.10.2021
Store: 13.03. – 16.03.2023
Test location: Stuttgart, Pfaffenwaldring 10
Identification of test samples: Adhesive label: C1632, 23STO445
Test engineers: Dipl.-Ing. S. Bachmann,
F. Sansonnens, Dipl.-Ing. (FH) C. Twerdy

Stuttgart, February 19th, 2024



Dr.-Ing. Harald Drück

- Head Solar Testing –

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