VELUX solar hot water systems

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VELUX Solar hot water system

Roof integrated
Solar collector
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Section 10.00.00

Products ▶ Solar hot water system

Solar hot water system

The VELUX solar hot water system contains roof-integrated solar collectors and complete tank system which can typically provide up to 70% of a home's hot water requirements.

Application

VELUX solar collectors are installed using standard VELUX flashings and can be integrated alongside VELUX roof windows. With typical installations the collectors should be placed in a shadow-free, south-facing roof with the required area of approximately 1m^2 per person for optimum performance. Specifying the tank near the solar collectors minimises heat loss. The solar tank is compatible with most types of auxiliary heating, such as gas, oil or solid fuel boilers. If these are not available then the tank can be supplied with an immersion heater to provide hot water when there is little or no solar gain.

Features

The solar collectors are cased in maintenance-free aluminium and incorporate a thick layer of high-density mineral wool insulation, giving unrivalled performance and longevity.

The copper absorber in the collector is produced with a selective surface, which gives the VELUX collector an extraordinary high efficiency. Using state-of-the-art laser technology, the absorber plate is attached to the register tubes with no visible welding stripes.

A special transparent solar glass with very high light transmittance ensures that the VELUX collector has one of the best performances on the market. The solar collector is elegantly finished and secured with the maintenance-free VELUX aluminium cladding concept.

Installation of several solar collectors is possible through the use of flexible pipes, which allow multiple combinations of solar collectors.

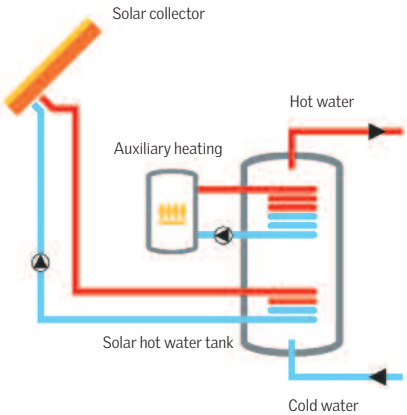
The solar collectors are built into the roof with standard VELUX flashings, providing safe and tight roof integration. Also, the flashings are perfectly suited to combining solar collectors and VELUX roof windows.

Operation

The controls on the VELUX solar hot water storage tank are uniquely designed to operate the pump to maximise solar gain from the collectors. The programmer has preset controls that allow you to view the temperature of each collector and the hot water tank, as well as indicating the accumulated hours of solar thermal gain. The system also has the capacity to control multi solar circuits including space heating. Should any problems occur, the system includes a fault diagnostic programme.

Installation

CLI Collectors can be installed in Roof Pitch 15˚-90˚.



Material

CLI Collectors-

Special Transparent Glass
Copper absorber
Aluminium casing
Mineral wool insulation

Tank System-

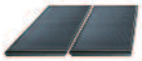
Enamel coated tank manufactured from sheet steel, with foam insulation.

Certification Details-

The VELUX system meets all current UK and Ireland standards and the collectors are certified to EN12957 for durability. The collectors also have the solar KeyMark which is the quality mark for European solar thermal products. All plumbing elements are WRAS certified and electrical components are CE marked.

VELUX®

Technical data

Typical solar hot water system	Up to 2 people	3-4 people	5-6 people
			
Solar collector(s)	1 x U12	2 x U12	3 x U12
Collector area (gross)	2.5m²	5m²	7.5m²
Flashings for profiled or slate roof	✔	✔	✔
Connection pipes		✔	✔
Solar tank	TFF 200 0201	TFF 300 0201	TFF 400 0201
Volume	180 litres	280 litres	375 litres
Weight	85 kilos	120 kilos	140 kilos
Dimensions (d x h)	540 x 1432mm	600 x 1794mm	700 x 1591mm
Control unit/pump station	✔	✔	✔
Safety mixer valve	✔	✔	✔
Expansion vessel(s)	✔	✔	✔
Micro bubble air separator	✔	✔	✔
Glycol	✔	✔	✔
Flexible flow and return pipes	10m	10m	10m
Underfelt sealing collars	✔	✔	✔

