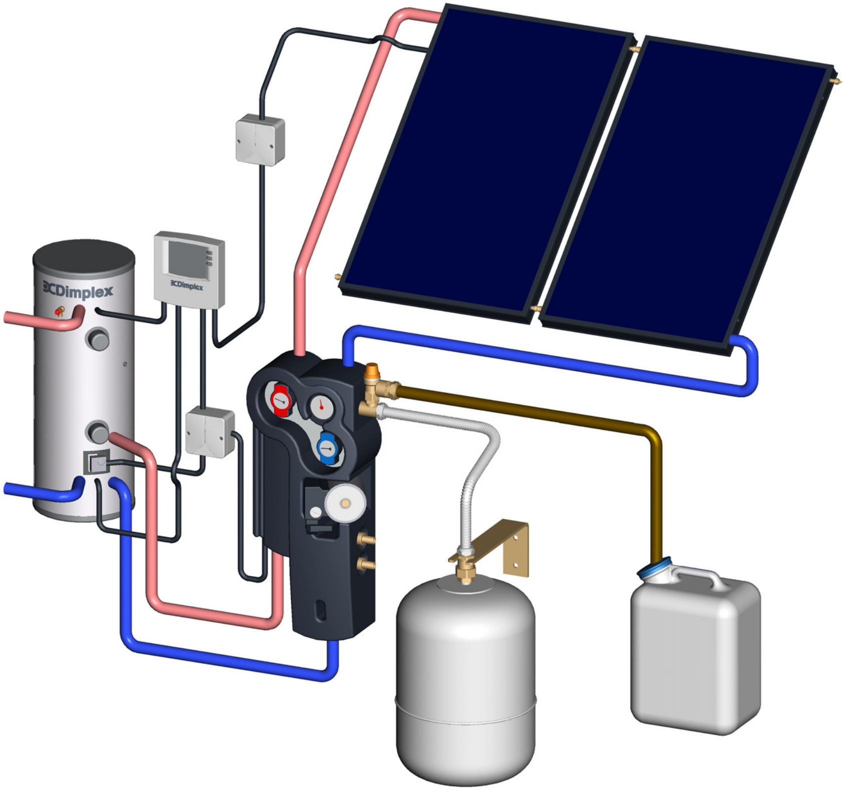
SOLAR



Technical Manual

Complete guide to Dimplex Solar

1 Contents

2 Before you start

General

Thank you for your interest in Dimplex Solar products. We trust this manual will give you all the answers to the questions that you might have regarding the products. Although every care was taken to ensure the content of this manual is correct we do not accept any liability for claims resulting directly or indirectly from the application of the information contained in this manual.

This manual is written specifically for the Dimples Solar product range. Any information contained therein must not be applied generally to any other solar products.

Should you require any further assistance please do not hesitate to contact us.

3 Solar thermal

3.1 Introduction

The sun supplies every day a multiple of the required world wide daily energy demand to the earth. The energy of the sun is available in various forms such as:
- direct, diffuse and reflected solar radiation
- wind
- waves
- the ground and in other forms.

Solar thermal systems convert the energy incident from the sun on an absorber surface into sensible heat in form of hot water. Depending on the temperature required and achieved, this hot water can be used for a whole range of applications as summarised in Figure 1.

Application	Temperature range
Swimming pool	22°C - 30°C
Domestic/commercial hot water	45°C - 60°C
Heating support	35°C - 65°C
Industrial processes	40°C - 110°C
Thermal refrigeration	65°C - 150°C

Figure 1 – Approximate temperature ranges of some solar thermal applications

3.2 Solar radiation

3.1.1 Available solar radiation

Solar thermal systems can only utilise the energy from the sun in form of solar radiation. The solar radiation can be incident on the solar panels in various forms which are shown in Figure 2, namely direct, reflected and diffuse radiation. The various types of radiation can occur in isolation but in most cases the radiation incident on a solar thermal collector is a combination thereof.

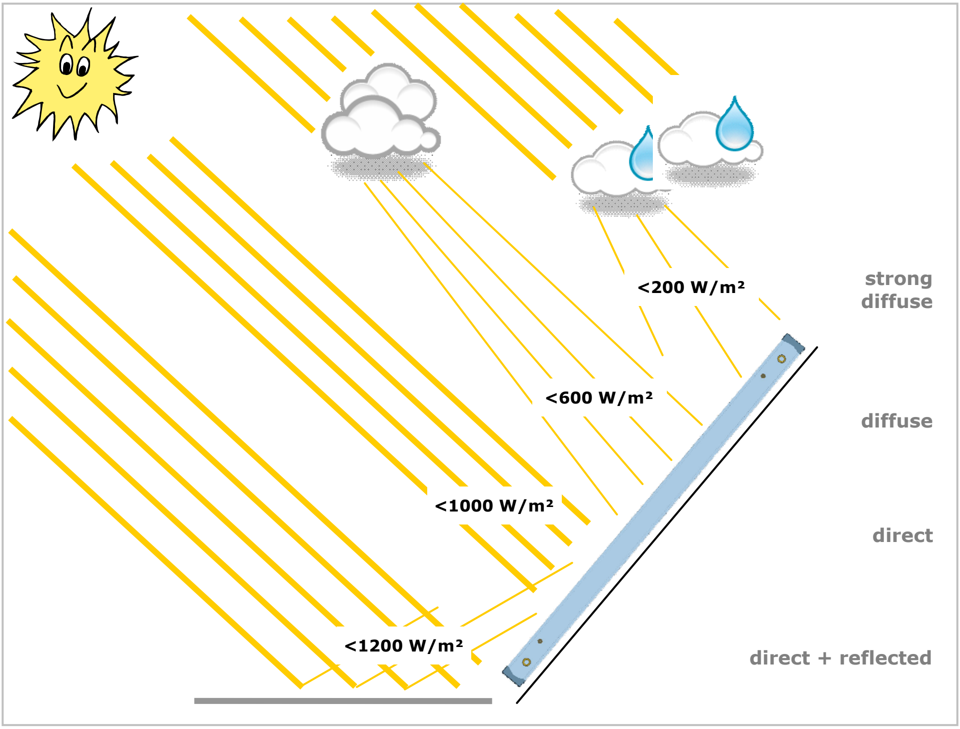


Figure 2 – Forms of incident solar radiation

The solar radiation available outside the earth's atmosphere, the so called extraterrestrial radiation, has a density of 1367 W/m². Depending on:

- the location of the solar system
- the time of day and year
- the "obstacles" in the atmosphere such as cloud cover and pollution
- and the inclination of the solar system in relation to the sun

this value varies strongly. A map of the United Kingdom and Ireland is shown in Figure 3, indicating average annual solar energy gains on the horizontal surface.

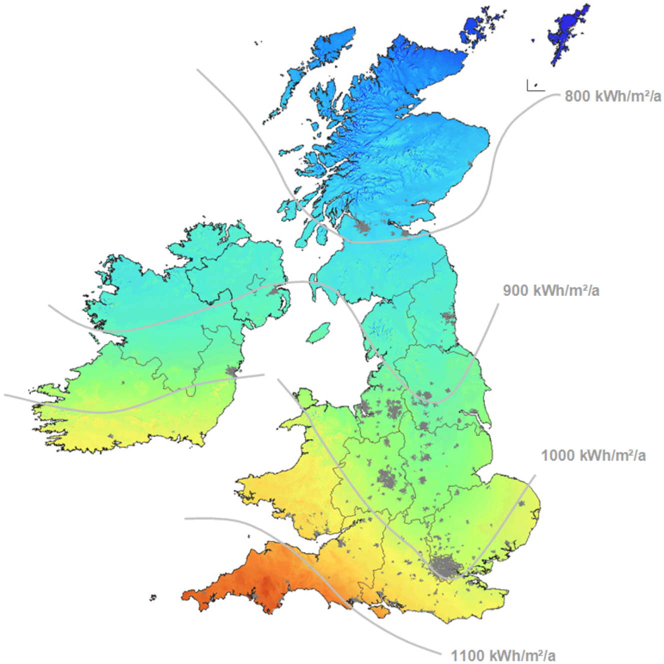


Figure 3 – UK and Ireland irradiation map (horizontal surface)

3.1.2 Orientation

The solar irradiance shown in Figure 3 is an average value incident on the horizontal surface. As mentioned above, depending on the orientation and inclination of the solar collector the incident radiation onto the collector surface can vary although it might be in the same location.

The terminology used to describe the exact location and orientation of a solar collector is described in Figure 4. The terms indicate:
- longitude: geographic coordinate for East/West measurement
- latitude: geographic coordinate North or South of the equator
- slope: angle between the horizontal and the collector plane
- azimuth: angle between South and the perpendicular to the collector pane (West +90°, South =0°, East -90°)

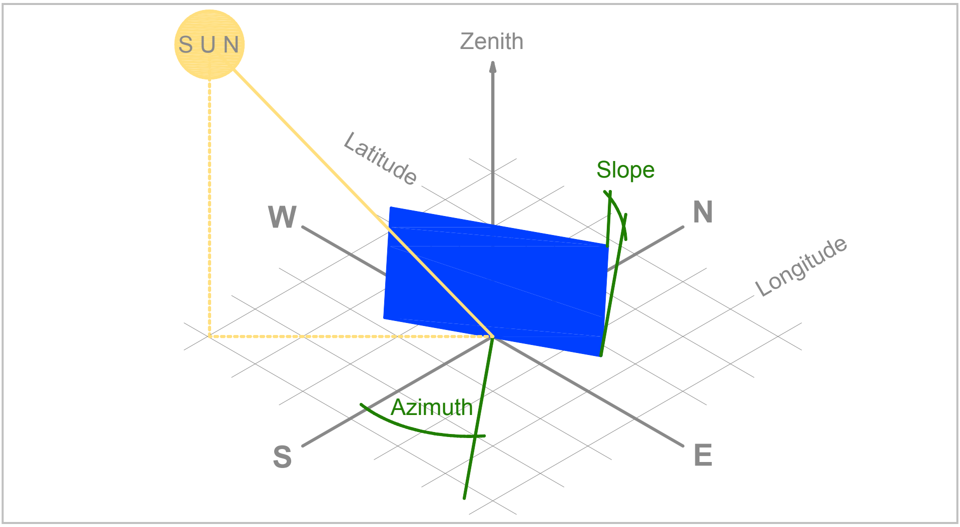


Figure 4 – Terminology to describe location and orientation of solar thermal panel

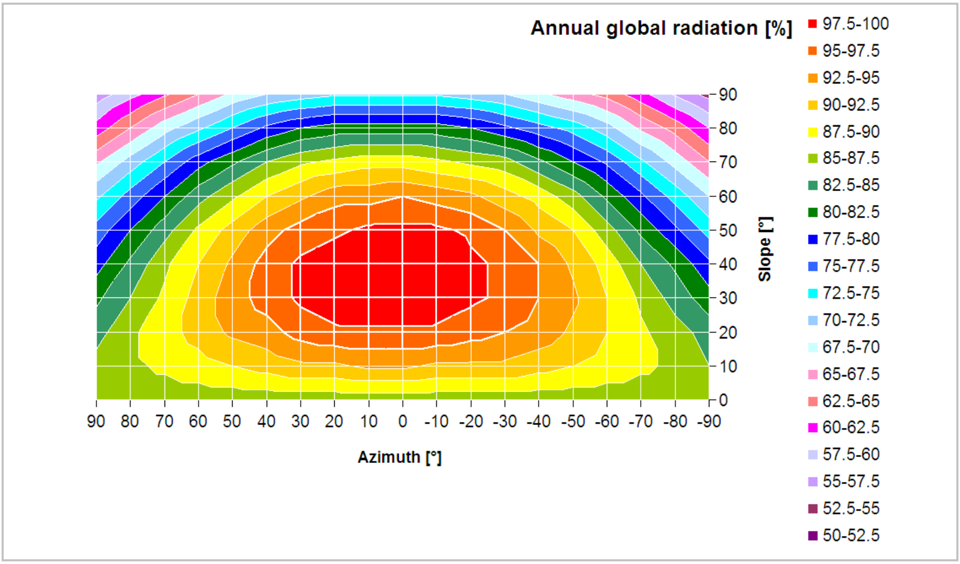


Figure 5 – Effect of orientation on incident radiation levels

Although the location of the solar thermal system can be described using the longitude and latitude of the installation, in practise the locality is being used to determine the location of the system.
The effect of the orientation on the incident solar radiation levels can be seen from Figure 5.

3.3 Solar thermal system

3.3.1 Components of a solar thermal system

Although solar thermal systems cover a whole range of applications, see Figure 1, the basic components used are in principle the same. A solar thermal system consists of:
- solar collector
- heat transfer medium
- pipe work
- pump and safety equipment
- heat exchanger
- storage facility
- control unit
- user

Applying the above to a domestic hot water system, the individual components are identified in Figure 6.

