



**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.: 21SU128/1OEM06

Stuttgart, February 14th, 2024

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

Manufacturer: THERMIC S.P.L.L.C.
System: THERMIC DELTA 2.5H
Store: BLT.ECOGL.200.DE
Collector: DELTA 2.5
Construction Year: 2021

Contents

	Page
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 store ¹			
Manufacturer:		Product type:	
THERMIC S.P.L.L.C.		BLT.ECOGL.200.DE	
Model year:	Serial No.:	Rated capacity:	Design:
2021	Not specified	200 liters	Horizontal thermosiphon solar domestic hot water store
Country of manufacture:	Length ² :	Diameter ² :	Weight (empty):
Europe	1.29 m	0.58 m	69.0 kg
Water volume:			
Corrosion protection:		Enamel Powder Coated, Magnesium Anode	
Max operation pressure:		10 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]:		6.5	
Area [m ²]:		0.96	

¹ as stated by the manufacturer

² with insulation

2 Technical data of collector³			
Manufacturer: THERMIC S.P.L.L.C.			Type: DELTA 2.5
Year: 2021	Serial No.: Not specified	Weight (empty): 35.0 kg	Design: Flat plate collector
Gross area			2.52 m²
Absorber area			2.31 m²
Length			2.006 m
Width			1.257 m
Height			0.085 m
Max. operating pressure			10 bar
Absorber volume			1.9 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.200.DE
Rated capacity:	200 l
Total store volume $V_{sto,tot}$:	202.5 l
Auxiliary store volume $V_{sto,bu}$:	101.3 l
Heat loss rate of the whole store $H_{sto,los,tot}$:	1.95 W/K
Rated thermal losses Q_{PR} :	2.11 kWh/24h
For further details see:	Test report: 21STO396OEM06, dated 14.02.2024 Test Institute: IGTE Universität Stuttgart

3.2 Parameters of the solar collector

Type:	DELTA 2.5
Gross area A_G :	2.52 m ²
Zero-loss efficiency η_0 :	0.746
First-order coefficient a_1 :	3.26
Second-order coefficient a_2 :	0.01
Incidence angle modifier $K_{hem}(50^\circ)$:	0.96
Number of collectors	1
For further details see:	Test report: 21COL1591OEM06, 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 15316-4-3:2014:	10 °C
Hot water temperature $\vartheta_{w;high}$ according to EN 15316-4-3:2014:	40 °C
Power collector loop pump $P_{sol;pmp}$ (no pump, thermosiphon system):	0 W
Correction coefficient for the orientation of the collector f_{col} : according to table A.9, EN 15316-4-3:2014	0.8
Type of system according to EN 15316-4-3:2014 (SOL_TYPE):	parallel
Efficiency factor of the collector loop η_{loop} according to EN 15316-4-3:2014, table A.11	0.9

Correction coefficient f_{app} according to EN 15316-4-3:2014, table A.18	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.
111.8	82.6	65.3	43.6	31.8	24.3	21.1	21.8	39.5	66.0	98.3	121.9

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

$$Q_{non,sol} = \sum_{m=1}^{12} Q_{w,bu,out,m} = 728.0 \text{ kWh} \quad (1)$$

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

$$Q_{tota} = \frac{Q_{non,sol}}{1.1 \times \eta_{WH,nonsol} - 0.1} + Q_{aux} \times CC = 728.0 \text{ kWh} \quad (2)$$

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

$$\eta_{WH} = \frac{220 \times Q_{ref}}{Q_{tota}} = 176.8 \% \quad (3)$$

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

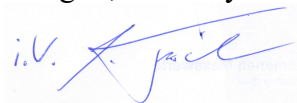
No special incidents

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:	27.01.2021 (collector), 04.05.2021 (storage tank)
Testing period:	12.02. bis 10.05.2021
Test location:	Stuttgart, Pfaffenwaldring 10
Identification of test samples:	Adhesive label: 21STO396, 21COL1591
Test engineer:	Dipl.-Ing. S. Bachmann, F. Sansonnens

Stuttgart, February 14th, 2024,



Dr.-Ing. Harald Drück

- Head of test section solar –

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