Collector technical details

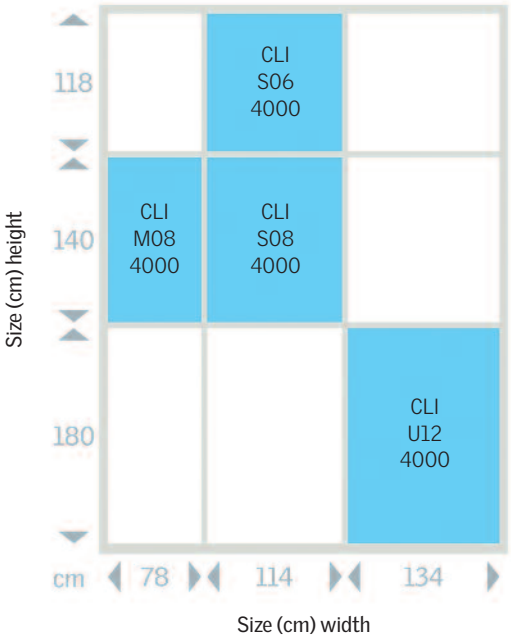
		VELUX solar collectors (variant 4000)			
		M08	S06	S08	U12
Weights	Gross Weight (kg) Net Weight (kg)	29 26	36 33	41 38	64 59
Areas	Gross area (m²) Aperture area (m²) Absorber area (m²)	1.2 0.9 0.9	1.4 1.2 1.2	1.7 1.4 1.4	2.5 2.2 2.2
Litres		0.9	1.3	1.5	2.2
Max operation pressure (bar)		6	6	6	6
Test pressure (bar)		10			10
Heat capacity (kJ (m²K))		8			7.4
Angle Factor (K^{dir} 50°)		0.93			0.95
Stagnation temperature (°C)		185			190
Efficiency	eta_0 (start efficiency) a_1 [W/(m²K)] a_2 [W/(m²K²)]	0.7970 4.1770 0.0039	0.7900 3.7560 0.0073	0.7900 3.7560 0.0073	0.7900 3.7560 0.0073

A variety of collector sizes are available and they have been tested in accordance with EN12975. Results can be found in the table above.

WRc-NSF Ltd
Building Regulations Approved

Collector size

The VELUX solar hot water system is highly adaptable to your own specific requirements. Currently we have four different collectors, the details of which are included in the table below.



Collector Code	Gross area*
CLI M08 4000	1.16m²
CLI S06 4000	1.42m²
CLI S08 4000	1.68m²
CLI U12 4000	2.51m²

*measured from the external outer edges of the collector.

Tank dimensions

	Units	TFF 200 0201 GB	TFF 300 0201 GB	TFF 400 0201 GB
Diameter, insulated	mm	540	600	700
Height, insulated	mm	1432	1794	1591
Tilted height	mm	1530	1930	1745
Weight	kg	85	120	140
Storage capacity	litres	180	280	375
Mass of unit when full	kg	285	420	540

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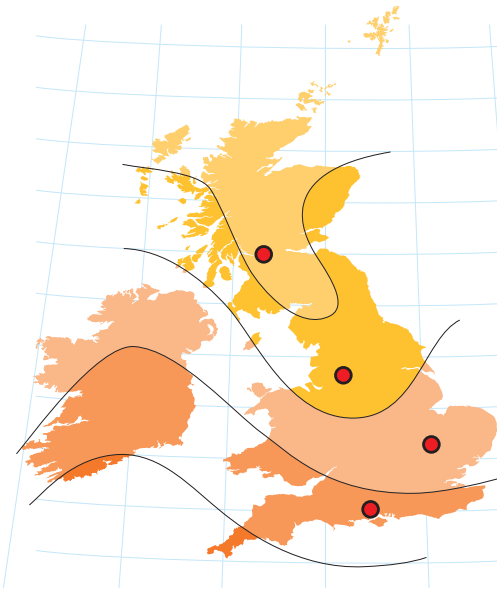
Tank specifications (unvented)