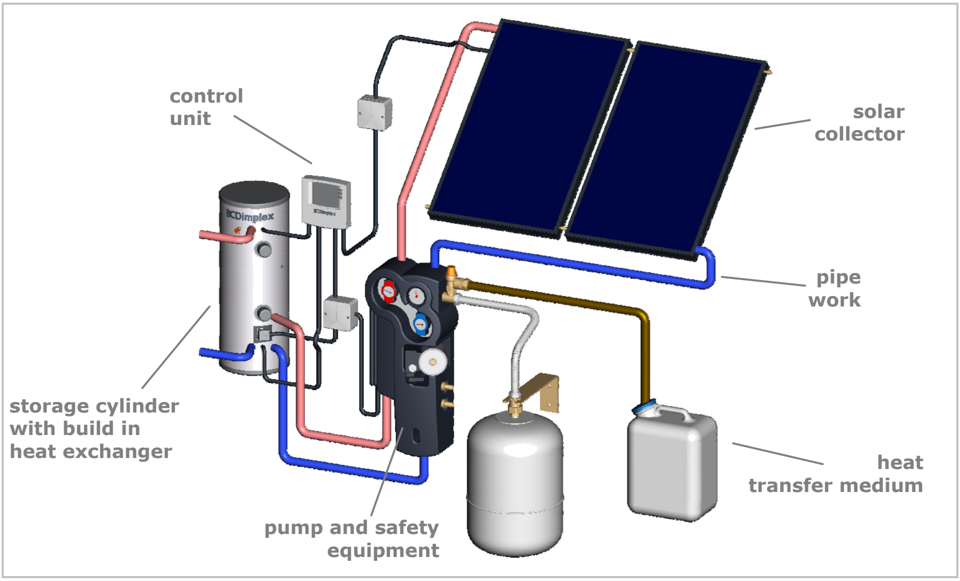


Figure 6 – Solar system components overall view

Each component in the solar thermal system fulfils a specific function which is described below:

Solar thermal collector
The solar thermal collector receives the solar radiation, converts it into thermal energy and passes it on to the heat transfer fluid.

Heat transfer fluid
The heat transfer fluid circulates through the solar collector, the pipe work and the heat exchanger. It transfers the energy gained by the collector into the storage device. The heat transfer fluid has additional properties such as frost protection and anti-corrosion inhibitors to ensure a long and reliable operation of the solar thermal system.

Pipe work
The pipe work connects the various components of the solar thermal system to allow the heat transfer medium to transport the energy from the collector to the storage device. The pipe work must be insulated and both, the pipe work and the insulation must be of appropriate material for solar thermal applications.

Pump and safety equipment
The pump and safety equipment are combined in the pump unit. Beside the actual circulation pump the pump unit contains a flow meter, flush and fill point, air separator, non return valves, manual thermometers, isolating valves, pressure relief valve, pressure gauge and the connection point for the expansion vessel.

Heat exchanger
The heat exchanger allows a hydraulic separation of systems but allows the transfer of energy between the two systems, i.e. the solar circuit and the wholesome water. In a domestic solar thermal hot water system the heat exchanger is usually in form of a coil immersed in the wholesome water inside the hot water cylinder.
To ensure the solar thermal system works at its optimum efficiency, the heat exchanger has to be sufficiently sized and positioned correctly within the hot water cylinder.

Storage facility
The storage facility is most likely to be a domestic hot water cylinder or a buffer vessel. As the solar thermal system will not always be able to supply all of the required energy, it is important that an auxiliary heating system is available to boost the system as and when required.
The storage facility should be of such design that all energy sources can work independent of each other without compromising each others efficiencies, giving solar thermal the priority to allow for maximum energy gain.

Control unit
The control unit has the primary function of switching the circulation pump on and off ensuring that the maximum amount of energy is being transferred from the solar thermal collector into the storage facility.
The control unit is usually also the user interface with the system and has therefore a display and additional functions to ease the operation, maintenance and control of the system.

User
The user varies from installation to installation but has a big influence on the operation of the solar thermal system. However, the system has all components to ensure the provision of the comfort levels that the user expects.

3.3.2 Function of a solar thermal system

Bearing in mind the function of the individual components, the function of a solar thermal system is in principle very simple. Based on two measured temperatures, one in the hottest (T1) and one in the coldest (T2) part of the system, the control unit switches the pump either on or off depending on the temperature difference between T1 and T2 and the temperature reached in the storage device. The location of the temperature sensors is indicated in Figure 7.

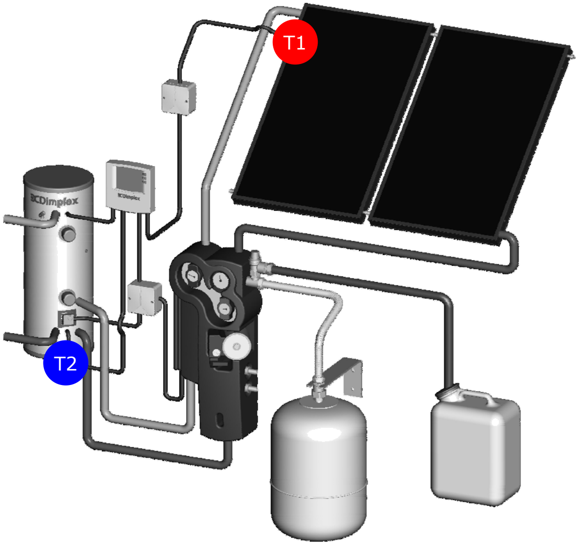


Figure 7 – Location of temperature sensors in solar thermal system

If T1 is greater than T2 plus an additional temperature differential (called ΔT 'delta T'), the circulation pump is being switched on by the control unit to transfer the energy from the collector into the storage device. As soon as this on condition is not given, the pump is being switched off.

The solar control unit also ensures that the water in the cylinder is not being heated above a set temperature which can be freely chosen and is measured by the temperature sensor T2.

A more detailed description of the function of the individual components follows in Chapter 4, Dimplex solar products.

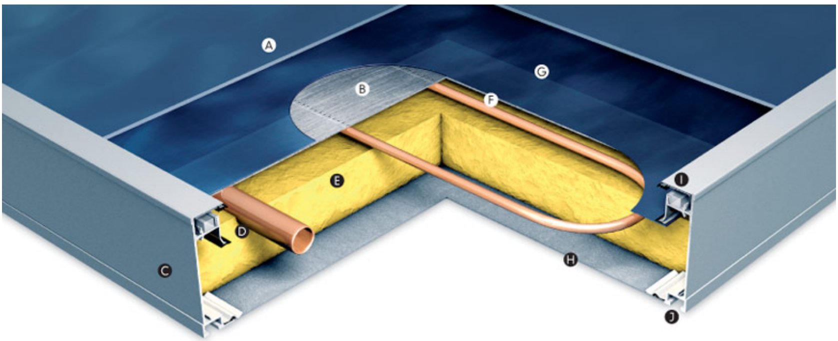
4 Dimplex solar products

The following section details the product features and relevant technical data of the components of the Dimplex solar offering. Where applicable a general description of the component's function is given.

4.1 Dimplex solar collector SOLC220

4.1.1 General description

The Dimplex solar collector SOLC220 is a solar thermal flat plate collector. A cross sectional drawing of the Dimplex SOLC220 is given in Figure 8 detailing the individual collector components.



(A) Collector cover (glass)
(B) Absorber plate (aluminium)
(C) Powder coated frame (aluminium)
(D) Manifold pipe (copper)
(E) Collector insulation (mineral wool)
(F) Meander pipe (copper)
(G) High selective absorber coating
(H) Back plate (aluminium)
(I) Secure cover fixation
(J) Continuous mounting channel

Figure 8 – Flat plate collector components

Due to its construction, a flat plate collector is subject to conduction, convection and radiation heat losses. The sum of these heat losses and the design and production quality are summarised in the thermal collector efficiency which is empirically determined through independent third party testing and expressed in Equation 1. The heat loss modes of a flat plate collector are shown in Figure 9.

$$\eta = \eta_0 - a_1 \cdot \frac{t_m - t_a}{G} - a_2 \cdot \frac{(t_m - t_a)^2}{G} \quad [1]$$

Where:			
	η	[-]	thermal collector efficiency
	η_0	[-]	optical collector efficiency/zero loss coefficient
	a_1	[W/m²/K]	linear heat loss coefficient
	a_2	[W/m²/K²]	squared heat loss coefficient
	G	[W/m²]	global incident radiation
	t_m	[°C]	collector middle temperature
	t_a	[°C]	collector ambient temperature

Ref. [-]	**Description** [-]	**App. value** [%]
1	Incident solar radiation	100
2	Cover reflectance	-9
3	Cover absorptance	-2
4	Absorber plate reflectance	-5
5	Absorber efficiency	-3
6	Absorber plate emissivity	-3
7	Collector heat loss front	=f(op. cond.)
8	Collector heat loss back	=f(op. cond.)
9	Useful collector output	78

Figure 9 – SOLC220 heat loss modes

The collector heat loss front (7) and collector heat loss back (8) are dependant on the operating conditions of the solar thermal collector, i.e. primarily on the temperature difference between the collector module and the ambient air and wind speed. Applying equation 1 to the Dimplex SOLC220 collector the graph shown in Figure 10 can be derived.

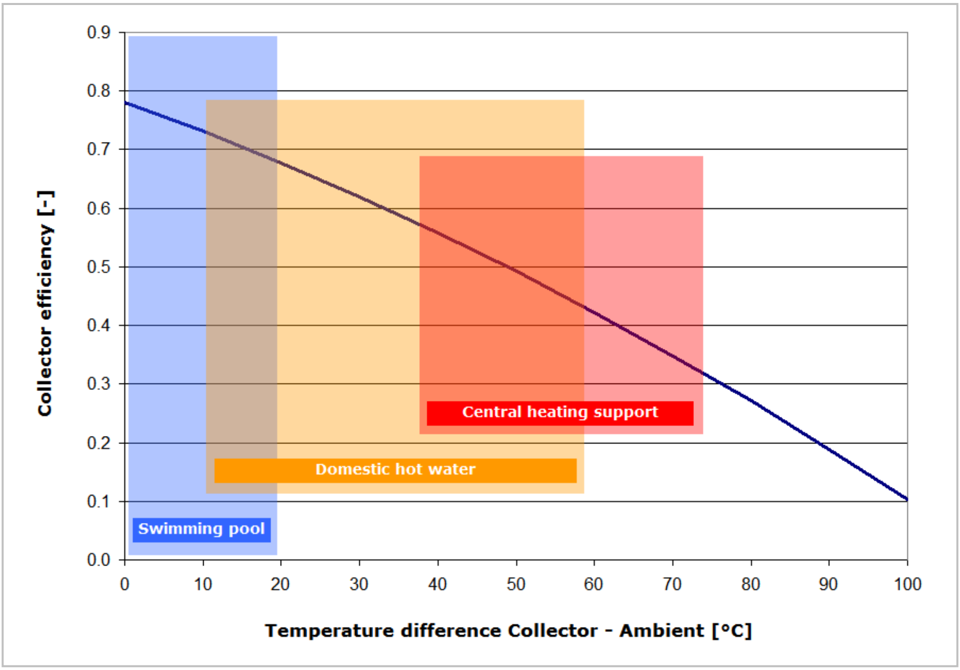


Figure 10 – Thermal efficiency curve Dimplex SOLC220 flat plate collector

Figure 10 shows that the higher the temperature difference between the collector module and the ambient is, the lower is the efficiency of the product. Due to the required operating conditions of various applications (see Figure 1) the collector has to operate at varying efficiencies.
In general central heating support applications are not recommended with solar thermal except if the whole system is especially designed for the application offering all the required features such as collector orientation, storage, heating operating temperatures, heating demand and others.

Beside the thermal efficiency of the solar collector various other parameters are of importance for the correct application thereof. All of these parameters are determined in accordance with EN12975 and some of them are detailed in Figure 25, Technical details Dimplex SOLC220.

4.1.2 Hydraulic collector connection

The hydraulic integration of the solar thermal collector in the overall system is critical to ensure the most efficient and reliable operation of the installation. When integrating the collector, the following aspects have to be considered:
- installation space availability

- collector design
- collector pressure drop
- flow rate
- required system output

Figure 11 shows the Dimplex SOLC220 collector with the pipe work attached to the absorber plate indicated.

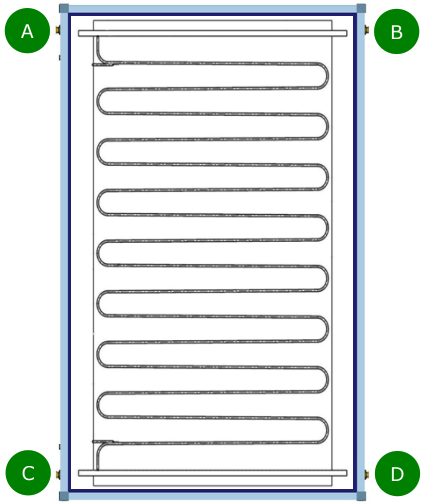


Figure 11 – Absorber pipe work Dimplex SOLC220 collector

From Figure 11 it can be seen that the collector has 4 connections which can be used to connect the flow and return pipes of the installation and to connect the collectors between each other. The 4 connections offer the following features:
- one collector for small or large installations
- left hand or right hand side connection of single collector installations
- up to 10 collectors directly connected together
- collectors connected in parallel to each other, thus low overall pressure drop of array
- same collector for vertical or horizontal installations

The sensor pockets to connect the collector sensor T1 from the control unit are always on the side with the connections marked (A) and (C). It is important to ensure that all of the pipe work within the collector is being utilised:
- for single collector installations, the flow and return pipes must be installed on connections (B) and (D).
- for multiple collector installations the sensor pockets must always face outwards.