	Units	TFF 200 0201 GB	TFF 300 0201 GB	TFF 400 0201 GB
Maximum permissible water pressure	bar	5.5	5.5	5.5
Maximum permissible heating pressure	bar	5.5	5.5	5.5
Maximum permissible solar loop pressure	bar	5.5	5.5	5.5
Maximum permissible operating temperature water	°C	95	95	95
Maximum permissible operating temperature heating	°C	110	110	110
Maximum permissible operating temperature solar loop	°C	110	110	110
Upper heating/reheating register	m^2	0.70	0.81	1
Lower heating area/solar register	m^2	0.95	1.49	1.83
Solar exchanger volume	l	6.4	10.4	12.8
Heating system heat exchanger volume	l	4.8	5.6	6.9
Performance indicator NL top	NL/kW	2.4/25	2.5/27	5.7/31
Performance indicator NL bottom	NL/kW	4.2/31	4.1/45	9.4/51
Auxiliary heating flow, HV	R mm	1" 1147	1" 1424	1" 1355
Auxiliary heating return, HR	R mm	1" 787	1" 1064	1" 1007
Solar flow, SV	R mm	1" 687	1" 965	1" 909
Solar return, SR	R mm	1" 687	1" 965	1" 909
Hot water outlet, WW	R mm	0.75" 1369	1" 1728	1" 1526
Cold water inlet, KW	R mm	0.75" 55	1" 90	1" 55
Thermal cutout, Z	R mm	0.5" 900	0.5" 1179	0.5" 1112
Sensor thermometer wells	mm	Ø 16 x 200	Ø 16 x 200	Ø 16 x 200
Auxiliary thermostat pocket, FH	mm	1012	1289	1224
Solar thermostat pocket, FS	mm	292	378	324
Sleeve for electrical heating element (1 ½), EHP	mm	737	1015	957
Thermometer, T	mm	1226		
Flange F, Di/TK/Do	mm	110/150/180	110/150/180	110/150/180
Anode, A	mm mm	Ø 26 x 550 Top	Ø 26 x 1100 Top	Ø 26 x 900 Top
Maximum water supply pressure to the pressure reducing valve	bar	16	16	16
Operating pressure	bar	3	3	3
Expansion vessel charge pressure	bar	3	3	3
Expansion relief valve setting	bar	6	6	6
Storage capacity	litres	180	280	375
Mass of unit when full	kg	285	420	540
Set opening pressure (bar) of the combined temperature and pressure relief valve(s)	bar	7	7	7
The set opening temperature (degrees centigrade) of the temperature relief or temperature and pressure relief valve(s)	°C	90	90	90

Performance



Well-positioned for optimum performance

Because the system performance depends on the solar collector being able to take advantage of available sunlight, the collector's physical location is crucial in determining efficiency. However, the collector does not need to be facing due south in order to work effectively.

The map on the left and the table below provide an approximate guide to the technical performance of the system. As with all solar systems, there are a number of factors that influence both its ability to produce solar thermal energy and its overall efficiency.

Solar thermal energy efficiency depends on geographical location, polar orientation and pitch of the roof.
The system's overall effectiveness will also be influenced by the efficiency of the auxiliary heating source, and the household's daily rate of hot water consumption.

For simplicity, we have selected four cities to represent the different meteorological zones on the map. Using the stated solar irradiation at these points we are able to calculate the savings achieved by a typical VELUX solar hot water system.

Performance of a VELUX solar hot water system

For the purposes of demonstrating performance, VELUX has split the country into four regional areas: North (Glasgow), Mid North (Manchester), Mid South (Cambridge) and South (Southampton) so that a reasonable comparison can be made.

Annual solar irradiation in the 4 regional areas

Region 1 North	Glasgow	1032 kWh/m²
Region 2 Mid North	Manchester	1109 kWh/m²
Region 3 Mid South	Cambridge	1160 kWh/m²
Region 4 South	Southampton	1286 kWh/m²

Performance of a typical system

Using the above information, and following a recent study that showed the typical consumption of daily hot water (DHW) per household in the UK is between 30 and 50 litres, at a temperature of 55°C per person, the total benefit of the VELUX solar hot water system per region is:

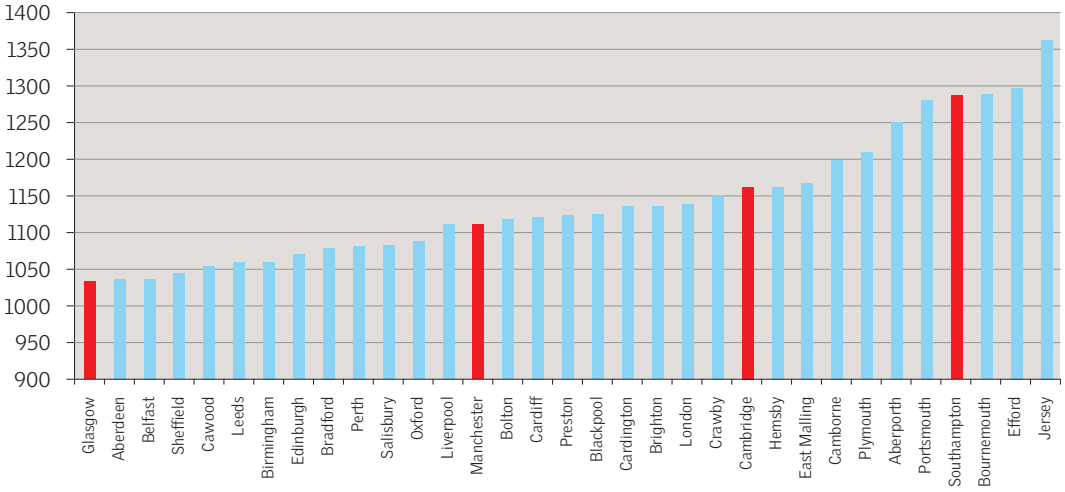
Region 1 North	Glasgow	2681 kWh/year
Region 2 Mid North	Manchester	2874 kWh/year
Region 3 Mid South	Cambridge	3003 kWh/year
Region 4 South	Southampton	3222 kWh/year

A typical VELUX solar hot water system: four person household (5m² of solar collectors 280 litre tank) due south orientation with 80% efficient gas boiler.

It is essential to consider the following when designing a solar hot water system

- Occupancy level
- Geographical area
- Polar orientation
- Pitch of roof
- Efficiency of auxiliary heating
- Size of collector area

Performance (continued)



Orientation of the collectors

The following tables demonstrate the performance of the VELUX solar hot water system in the four chosen regions. Each table shows the direction of the roof and its pitch (or inclination). These tables show that solar energy is a viable option as a renewable energy source in the UK.

For example, in region 1, a collector facing South at a pitch of 40° will achieve 100% performance. However a collector facing WSW at a pitch of 30° will achieve 88% efficiency.

In new build cases, these factors can be taken into consideration at design stage and the orientation and design of the roof pitch can be adjusted for optimum efficiency. In renovation projects, the data serves as a guide to calculating the approximate savings available.

Performance Factor (%) – Region 1 (Glasgow)									
Orientation	E	ESE	SE	SSE	S	SSW	SW	WSW	W
Pitch	-90	-67,5	-45	-22,2	0	22,5	45	67,5	90
0	79	79	79	79	79	79	79	79	79
5	79	81	83	84	84	84	83	82	80
10	79	83	86	87	88	87	86	84	80
15	79	84	88	90	91	91	89	85	80
20	78	85	90	93	94	93	91	86	80
25	77	85	91	95	96	96	93	87	80
30	76	85	92	97	98	97	94	88	79
35	75	85	93	98	99	98	95	88	79
40	73	85	93	98	100	99	95	88	78
45	72	84	92	98	100	99	95	87	76
50	70	82	91	97	100	98	94	86	75
55	68	81	90	96	98	97	93	85	74
60	66	79	88	94	97	96	91	83	72
65	63	76	86	92	95	94	89	81	70
70	60	74	83	89	92	91	87	79	68
75	58	70	80	86	89	88	84	76	65
80	55	67	76	82	85	84	80	73	63
85	51	63	72	78	80	80	76	70	60
90	48	59	67	73	75	75	72	66	57