The flow and return of the collector are connected using a 800mm long insulated corrugated stainless steel flexible hose (9.1). The interconnections consist of short flexible bellows (10.1). The remaining connections are to be blanked off using the blanking pieces (9.2). The connections components are depicted in Figure 12 using the same references as in the installation manuals.

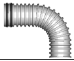
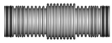
Part No	Image	Description
9.1		Inlet/outlet connection
9.2		Blanking connection
10.1		Collector interconnection

Figure 12 – Connection components Dimplex SOLC220 collector

An overall view of the application of the individual connection components is given in Figure 13 (two collectors, flow left hand side, return right hand side). Note: the sensor pockets on both collectors face outwards.

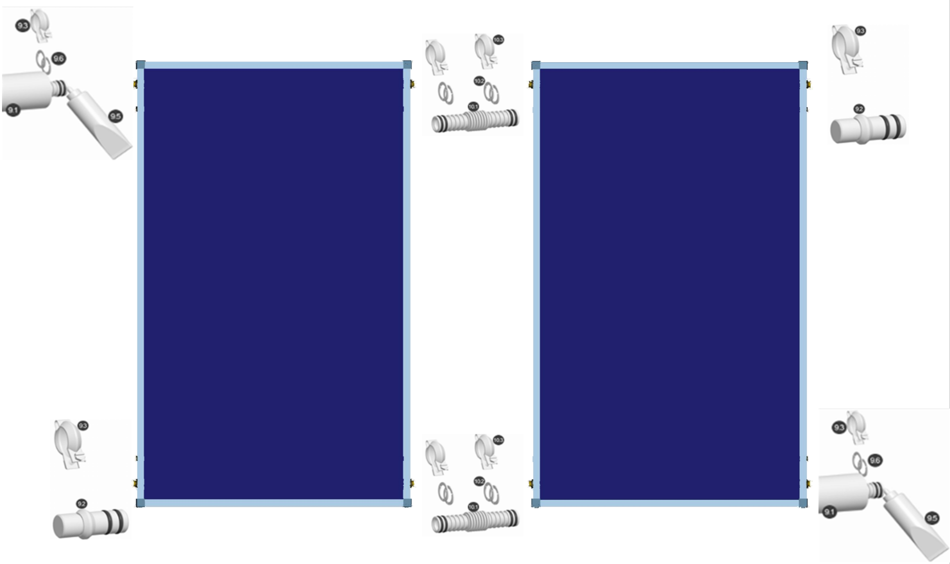
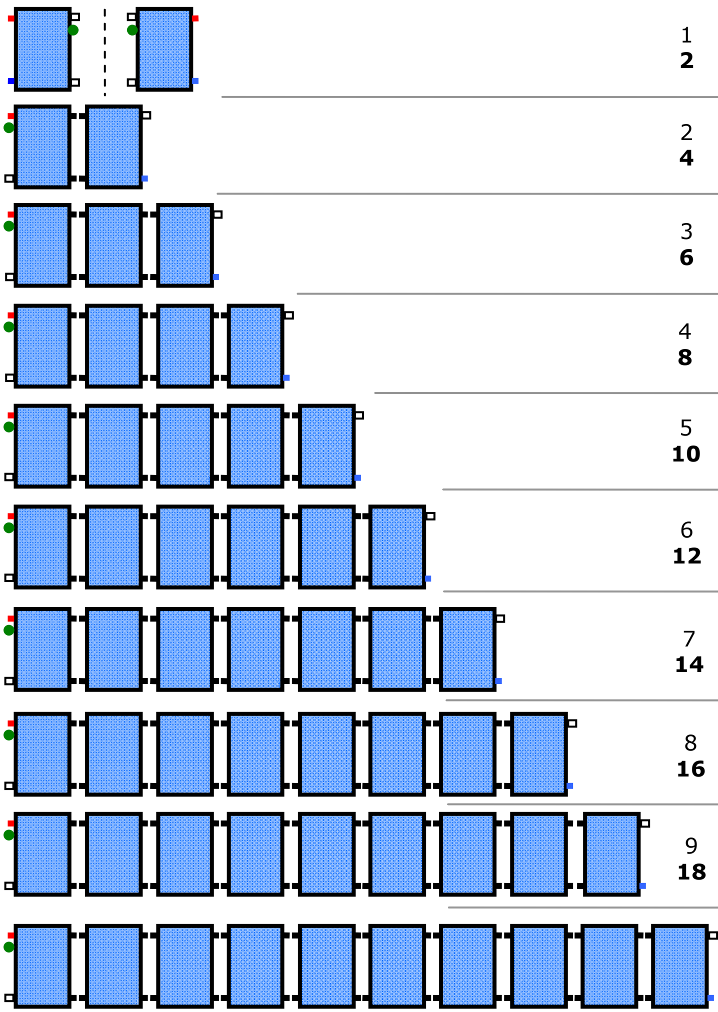


Figure 13 – Typical connection of Dimplex SOLC220 collector

An overall view of possible collector connections is given in Figure 14 detailing also the pressure drop at nominal low-flow and high-flow flow rates.



No. of collectors	Flow rate [l/min]	Pres. drop [mbar]
1	1 **2**	150 **325**
2	2 **4**	150 **330**
3	3 **6**	150 **330**
4	4 **8**	160 **340**
5	5 **10**	160 **340**
6	6 **12**	170 **350**
7	7 **14**	185 **385**
8	8 **16**	195 **400**
9	9 **18**	200 **420**
10	10 **20**	210 **500**

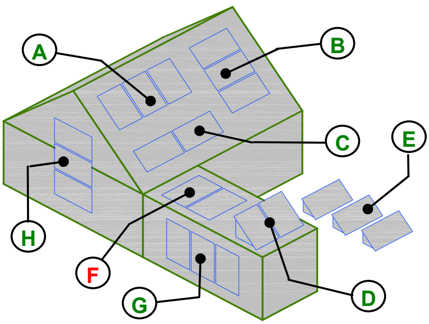
Figure 14 – Collector connection options, flow rates and pressure drop

Although only the vertical collector orientation is shown, the same principles can be applied to the horizontal collector installation. The same applies for the positioning of the flow and return, it can be changed from left to right hand side as long as the sensor (indicated by dot) is moved accordingly.

Note: Up to 5 collectors can also be connected single sided with the orientation of the individual collectors as shown in Figure 14 and the sensor placed in the sensor pocket on the collector flow.

4.1.3 Roof fixing kits

The Dimplex solar collectors SOLC220 can be installed in most situations on or near a building. An overall view of the installation options is shown in Figure 15.



Reference	Comment	On roof	In roof
A	Standard solution	✓	✓
B	Standard solution	✓	✗
C	Possible using basic kits only but additional piping effort	✓	✗
D	Standard solution	✓	✗
E	Possible using basic kits only but additional piping effort	✓	✗
F	Not permitted!	✗	✗
G	Possible with additional parts to be ordered.	✓	✗
H	Possible with additional parts to be ordered.	✓	✗

Figure 15 – Dimplex Solar collector installation options

Dimplex offers a wide range of roof fixing kits for the installation of the SOLC220 solar collector. The available roof fixing kits are summarised in Figure 16.

Roof covering	On roof		In roof	
	vertical	horizontal	vertical	horizontal
Corrugated tile	✓	✓	✓	✗
Plain tile	✓	✓	✓	✗
Slate	✓	✓	✓	✗
Sheet metal	✓	✓	✗	✗
Free standing	✓	✗	✗	✗

Flashing kits are available as accessory for the integrated roof kits to cover the sides, bottom and the gap between the collectors.

Figure 16 – Dimplex solar roof fixing kits overall view

On roof kits

The on roof kits come as basic and extension kit. The basic kit has to be ordered for each first collector of a collector field, the extension kit for each additional collector in the installation.

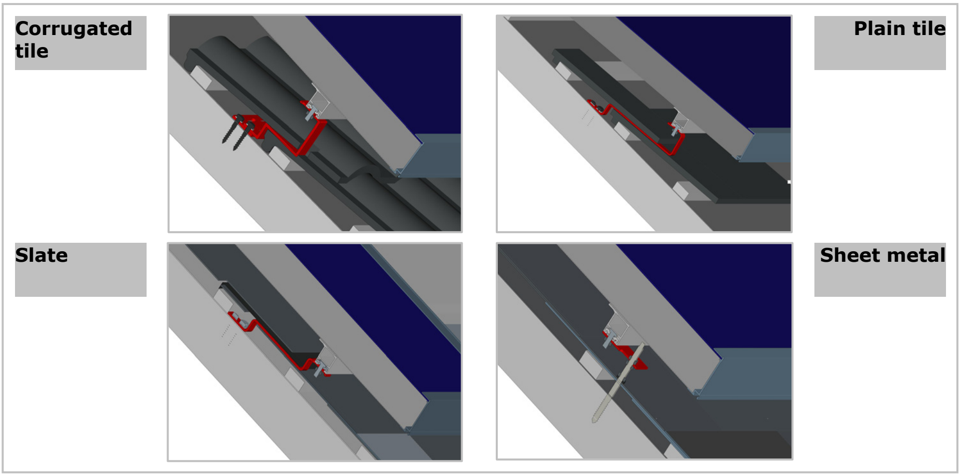


Figure 17 – On roof mounting options

As detailed in Figure 16 the on roof kits suit various types of roof coverings. The different mounting methods for the various tiles are shown in Figure 17 differing only in the design of the bracket/fixation of the collector support rail to the roof structure.

In roof kits

The in roof kits are only available for vertical collector installation and vary for tile roof coverings and slate covering only. Additional flashing kits are available to complement the integrated roof kits, covering the pipe work on the side of the collector, the fixing brackets at the bottom and the gap between the collectors.

The in roof kits and flashing kits are not sold as basic and extension kits but come as complete kits for 2, 4 and 6m² installations. Should a larger collector field be installed, further extension kits are available.

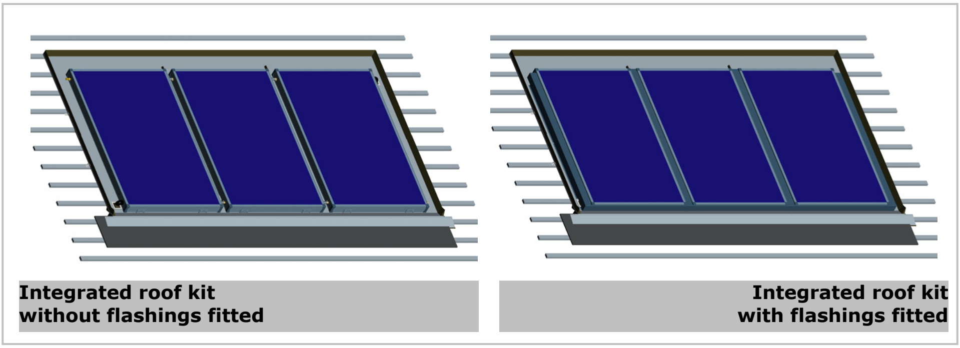


Figure 18 – Dimplex SOLC220 integrated roof kit without and with flashing kit fitted

Free standing kits

The free standing kit is designed for the vertical installation of the solar collector on even ground with a slope of 45° to 60°. For lower sloping angles shorted support struts can be ordered, allowing the collector to slope between 30° and 40°.
As shown in Figure 24, the free standing mounting kit is usually fixed at 4 individual points. Alternatively a U – section rail is available as accessory aiding on uneven ground or for suspended installation.

When more than one row of solar collectors is being installed it is important to minimise the impact of shading of one row to the other. Equation 2 can be used to calculate the optimum row spacing to avoid shading at solar noon on the least favourable day of the year, i.e. 21st December.