Performance Factor (%) – Region 2 (Manchester)									
Orientation	E	ESE	SE	SSE	S	SSW	SW	WSW	W
Pitch	-90	-67,5	-45	-22,2	0	22,5	45	67,5	90
0	80	80	80	80	80	80	80	80	80
5	80	82	83	84	84	84	83	82	80
10	79	83	86	88	88	88	86	84	80
15	79	84	88	91	92	91	89	85	80
20	78	85	90	93	94	94	91	87	80
25	77	86	92	95	97	96	93	87	80
30	76	86	92	97	98	97	94	88	79
35	75	85	93	98	99	99	95	88	78
40	73	85	93	98	100	99	95	88	77
45	72	84	92	98	100	99	95	87	76
50	70	82	91	97	99	98	94	86	75
55	68	80	90	96	98	97	93	85	73
60	65	78	88	94	96	95	91	83	71
65	63	76	85	91	94	93	89	81	69
70	60	73	82	88	91	90	86	78	67
75	57	70	79	85	87	87	83	75	65
80	54	66	75	81	93	83	79	72	62
85	51	62	70	76	78	78	75	69	59
90	47	58	66	71	73	73	70	65	56

Orientation of the collectors (continued)

Performance Factor (%) – Region 3 (Cambridge)									
Orientation	E	ESE	SE	SSE	S	SSW	SW	WSW	W
Pitch	-90	-67,5	-45	-22,2	0	22,5	45	67,5	90
0	79	79	79	79	79	79	79	79	79
5	79	81	83	84	84	84	83	82	80
10	79	83	86	87	88	88	86	83	80
15	79	84	88	91	91	91	89	85	80
20	798	85	90	93	94	94	91	86	80
25	77	86	92	95	97	96	92	87	79
30	76	86	93	97	98	97	94	87	79
35	75	86	93	98	99	98	94	87	78
40	74	85	93	98	100	99	95	87	77
45	72	84	93	98	100	99	94	86	75
50	70	83	92	97	99	98	93	85	74
55	69	81	90	96	98	97	92	84	72
60	66	79	88	94	96	95	90	82	71
65	64	77	86	92	94	93	88	80	69
70	61	74	83	89	91	90	86	78	67
75	59	71	80	85	87	87	82	75	64
80	56	67	76	81	83	83	79	72	62
85	53	63	71	76	79	78	74	68	59
90	49	59	67	71	73	73	70	64	56

Performance Factor (%) – Region 4 (Southampton)									
Orientation	E	ESE	SE	SSE	S	SSW	SW	WSW	W
Pitch	-90	-67,5	-45	-22,2	0	22,5	45	67,5	90
0	80	80	80	80	80	80	80	80	80
5	80	82	83	84	85	84	84	82	80
10	79	83	86	88	89	88	87	84	80
15	79	84	89	91	92	91	89	85	80
20	78	85	90	94	95	94	91	86	80
25	77	86	92	96	97	96	93	87	79
30	76	86	93	97	99	98	94	87	78
35	74	85	93	98	100	98	94	87	77
40	73	84	93	98	100	99	94	87	76
45	71	83	92	98	100	99	94	86	75
50	69	82	91	97	99	98	93	85	73
55	67	80	89	95	98	96	92	83	72
60	65	78	87	93	96	94	90	81	70
65	63	75	85	91	93	92	87	79	68
70	60	73	82	88	90	89	84	77	65
75	57	69	78	84	86	85	81	74	63
80	54	66	74	80	82	81	77	70	60
85	51	62	70	75	77	76	73	67	57
90	48	57	64	69	71	71	68	63	55

Area Factor

Average area factor, all regions									
Orientation	E	ESE	SE	SSE	S	SSW	SW	WSW	W
Pitch	-90	-67,5	-45	-22,2	0	22,5	45	67,5	90
0	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49
5	1.49	1.43	1.39	1.36	1.35	1.36	1.38	1.42	1.49
10	1.51	1.38	1.31	1.26	1.25	1.26	1.30	1.37	1.48
15	1.52	1.35	1.25	1.19	1.17	1.18	1.23	1.32	1.48
20	1.54	1.33	1.20	1.13	1.11	1.12	1.18	1.29	1.48
25	1.58	1.31	1.17	1.09	1.06	1.08	1.14	1.27	1.50
30	1.61	1.31	1.15	1.06	1.03	1.05	1.12	1.26	1.52
35	1.66	1.32	1.14	1.04	1.01	1.03	1.11	1.26	1.55
40	1.72	1.34	1.14	1.04	1.00	1.02	1.10	1.27	1.58
45	1.79	1.37	1.15	1.04	1.00	1.02	1.11	1.28	1.63
50	1.88	1.41	1.17	1.05	1.01	1.03	1.13	1.31	1.68
55	1.97	1.46	1.21	1.08	1.03	1.06	1.15	1.35	1.75
60	2.10	1.53	1.26	1.12	1.07	1.09	1.19	1.40	1.83
65	2.24	1.62	1.32	1.17	1.12	1.14	1.25	1.46	1.92
70	2.41	1.73	1.40	1.24	1.18	1.20	1.32	1.55	2.03
75	2.63	1.87	1.51	1.33	1.27	1.29	1.40	1.66	2.17
80	2.89	2.05	1.65	1.45	1.38	1.40	1.52	1.79	2.33
85	3.21	2.28	1.83	1.61	1.53	1.55	1.67	1.96	2.52
90	3.62	2.58	2.08	1.83	1.73	1.74	1.87	2.17	2.76

In order to maximise the solar irradiation available when it is not possible to achieve due south orientation and 40° pitch, it is possible to increase the collector area to compensate for this. The following table shows the relevant average multiplication factor for the collector area.

In most cases, the variety of standard VELUX solar hot water systems are sufficient for the majority of design applications. However, should you wish to design a bespoke system please contact VELUX solar energy.

Energy efficient, cost effective

We have completed this case study which gives an indication of the likely value of the energy savings that can be achieved by the installation of a VELUX solar hot water system. For the purposes of this case study, we have assumed that the auxiliary boiler is gas fired in all cases.

Case study 1

This case study gives three collectors with a combined area of 7.5m² and a 375 litre tank, typically specified for households of between four to seven occupants.

	3 x collectors at 7.5m² with 375 litre tank			
	Number of people	4	5	6	7
	Daily draw-off	160	200	240	280
	Net hot water load, kWh/year	3051	3814	4577	5340
Region 1 Glasgow	Solar fraction, %	59.6	54.9	50.8	47.1
	Auxiliary energy input needed, kWh/year	1574	2070	2608	3187
	Solar benefit with a 90% efficient boiler, kWh/year	2978	3275	3525	3730
	Solar benefit with an 80% efficient boiler, kWh/year	3351	3684	3966	4196
	Solar benefit with a 70% efficient boiler, kWh/year	3829	4211	4532	4795
Region 2 Manchester	Solar fraction, %	64.2	59.5	55.3	51.6
	Auxiliary energy input needed, kWh/year	1417	1878	2386	2929
	Solar benefit with a 90% efficient boiler, kWh/year	3153	3488	3772	4016
	Solar benefit with an 80% efficient boiler, kWh/year	3547	3924	4243	4518
	Solar benefit with a 70% efficient boiler, kWh/year	4054	4485	4849	5164
Region 3 Cambridge	Solar fraction, %	68.1	63.0	58.5	54.4
	Auxiliary energy input needed, kWh/year	1256	1711	2214	2754
	Solar benefit with a 90% efficient boiler, kWh/year	3332	3674	3963	4211
	Solar benefit with an 80% efficient boiler, kWh/year	3748	4133	4458	4737
	Solar benefit with a 70% efficient boiler, kWh/year	4284	4724	5095	5414
Region 4 Southampton	Solar fraction, %	73.1	68.0	63.3	59.8
	Auxiliary energy input needed, kWh/year	1090	1514	1962	2459
	Solar benefit with a 90% efficient boiler, kWh/year	3516	3893	4243	4538
	Solar benefit with an 80% efficient boiler, kWh/year	3956	4379	4773	5106
	Solar benefit with a 70% efficient boiler, kWh/year	4521	5005	5455	5835

Summary:

The solar fraction that can be gained increases from a significant 59% in region 1 to a maximum of 73% in region 4. The solar benefit that can be achieved with a 70% efficient boiler within region 4 is 5835 kWh/year.