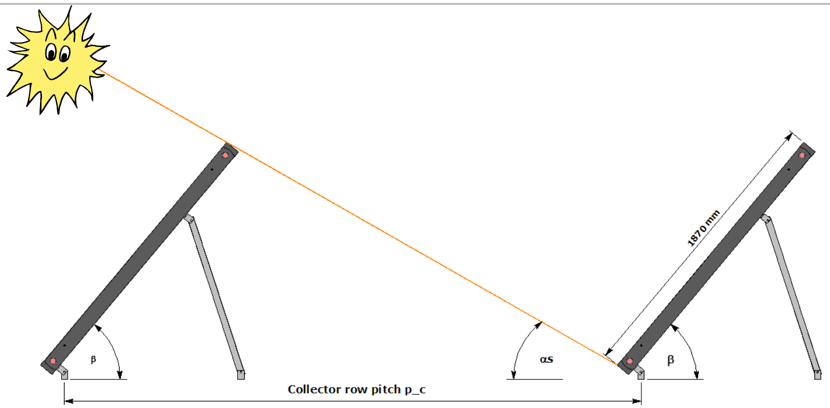
$$p\_c = \frac{1870mm \cdot \sin(180° - (\beta + \alpha_s))}{\sin \alpha_s} \qquad [2]$$

Where:	p_c	[mm]	pitch between collector rows
	β	[°]	sloping angle of solar collector
	α_s	[°]	solar altitude angle

The solar altitude angle can be calculated applying Equation 3 or approximating it from Figure 19.

$$\alpha_s = 90° - (\cos\phi \cdot \cos 23.45° + \sin\phi \cdot \sin 23.45°) \qquad [3]$$

Where:	α_s	[°]	solar altitude angle
	ϕ	[°]	latitude of installation



Location [-]	Latitude ϕ	Solar altitude angle αs [°]	Row distance at 45° p_c [mm]
Exeter	50°42'	16.13	5894
London	51°30'	15.25	6172
Cork	51°54'	15.01	6254
Cambridge	52°12'	14.43	6461
Liverpool	53°25'	13.30	6916
Dublin	53°26'	13.29	6920
Middlesborough	54°35'	12.20	7438
Belfast	54°36'	12.19	7443
Malin Head	55°22'	11.33	7922
Glasgow	55°53'	11.02	8112
Dundee	56°28'	10.27	8620
Aberdeen	57°10'	9.45	9267
Stornoway	58°18'	8.37	10309
Kirkwall	58°57'	7.98	10755
Lerwick	60°08'	6.47	12982

Figure 19 – Free standing kit row distance calculation details

In addition to the row distance the fixation of the free standing kit to the mounting surface has to be considered carefully. Due to the shape of the flat plate collector considerable wind forces can act on the free standing kit installation.
Ideally the free standing kit is bolted to a fixed structure. However, this is not always practicable, especially when the roof surface must not be penetrated for water tightness reasons.
Equation 4 is to be used to calculated the required mass to securely locate the free standing kit. The required parameters can be found in Figure 20.
Note: the stated parameters are only valid for the wind speeds stated in Figure 20. It is the responsibility of the installer/mechanical engineer to validate these figures for the individual installation. Dimplex does not accept any liability for damage to material, buildings or persons resulting from free standing installations not being sufficiently supported.

$$m_{tot} = n_{spt} \cdot m_{spt} - n_{col} \cdot m_{col} \qquad [4]$$

Where:			
	m_{tot}	[kg]	minimum mass required
	n_{spt}	[-]	number of supports in installation
	m_{spt}	[kg]	mass for each support (see Figure 20)
	n_{col}	[-]	number of collectors in installation
	m_{col}	[kg]	mass of collector (SOLC220 = 34.5 kg)

Free standing installation collector SOLC220

Minimum mass (kg) m_{spt} requirement for each fixing point

	Height of building above ground B_h	B_h ≤ 8m	8 < B_h ≤ 20m	20 < B_h ≤ 100m	100 < B_h
	Wind speed w_s	28 m/s	36 m/s	42 m/s	46 m/s
	Pressure w_p	1 kN/m²	1 kN/m²	1 kN/m²	1 kN/m²
Slope	30°	36	62	88	105
	45°	54	91	128	153
	60°	68	113	158	189

Figure 20 – Free standing kit support weight calculation details

In some cases it might be required to prepare the load baring structure in advance to accept the fittings of the Dimplex solar free standing kit. Figure 21 details the support feet (4x for each collector) and the free standing bottom bar (2x for each collector).

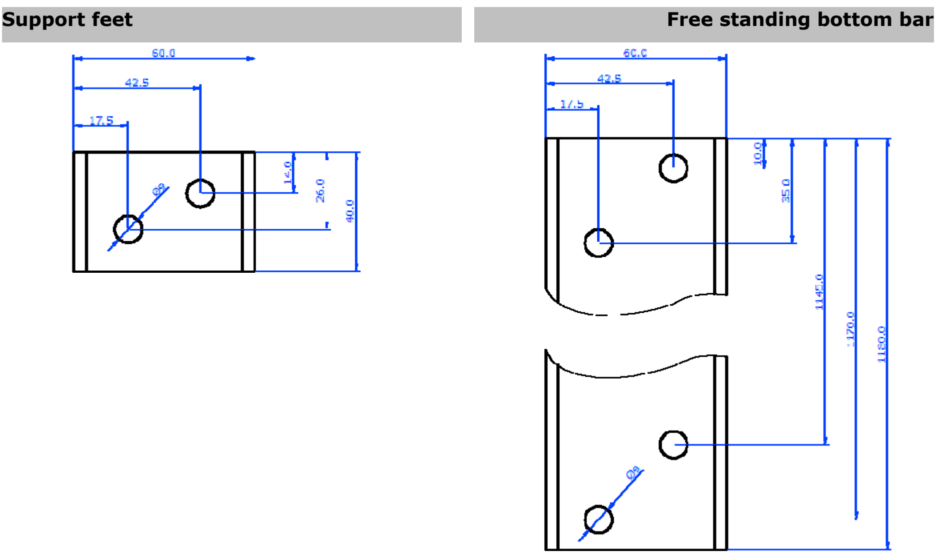


Figure 21 – Fixation details Dimplex solar free standing kit

4.1.4 Space requirement

Depending on the mounting method the foot print required by the solar collector installation varies. The dimension for the on roof and free standing mounting kits do not include the space required to fit the connection pipes as these vary depending on the pipe feed through chosen. The dimensions provided for the integrated roof kits include the pipe work as the pipe feed through is part of the integrated roof kit.

No. collectors	Dmn. A	Dmn. B
1	1150 mm	1870 mm
2	2390 mm	
3	3630 mm	
4	4870 mm	
5	6110 mm	
6	7350 mm	
7	8590 mm	
8	9830 mm	
9	11070 mm	
10	12310 mm	

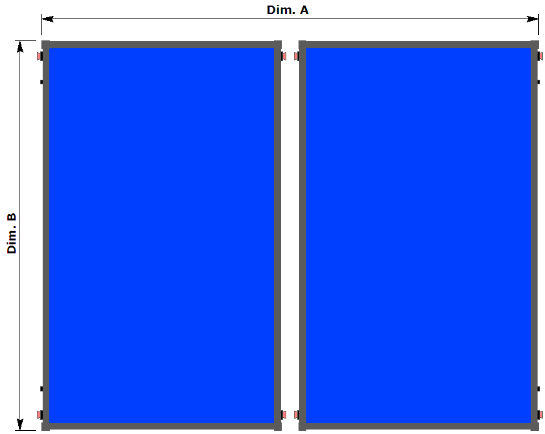


Figure 22 – Space requirement Dimplex SOLC220 on roof installation

	Tile kit	
No. collectors	Dmn. A	Dmn. B
1	1360 mm	2400 mm
2	2720 mm	
3	3970 mm	
4	5220 mm	
5	6470 mm	
6	7720 mm	
7	8970 mm	
8	10220 mm	
9	11470 mm	
10	12720 mm	

	Slate kit	
No. collectors	Dmn. A	Dmn. B
1	1380 mm	2310 mm
2	2760 mm	
3	4010 mm	
4	5260 mm	
5	6510 mm	
6	7760 mm	
7	9010 mm	
8	10260 mm	
9	11510 mm	
10	12760 mm	

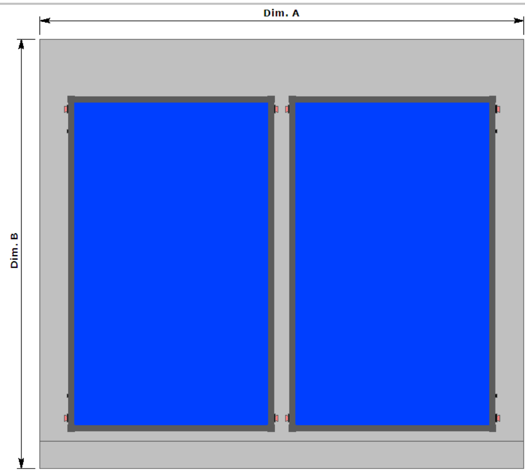
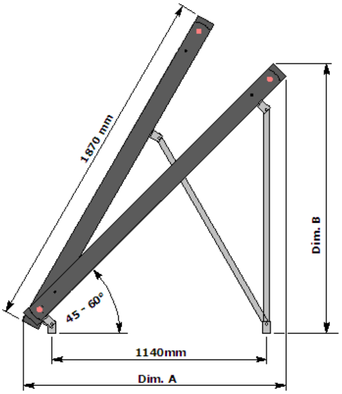
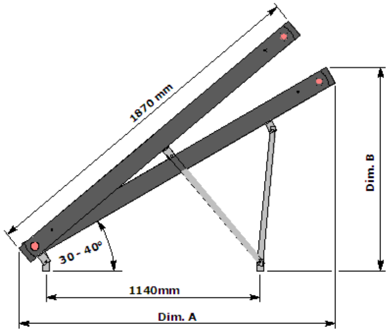


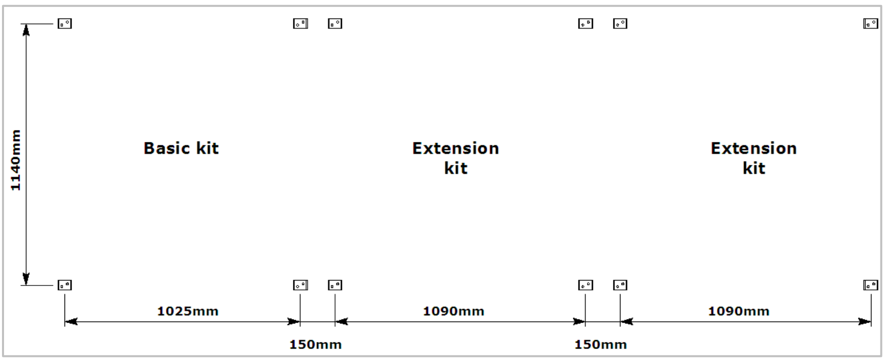
Figure 23 – Space requirement Dimplex SOLC200 in roof installation





Sloping angle	Dmn. A	Dmn. B
45°	1392 mm	1431 mm
50°	1312 mm	1528 mm
55°	1316 mm	1614 mm
60°	1319 mm	1688 mm

Sloping angle	Dmn. A	Dmn. B
30°	1670 mm	1080 mm
35°	1588 mm	1206 mm
40°	1496 mm	1324 mm



No. collectors	1	2	3	4	5	6	7	8	9	10
Centre - centre [mm]	1025	2265	3505	4745	5985	7225	8465	9705	10945	12185

Figure 24 – Space requirement Dimplex SOLC220 free standing installation

4.1.4 Technical data

Figure 25 summarises the key technical data of the Dimplex SOLC220 solar thermal collector.

Dimensions	
- length	1870mm
- width	1150mm
- height	95mm
- gross area	2.151m²
- aperture area	1.972m²
- absorber area	2.008m²
Operation	
- maximum operating pressure	10 bar
- nominal mass flow	60 kg/m²/h
- nominal flow rate (20°C)	1 l/min
- max. no. connected diagonal	10
- max. no. connected signle sided	5
Construction	
- weight (empty)	34.5 kg
- liquid content	1.7 l
- connections	double o-ring

Cover	
- type and thickness	low iron glass, 3.2mm
- transmission	91.5%
Insulation	
- type	mineral wool
- thickness	50mm
Absorber	
- material	aluminium/copper
- absorption	95%
- emittance	5%
Thermal properties	
- zero loss coefficient	78.1%
- heat loss coefficient	a_1 = 3.83 W/m²/K a_2 = 0.0159 W/m²/K²
- heat capacity	c = 6.2 kJ/m²/K
- stagnation temperature	202°C
- peak power output	1540 W_{peak}

Figure 25 – Technical data Dimplex SOLC220 collector

4.2 Dimplex solar control unit SOLCU1/2/3

4.2.1 General description

Dimplex solar offer a range of solar control units with differing input and output options and functionality. All control units operate on the basic principles described in chapter 3.3.2. Figure 26 shows the SOLCU1 control unit detailing the main components which are common to all Dimplex solar control units.

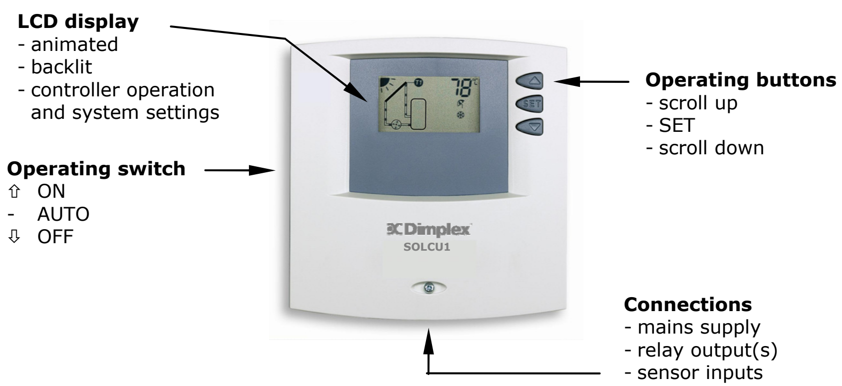


Figure 26 – Dimplex solar control unit overall view

A detailed description of the individual operation and function of the control units can be found in the respective installation and operating instructions.

4.2.2 Temperature sensors

All Dimplex solar control units come with three PT1000 temperature sensors which can be extended as required. The polarity of the sensor contacts is not important.

The length of the sensors delivered with each control unit is:
- collector sensor: 1.5m
- cylinder sensors (x2): 3.0m

When extending the collector sensor, the overvoltage protection box is to be used to protect the control unit from voltage surges caused by lightening (see Figure 27). The overvoltage protection box is part of the pump unit delivery.
The cable used for the extension of any of the sensors should meet the following minimum requirements:
- 0.75mm² up to 50m long
- 1.50mm² up to 100m long

Note: Sensor and mains cables must not be routed or ducted together. A minimum separation of 100mm or equivalent shielding must be observed.

Overvoltage protection	
ambient temperature	-25°C … +70°C
max. operating voltage	12V, DC
ingress protection	IP 65, DIN40050
weight	50g
dimensions l x w x h	80 x 80 x 50mm

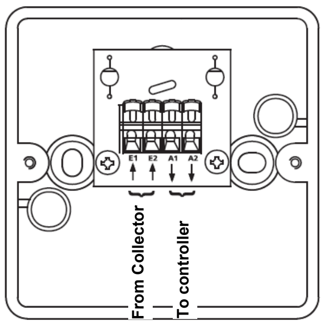


Figure 27 – Connection of collector temperature sensor to overvoltage protection box (included with Dimplex solar pump unit SOLPU1/2)

4.2.3 Technical data

The main features of the Dimplex solar control units SOLCU1/2/3 are summarised in Figure 28.

Feature	Control unit SOLCU1	SOLCU2	SOLCU3
operational voltage	230 V~, 50 Hz		
own consumption	< 1W	≤ 4W	
inputs (total)	**3**	**5**	**6**
- PT1000 temperature	3	5	6
-pulse	-	1	1
- direct sensor	-	1	1
outputs	**1**	**2**	**3**
-TRIAC output for RPM control 1.1 A	1	1	2
- relay switched output 3.47 A	-	1	1
-alarm output (potential free)	-	1	1
no of hydraulic schematics	**1**	**14**	**40**
ΔT ON	8 K	variable	
ΔT OFF	4 K	variable	
Display	Animated backlit LCD display		
Ingress protection	IP 20 (DIN 40050)		
Ambient temperature	0°C to +45°C		
Mounting options	Wall mounting		
Weight	0.25kg	0.45kg	0.50kg
Dimensions [mm]			
- length	137	170	
- width	134	170	
- depth	38	46	
Interfaces			
- RS232	-	1	
- RS485	-	1	
Energy gain calculation	**-**	**Yes**	
Data logging	**-**	**-**	**Yes**

Figure 28 – Technical data overall view Dimplex solar control units SOLCU1/2/3

4.3 Dimplex solar pump unit SOLPU1/2

4.3.1 General description

The Dimplex solar pump units SOLPU1 and SOLPU2 comprise a number of features aiding in the installation, commissioning, operation and maintenance of the solar thermal installation. The components of the pump unit are depicted in Figure 29 followed by a brief description of their function.

Ref.	Description
1	Connection from collector
2	Connection to collector
3	6bar pressure relief valve
4	Pressure gauge
5	Non return ball valve, temperature gauge
6	Circulation pump
7	Flush and fill point
8	Expansion vessel fixing kit (not included with pump unit)
9	Flow meter
10	Connection from cylinder
11	Bleed valve discharge
12	Insulation cover
13	Connection to cylinder
14	Air purger
15	Manual bleed valve from air purger
16	Non return ball valve, temperature gauge

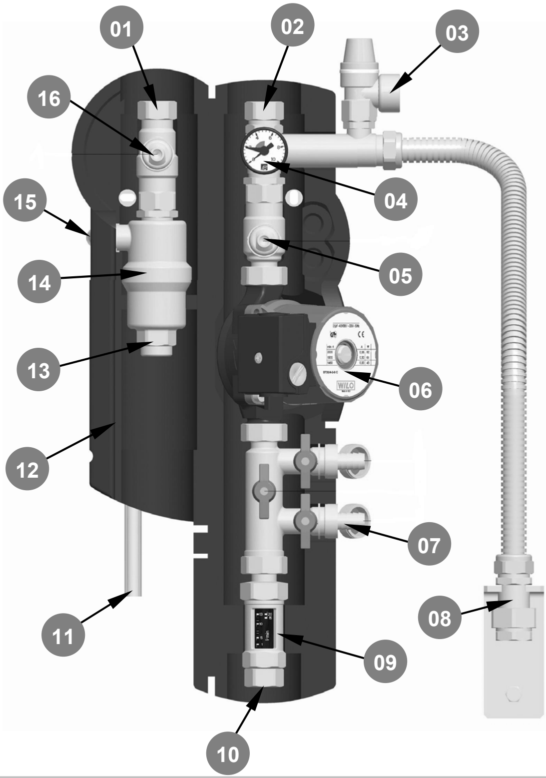


Figure 29 – Components of Dimplex solar pump unit SOLPU1 and SOLPU2

Pump unit connections (1, 2, 10 and 13)

The SOLPU1 pump unit connections can be utilised in three different ways:
- 3/4" flat seal at the end of corrugated stainless steel pipe
- 3/4"F x 22mm straight connection
- 15mm reducing set

The 15mm reducing set is included in the delivery of the SOLPU1 pump unit, the ¾" flat seal is part of the delivery of the Dimplex solar flexible hose SOLFH10/15. The ¾"F x 22mm straight connection has to be provided by the installer.

The SOLPU2 pump unit connections follow the same principle as those of the SOLPU1 except that the connection diameters are increased:
- 1" flat seal at the end of corrugated stainless steel pipe
- 1"F x 22mm or 1"F x 28mm straight connection
- 22mm reducing set

The 22mm reducing set is included in the delivery of the SOLPU2 pump unit, the 1" flat seal should be part of a DN20 corrugated stainless steel hose. Note, the Dimplex solar flexible hose SOLFH10/15 is DN16 and only provides ¾" connections. Should this product be applied to the SOLPU2 a 1" to ¾" reducer has to be provided with sufficient sealing surface for the flat seal to sit against. The 1"F x 22mm or 1"F x 28mm straight connection has to be provided by the installer.

6 bar pressure relief valve (3)
The 6 bar pressure relief valve is part of the safety components in the solar circuit. Its correct application is therefore important. The discharge pipe from the relief valve must be:
- 22mm copper pipe
- with no more than 2 bends
- terminating safely (it is recommended to end the discharge pipe in a suitable vessel and not to discharge to drain)

Should the pressure relief valve open and discharge fluid, this is a clear sign that the system is malfunctioning. The malfunction can be caused by:
- cold fill pressure of system too high
- expansion vessel too small
- expansion vessel pre-charge not adjusted correctly
- expansion vessel faulty
- solar collector array considerably oversized

Pressure gauge (4)
The pressure gauge indicates the current pressure inside the solar thermal loop. In a properly designed, installed, commissioned and operated system the pressure indicated by the pressure gauge should remain constant in all operating conditions.

Non return ball valve, temperature gauge (5 and 16)
The non return valve is critical in a solar thermal system to avoid gravity circulation at times when the cylinder is warmer than the collector as during night time hours. The non return valves avoid unwanted gravity circulation from the cylinder to the collector, thus losing energy from the system. As both the flow and the return path of the SOLPU1/2 pump units have a non return valve the circulation of flow from the collector to the cylinder can be eliminated when the pump is switched off.
The non return valves have an integrated ball valve which can be closed by turning the handle with the integrated manual thermometer by 90°. This allows the temporarily isolation of certain parts of the system for maintenance purposes. The non return valves can be opened for venting or draining purposes by turning the handles to 45°.

Circulation pump (6)
Two different circulation pumps are being utilised in the SOLPU1 and the SOLPU2 pump station to increase the capacity of the range. The characteristic pump curves for the pumps used are shown in Figure 30 along side the pressure drop of each pump unit.

Flush and fill point (7)
The flush and fill point allows the connection of the Dimplex solar flush and fill pump SOLFFP110/240 for the flushing and filling of the solar loop. Should a hand pump being used it is also to be connected at this point but not all three valves are being made use of during the filling process.

The centre valve of the flush and fill point is being used to adjust the flow rate if required.

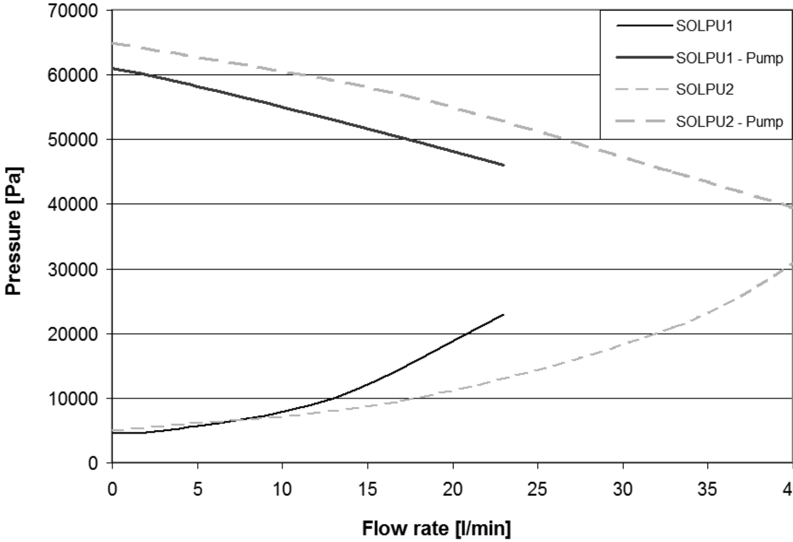


Figure 30 - Pump characteristics and pump unit pressure drop SOLPU1 and SOLPU2

Expansion vessel fixing kit (8)
The expansion vessel fixing kit is not part of the scope of delivery of the pump units but is part of the standard Dimplex solar kits and is suitable for expansion vessels of up to 24 litre contents. It simplifies the expansion vessel installation and reduces the maintenance effort.

Flow meter (9)
The flow meter indicates the flow rate of the solar loop. It aids during the commissioning process to adjust the flow rate correctly and assists during operation, maintenance and troubleshooting to identify eventual problems.

Air purger and related components (11, 14 and 15)
The heat transfer medium used has a high affinity to air, thus the air does not readily separate from the medium while the medium is cold. At the beginning of the operation of a solar thermal system therefore the heat transfer medium will release air into the system which would without the presence of a collection and separation device eventually cause the system to stop functioning.
The air purger collects the dissolved air and it can be conveniently vented from the manual bleed valve. The flexible bleed valve discharge tube ensures that the venting process can be done safely.

Insulation cover (12)
The insulation cover avoids unnecessary heat loss from the solar loop and gives the pump unit its aesthetically pleasing appearance.

4.3.2 Pump connection

The connection of the circulation pump to the control unit has to be considered in its application for:
- open vented hot water systems
- closed unvented hot water systems

When installing the solar thermal system in conjunction with an open vented system, the pump can be directly wired into the control unit as shown in the control unit manual.

When using an unvented hot water system, the pump has to be wired through the twin thermostat at the cylinder. Figure 31 shows the wiring schematic utilising the 4-way wiring centre provided with the pump unit.

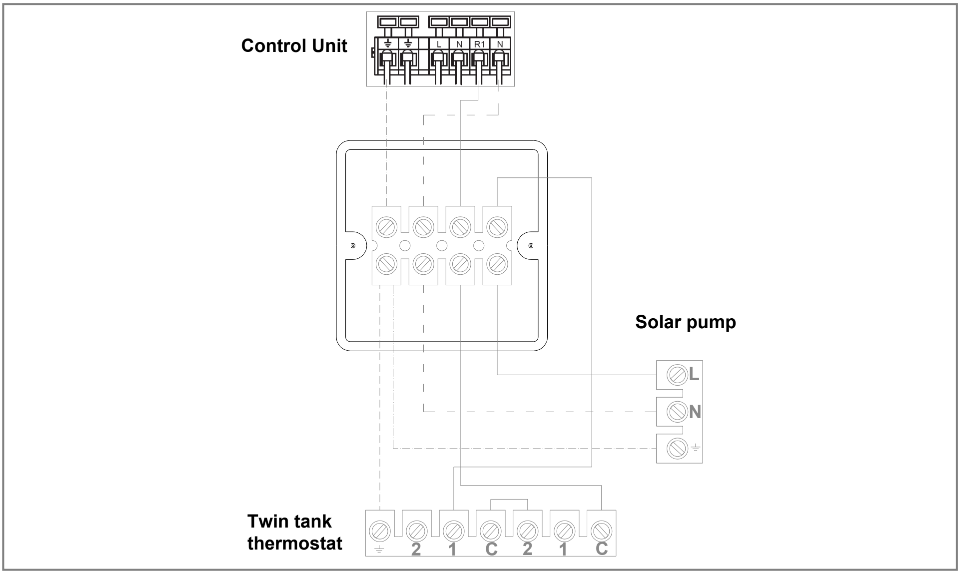


Figure 31 – Wiring of solar circulation pump to control unit utilising 4-way wiring centre

The use of a motorised two port valve is not required as long as:
- the pump unit has a non return valve in flow and return
- the circulation pump is connected using the twin thermostat mounted to the cylinder
- the cylinder is situated lower in the property than the lowest part of the solar collector

Should the above conditions not be given, the motorised two port valve has to be installed in series to the twin thermostat.

4.3.3 Technical data

Feature	**SOLPU1**	**SOLPU2**
Dimensions - length - width - depth	 520 mm 315 mm 170 mm	 535 mm 320 mm 180 mm
Flow rate range	1 – 20 l/min	5 – 40 l/min
Available head at maximum flow rate	46000 Pa	38000 Pa
Pump	Wilo Star ST 20/6	Wilo Star ST 25/7
Connections	¾" BSP M 15mm Compression	1" BSP M 22mm compression
Approximate liquid content	2.0 l	2.5 l
Non return valves	2 x 200mm wc (~2x 2000 Pa)	
Manual thermometer	0 – 160°C	
Pressure gauge	0 – 6bar	
Maximum operating pressure	6 bar	
Maximum operating temperature [°C]	120°C, temporarily 160°C	
Pressure relief valve [bar]	6bar, ¾" BSP F	
Flow – return pipe centre distance	90mm	
Connection expansion vessel	¾" BSP M	
Flush and fill point	3x ball valve arrangement	
Air purger	Manual bleed valve	
Sensor pocket	2x ½" BSP x 50mm	
Overvoltage protection	IP65 housing for collector sensor connection	
Wiring centre	4 way for unvented cylinder integration	
Materials - fittings - gaskets - o-rings - non return valves - insulation	 case: brass Klingersil – max. 200°C VITON / EPDM – max. 160°C Brass – max. 180°C EPP, λ = 0.041 W/m/K	

Figure 32 – Technical data Dimplex solar pump unit SOLPU1 and SOLPU2

4.4 Dimplex solar expansion vessels SOLEV

4.4.1 General description

Dimplex solar offer an extensive range of expansion vessels from 18 to 80 litres. All expansion vessels are particularly suited for the application in solar thermal systems with a high temperature resistant membrane which has also excellent diffusion barrier characteristics in conjunction with the heat transfer medium used in solar thermal systems.

In solar thermal systems the expansion vessels has a number of functions to ensure the safe and reliable operation of the system:
- absorption of additional system volume when system is heating up during normal operation
- absorption of steam volume of system when installation enters stagnation
- holding of medium reserve when system temperature drops below fill temperature

4.4.2 Expansion vessel sizing

A number of parameters have to be considered when sizing the expansion vessel. The parameters to be considered are:
- total system volume
- static height of system
- expansion coefficient of heat transfer medium
- opening pressure of pressure relief valve
- required pressure in highest system point
- number of collectors installed
- fluid content of each collector

Applying the above system parameters, Equation 5 can be used to calculate the expansion vessel size V_{EV}, the cold fill pressure of the system and the membrane pre-charge pressure of the expansion vessel.

$$V_{EV} = \frac{\left(V_{pc} + V_{ep} + n \cdot V_{col}\right) \cdot \left(p_{rv} + 1\right)}{\left(p_{rv} - p_{pc}\right) \cdot 0.6} \qquad [5]$$

Where:	V_{EV}	[l]	minimum expansion vessel volume
	V_{pc}	[l]	pre-charge volume
	V_{ep}	[l]	system expansion volume
	n	[-]	number of collectors connected to expansion vessel
	V_{col}	[l]	collector volume (SOLC220 = 1.7 litre)
	p_{rv}	[bar]	relief valve pressure
	p_{pc}	[bar]	cold fill pressure

Equation 6 is to be applied to determine the expansion vessel pre-charge volume V_{pc}.

$$V_{pc} = 0.005 \cdot V_{sys} \geq 3 litre \qquad [6]$$

Where:	V_{pc}	[l]	pre-charge volume
	V_{sys}	[l]	total system volume

The expansion volume of the system Vep can be calculated using Equation 7.

$$V_{ep} = V_{sys} \cdot \beta \qquad [7]$$

Where:	V_{ep}	[l]	system expansion volume
	V_{sys}	[l]	total system volume
	β	[-]	heat transfer medium expansion coefficient (0.00085)

The pressure relief valve pressure p_{rv} can as first approximation be used as 6 bar. However, to allow for some tolerance it is recommended to calculate the pressure relief valve pressure p_{rv} in accordance with Equation 8.

$$p_{rv} = p_{op} \cdot (1 - 0.1) \qquad [8]$$

Where:	p_{rv}	[bar]	relief valve pressure
	p_{op}	[l]	opening pressure of relief valve (6 bar)

The last parameter to be calculated for use in Equation 5 is the cold fill pressure p_{pc} of the system. The cold fill pressure p_{pc} depends on the static height h_{stat} of the solar thermal system and the required pressure in the highest system point p_{min}. The definition of the static height h_{stat} is depicted in Figure 33.

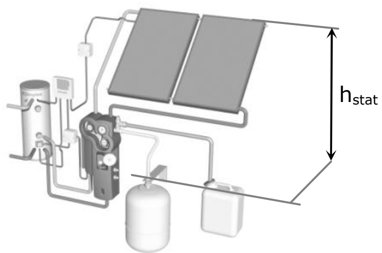


Figure 33 – Definition of static height of solar system

The pressure in the highest system point p_{min} should be between 1 and 1.5 bar. The cold fill pressure p_{pc} can therefore be calculated as shown in Equation 9.

$$p_{pc} = p_{\min} + 0.1 \frac{bar}{m} \cdot h_{stat} \qquad [9]$$

Where:	p_{pc}	[bar]	cold fill pressure
	p_{min}	[bar]	pressure in highest system point
	h_{stat}	[m]	static height of system

Equation 9 concludes the calculation of parameters required for Equation 4 to calculate the expansion vessel volume V_{EV}. To be able to commission the expansion vessel, the membrane pre-charge pressure p_{mp} has to be calculated as shown in Equation 10.

$$p_{mp} = p_{pc} \cdot \frac{V_{EV} - V_{pc}}{V_{EV}} \qquad [10]$$

Where:			
	p_{mp}	[bar]	membrane pressure
	p_{pc}	[bar]	cold fill pressure
	V_{EV}	[l]	expansion vessel volume
	V_{pc}	[l]	pre-charge volume

The expansion vessel membrane pressure p_{mp} has to be adjusted before the system is being filled and pressurised. Once the theoretical expansion vessel volume has been calculated, the next larger available vessel is to be chosen.

A sizing guide of the expansion vessel under the stated conditions is given in Figure 34. Please note that the calculation should be carried out in the case that the assumptions shown in Figure 34 do not apply.

Static height [m]	Collector area 2m²	4m²	6m²	8m²	10m²	12m²
0m	18	18	18	24	35	35
2m	18	18	18	24	35	35
4m	18	18	18	24	35	35
6m	18	18	18	24	35	35
8m	18	18	24	35	35	50
10m	18	18	24	35	35	50
12m	18	18	24	35	35	50
14m	18	18	24	35	50	50
16m	18	18	35	35	50	50
18m	18	18	35	50	50	80
20m	18	24	35	50	50	80

System parameters:

2 to 6m²:
- system volume = 12 litres + respective collector volume
- pressure in highest point = 1.5bar
- TYFOCOR LS medium
- all other components Dimplex Solar

8 to 12m²:
- system volume = 20 litres + respective collector volume
- pressure in highest point = 1.5bar
- TYFOCOR LS medium
- all other components Dimplex Solar (except cylinder)

Figure 34 – Expansion vessel sizing chart applying Equations 5 to 10

4.4.3 Technical data

Feature	Type SOLEV ... 18	24	35	50	80
Diameter [mm]	260	260	380	380	460
Height [mm]	375	485	450	590	690
Connection - size - position	3/4" M TOP		SIDE		TOP
Working temperature range	-10°C to +100°C				
Membrane charge	2.5 bar				
Max. operating pressure	10 bar				

Figure 35 – Technical data Dimplex SOLEV expansion vessels

4.5 Dimplex expansion vessel fixing kit SOLVK1

4.5.1 General description

The expansion vessel fixing kit SOLVK1 aids with the installation, maintenance and de-commissioning of the solar thermal system. The product consists of (see Figure 36):
- expansion vessel wall bracket (suitable for vessels of up to 440mm)
- 500mm corrugated stainless steel hose with ¾" flat seal connections
- quick fit connection

Ref.	Description
1	500mm corrugated hose
2	wall bracket
3	quick fit connection

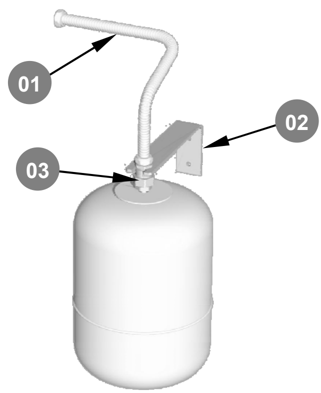


Figure 36 – Components Dimplex solar expansion vessel fixing kit SOLVK1

It is not recommended to fit vessels larger than 24 litres using the expansion vessel fixing kit as faulty vessels gain considerably in weight and the wall bracket would not support the additional weight.

The 500mm corrugated stainless steel hose allows the expansion vessel to be directly connected to the expansion vessel connection port of the Dimplex solar pump units SOLPU1 and SOLPU2.
The quick fit connection is a combined retainer and vessel connection. The vessel connection incorporates a fast acting two way valve operating always in the direction of lower pressure. Should the vessel need maintained or replaced, the fitting eliminates the need for the system to be drained down as it will close as soon as the vessel disconnects from the circuit.
Once the vessel is maintained or replaced the same fitting can be used to reconnect the vessel to the system.

4.5.2 Technical data

	Component		
Feature	Connection hose	Wall bracket	Connection
Material	stainless steel	plated mild steel	brass
Length	500mm	up to Ø440mm	n/a

Figure 37 – Technical data Dimplex expansion vessel fixing kit SOLVK1

4.6 Dimplex heat transfer medium SOLHT20

4.6.1 General description

The Dimplex solar heat transfer medium SOLHT20 is a ready to use 1.2-polypropylene glycol fluid for solar thermal installations. The product has particularly good characteristics at higher temperatures where the liquid inhibitors resolve more readily back into the solution than solid inhibitors.

This increases the useable life of the product, reduces the acidity of the medium when at high temperatures and ensures the frost protection function is not being lost. In addition the inhibitors will not solidify inside the solar system and block ducts with small diameters.

The heat transfer medium is ready mixed and must not be diluted on site. When replacement of lost medium is required it is important to ensure that only the same medium is being used.

Dimplex provide a test kit, SOLHTTK, to monitor the condition of the medium over the course of its life.

4.6.2 Technical data

Feature	
Appearance	clear, red fluorescent
Density (20°C)	1.032 - 1.035 kg/l
Heat capacity (20°C)	3.6 kJ/kg/K
pH value	9.0 - 10.5
Boiling point	102 - 105°C
Frost protection	-28°C
Temperature resistance - long term:	 170°C
- short term:	200°C

Figure 38 – Technical data Dimplex solar heat transfer medium SOLHT20

4.7 Dimplex solar cylinders SCx

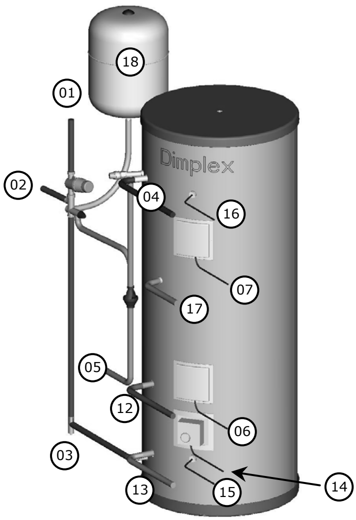
4.7.1 General description

Dimplex offer a range of direct electric and indirect heated solar cylinders from 175 litre to 305 litre overall volume. An overall view of the products is given in Figure 39 and a summary of the key features is given in Figure 40.

The inlet and outlet pipe routing of the cylinders is in such a way that during water draw offs the stratification of the stored hot water is effected as little as possible, ensuring the maximum amount possible to be drawn at high water temperatures.
In addition, the sloped outlet pipe of the cylinder minimises the required installation height and reduces the heat losses from the unit to a minimum.

The corrugated stainless steel solar coil ensures high heat transfer rates and minimises the risk of lime build up. The position of the solar coil ensures maximum usage of the available cylinder volume without compromising the comfort of sufficient auxiliary volume available.

SCx175/215/255/305sd



Reference	Description
1	Cold water mains supply
2	Balanced cold water supply
3	Cylinder drain point
4	Hot water supply
5	Discharge pipe
6	Off peak immersion supply
7	Boost immersion supply
8	Indirect heating flow
9	Indirect heating return
10	Indirect heating twin thermostat
11	Indirect heating motorised two port valve
12	Solar heating flow
13	Solar heating return
14	Solar heating twin thermostat
15	Solar cylinder sensor BOTTOM
16	Solar cylinder sensor TOP
17	Secondary return
18	Expansion vessel

SCx175/215/255/305si

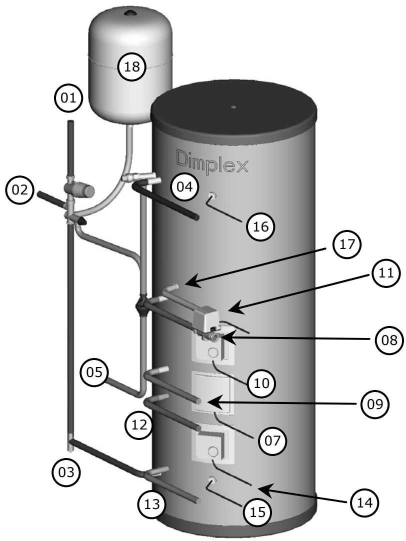


Figure 39 – Overall view Dimplex solar SCx unvented stainless steel cylinders

Feature	SCx si	SCx sd
Materials		
- inner cylinder	Duplex stainless steel	
- outer cylinder	dove grey leather grain coated steel	
- inlet/outlet	stainless steel	
- coils	corrugated stainless steel	
- insulation	60mm PU foam (GWP=1, ODP=0)	
Maximum operating conditions		
- potable water temperature	70°C	
- heating water temperature	95°C	
- operating pressure	6bar	
Cold water supply		
- minimum dynamic pressure	1.5bar	
- minimum flow rate	15 l/min	
- maximum mains pressure	25bar	
Connections		
- cold water inlet	22mm stainless steel	
- hot water outlet	22mm stainless steel	
- secondary return	1/2" F BSP	
- coil flow and return	22mm stainless steel	
- sensor bosses	1/2" F BSP	
Coil specification		
- surface area	0.75m² / 1.1m²	- / 1.1m²
- rating	17kW / -	- / -
Immersion heater	1 x 3kW	2 x 3kW
Thermostatic control		
- direct input	- integral immersion heater thermostat and cut out	
- indirect input	- external twin thermostat and cut out	
Safety components		
- pressure reducing valve and strainer	3bar	
- expansion relief valve	6bar	
- temperature and pressure relief valve	7bar/90°C	
- factory pressure test	10bar	

Figure 40 – Key features Dimplex solar cylinders SCx

4.7.2 Wiring integration Dimplex solar cylinders SCx

There are several ways to integrate the Dimplex solar cylinders into an existing or a new central heating system. The principle plumbing and wiring schematics are shown for two systems in Figures 41 and 42. Please note that these illustrations do not show all the required components to ensure a safe and reliable operation of the systems.

Figure 41 shows the integration using 2x two port motorised valves. The advantage of this system is that the provision of space heating and the provision of domestic hot water can be carried out independently.

Figure 42 shows the application of a three way diverter valve allowing the provision of hot water and central heating at the same time. However, to comply with the regulative requirements the fitting of a motorised two port valve to the cylinder is still required.

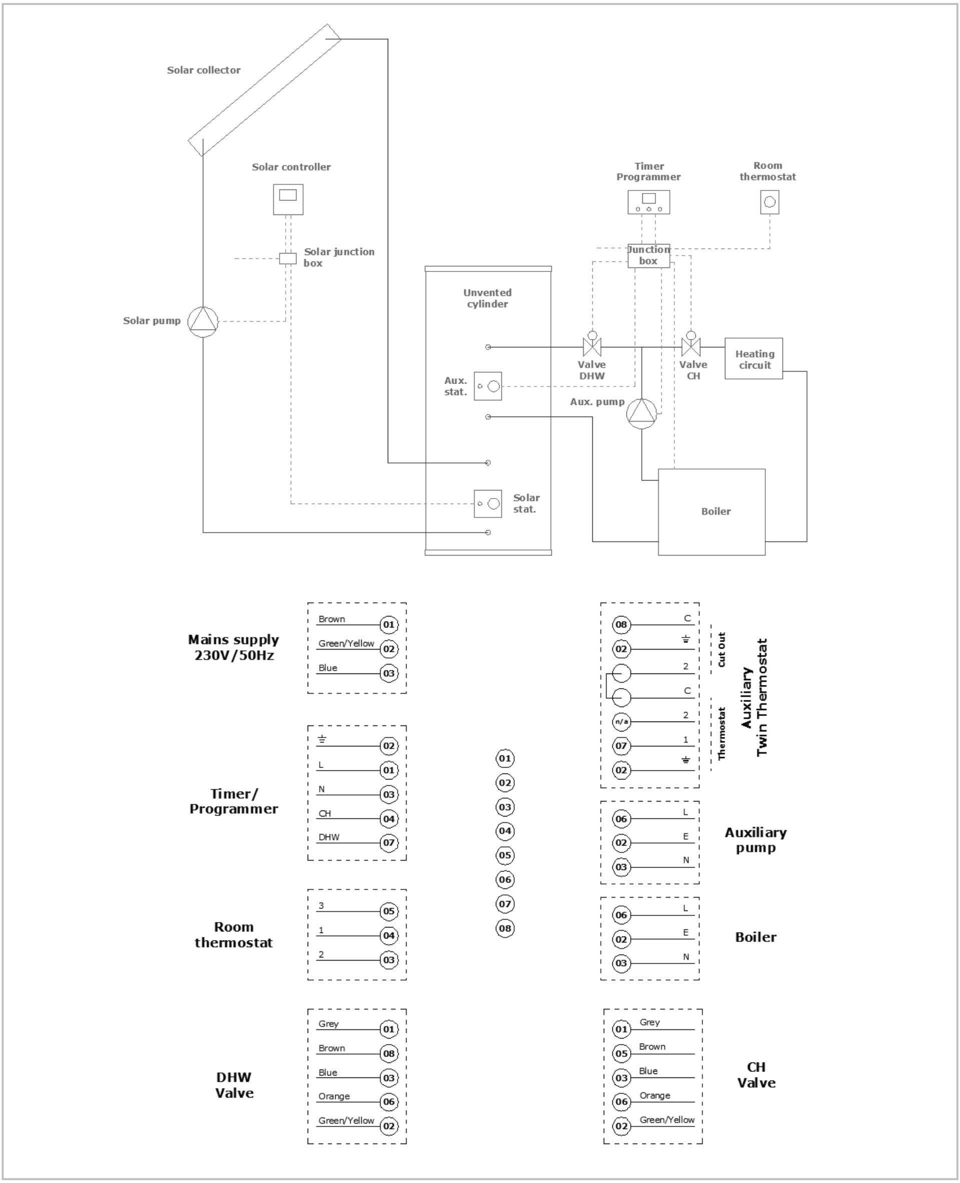


Figure 41 – Auxiliary loop integration 2x motorised two port valve

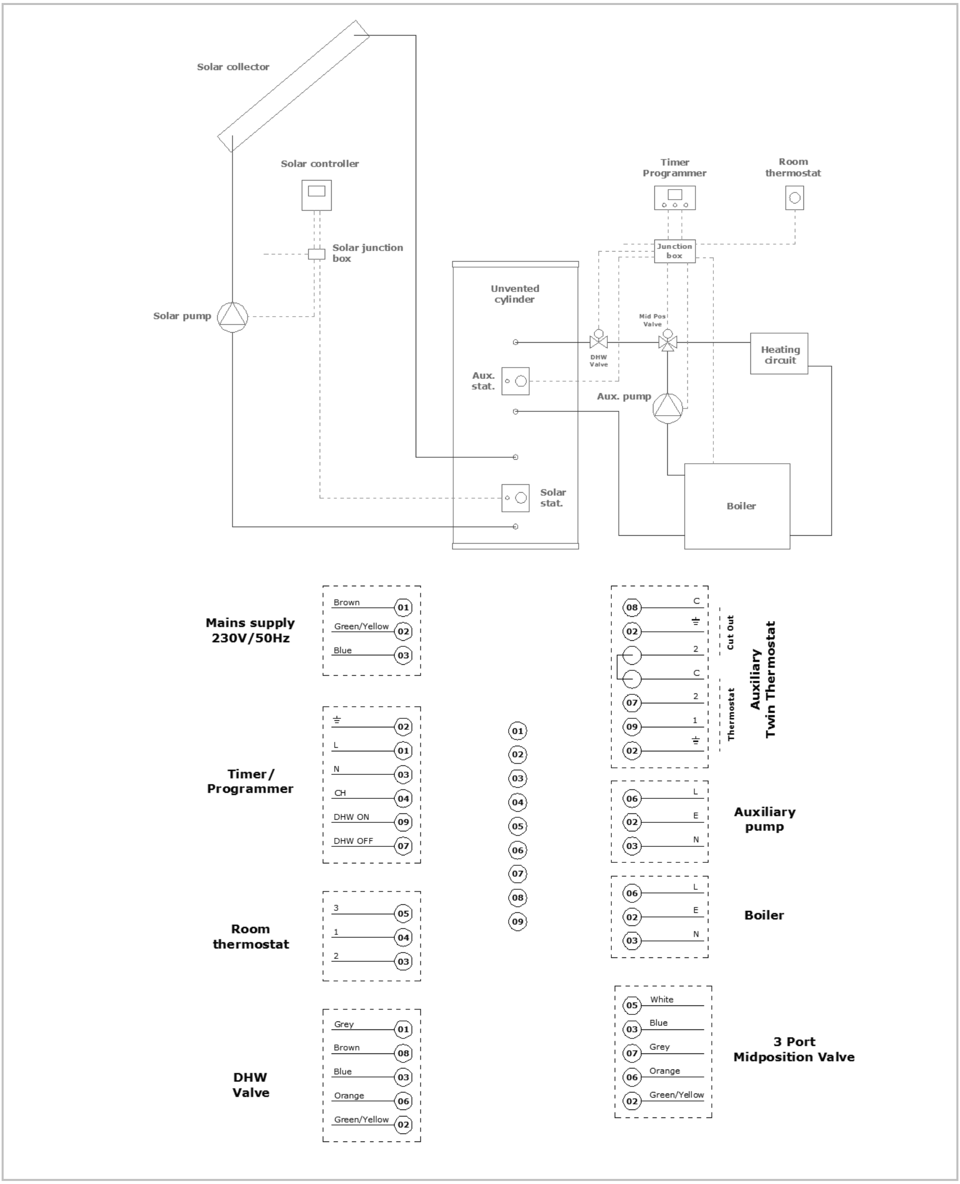


Figure 42 - Auxiliary loop integration 1x motorised two port valve and mid-position valve

The integration of the solar thermal control and pump unit independent from manufacturer nomenclature is shown in Figure 43.

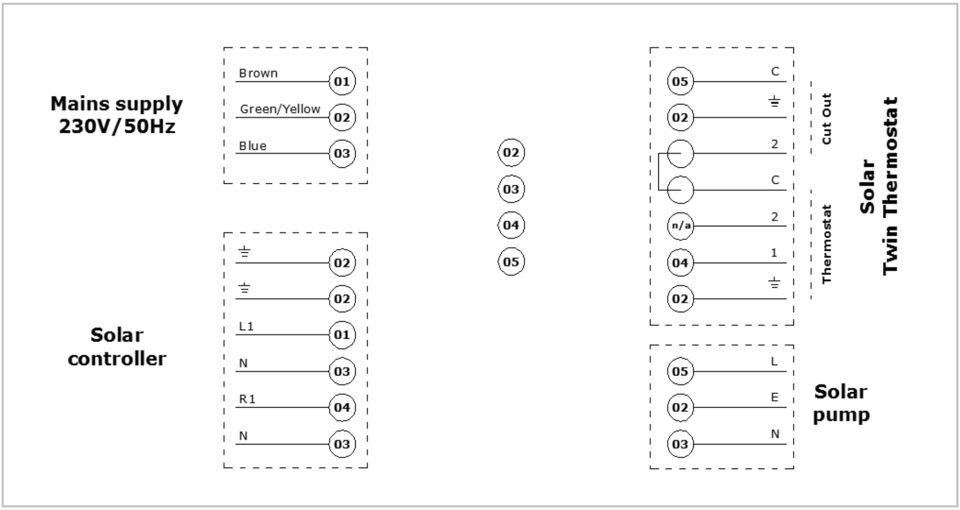


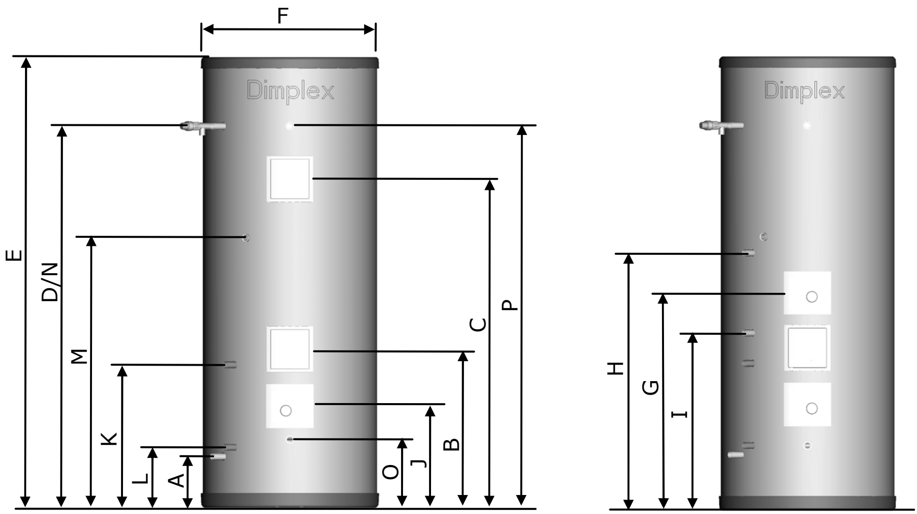
Figure 43 – Solar loop integration

4.7.3 Hydraulic integration Dimplex solar cylinders SCx

Should the cylinder range of 175 to 305 litres not be sufficient, any number of cylinders can be connected in parallel or in series to achieve higher storage volumes. The following should be observed when connecting the cylinders:

- each cylinder must be equipped with its own safety equipment as part of the scope of delivery
- each cylinder must have its own save discharge in accordance with building regulations
- connect the cylinders on the potable and energy supply side in series when an even demand is required over a period of time
- connect the cylinders on the potable and energy supply side in parallel when peak demands are expected exceeding the capacity of an individual cylinder with its supply
- when installing larger systems ensure a risk assessment is carried out in accordance with approved code of practise L8 from the HSE
- ensure each cylinder is accessible for maintenance and replacement work as required
- ensure the hydraulic circuit from the solar loop is balanced, i.e. the correct flow rate is achieved through each coil

4.7.4 Technical data



		SCx			
Capacity		**175**	**215**	**255**	**305**
Weight [kg]	sd	44	52	59	69
	si	48	56	63	73
Heat loss [kWh]	sd/si	1.78	2.19	2.31	2.51
Heat up time [mns]	sd	20	24	29	34
	si	18	22	25	30
Re-heat time [mns]	sd	14	17	20	24
	si	13	18	19	22
A [mm]	sd/si	182			
B [mm]	sd/si	531/589			
C [mm]	sd	846	1087	1355	1631
D/N/P [mm]	sd/si	1017	1259	1527	1804
E [mm]	sd/si	1243	1485	1753	2029
F [mm]	sd/si	574			
G [mm]	si	711			
H [mm]	si	842			
I [mm]	si	580			
J [mm]	sd/si	346			
K [mm]	sd/si	480			
L/O [mm]	sd/si	213			
M [mm]	sd	803	879	1057	1196
	si	774	1116	1029	1167
Aux. vol. [l]	sd	90	130	170	220
	si	80	120	160	205
Volume auxiliary coil [l]		2.4			
Volume solar coil [l]		3.5			

Figure 44 – Technical data Dimplex solar cylinder SCx

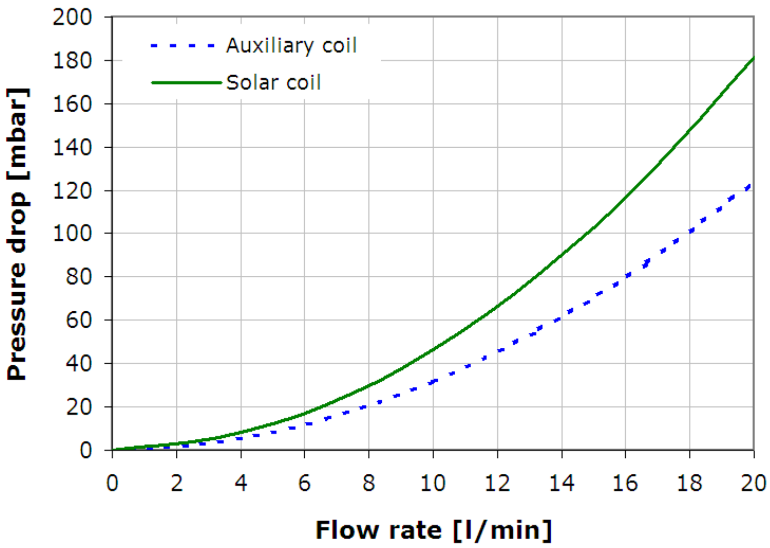


Figure 45 – Pressure drop Dimplex solar SCx cylinder coils

4.8 Dimplex solar accessories

4.8.1 General description

To aid in the installation, commissioning, maintenance and the realisation of more complex systems Dimplex offer a range of accessories as summarised in Figure 46.

Installation aids	Corrugated flexible pipe, pre-insulated with integrated sensor cable (10m and 15m)
	Feed through tile for tile/slate
	Feed through tile for sheet metal
	Free standing rear strut (30° to 40°)
	Free standing bottom bar
	Collector cover
	Collector lifting hook
	Suction lifter
Commissioning aids	Flush and fill pump (110V and 240V)
	Air separator
Maintenance	Heat transfer medium test kit
System solutions	Flow meters (1 to 20 l/min and 2 to 40 l/min)
	2 port valves
	3 port valves
	Thermostatic mixing valve (22mm)

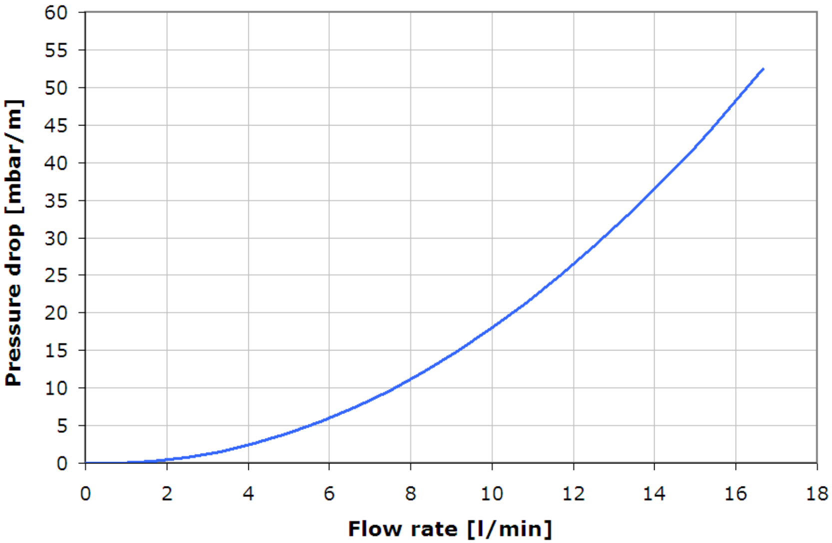
Figure 46 – Dimplex solar accessories

4.8.2 Corrugated flexible pipe SOLFH10/15

The Dimplex solar flexible corrugated stainless steel pipe includes:
- high temperature and weather resistant insulation
- integrated 2 core sensor cable
- wall fixings
- connection fittings from the collector to the pump unit and from the pump unit to the cylinder
- 10m or 15m length.

The SOLFH10/15 pipe work reduces the installation time considerably by reducing the number of joints to be performed, insulation of the pipe work separately, laying the sensor cable and ensuring the leak tightness along its installation.

The technical data of the SOLFH10/15 pipe work is summarised in Figure 47.



Feature	
Material	Stainless steel 316L
Volume	0.22 l/m
Weight	0.091 kg/m
Size	DN 16

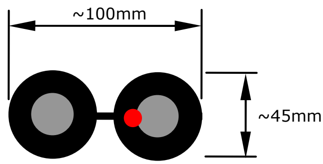


Figure 47 – Technical data Dimplex flexible hose SOLFH10/15

4.8.3 Feed through tiles SOLFTT and SOLFTM

The Dimplex solar feed through tiles are suitable for corrugated and plain tiles, slate roof coverings and sheet metal coverings depending on the type chosen:
- SOLFTT: corrugated and plain tile, slate roof covering
- SOLFTM: sheet metal roof covering, plain or corrugated

For each pipe feed through one tile of the appropriate type is required. The product allows pipes and cables from 0 to 35mm to be fed securely into the roof. The feed through tiles are suitable for plain copper tubing and for corrugated stainless steel hose.

An overall view of the two types of feed through tiles and the technical data are given in Figure 48.

SOLFTT

SOLFTM

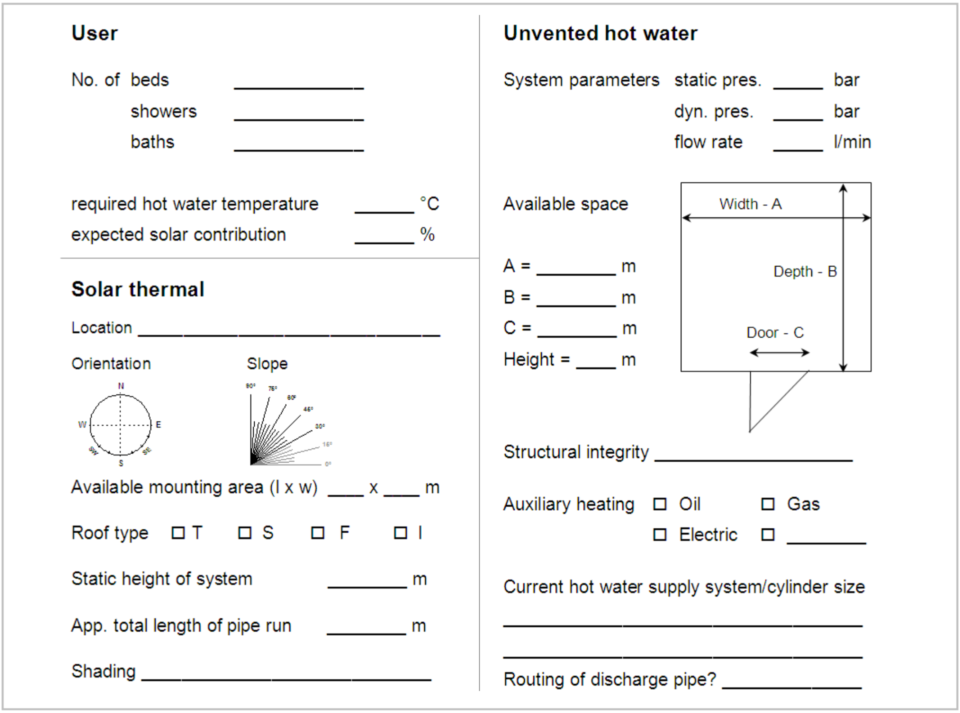
	SOLFTT	SOLFTM
Roof covering	- corrugated tile	- plain sheet metal
	- plain tile	- corrugated sheet metal
	- slate	
Roof pitch	0° to 45°	0° to 60°
Dimensions		
- width	490mm	100mm
- length	410mm	100mm
Material		
- base	Lead	Aluminium
- feed through	Silicone rubber	EPDM
Operating temperature	up to 200°C (250°C)	up to 115°C (150°C)
Colour	grey/red	grey/black

Figure 48 – Overall view feed through tiles SOLFTT and SOLFTM

5 System sizing

5.1 Required information

The sizing of solar thermal systems depends on a number of factors which require the use of solar simulation software to allow reliable solar fraction predictions. The information required to reliably specify a domestic solar thermal hot water system is shown in Figure 49.



User

No. of beds ____________
showers ____________
baths ____________

required hot water temperature ______ °C
expected solar contribution ______ %

Solar thermal

Location ____________________________

Orientation
Slope

Available mounting area (l x w) ___ x ___ m

Roof type ☐ T ☐ S ☐ F ☐ I

Static height of system _______ m

App. total length of pipe run _______ m

Shading ___________________________

Unvented hot water

System parameters static pres. _____ bar
dyn. pres. _____ bar
flow rate _____ l/min

Available space

A = _______ m
B = _______ m
C = _______ m
Height = ____ m

Width - A
Depth - B
Door - C

Structural integrity ________________

Auxiliary heating ☐ Oil ☐ Gas
☐ Electric ☐ _______

Current hot water supply system/cylinder size

____

____

Routing of discharge pipe? ____________

Figure 49 – Required information for domestic solar thermal hot water system sizing

It can be seen from Figure 49 that the suitability of solar thermal depends primarily on the user and the local conditions.

5.2 Sizing guide

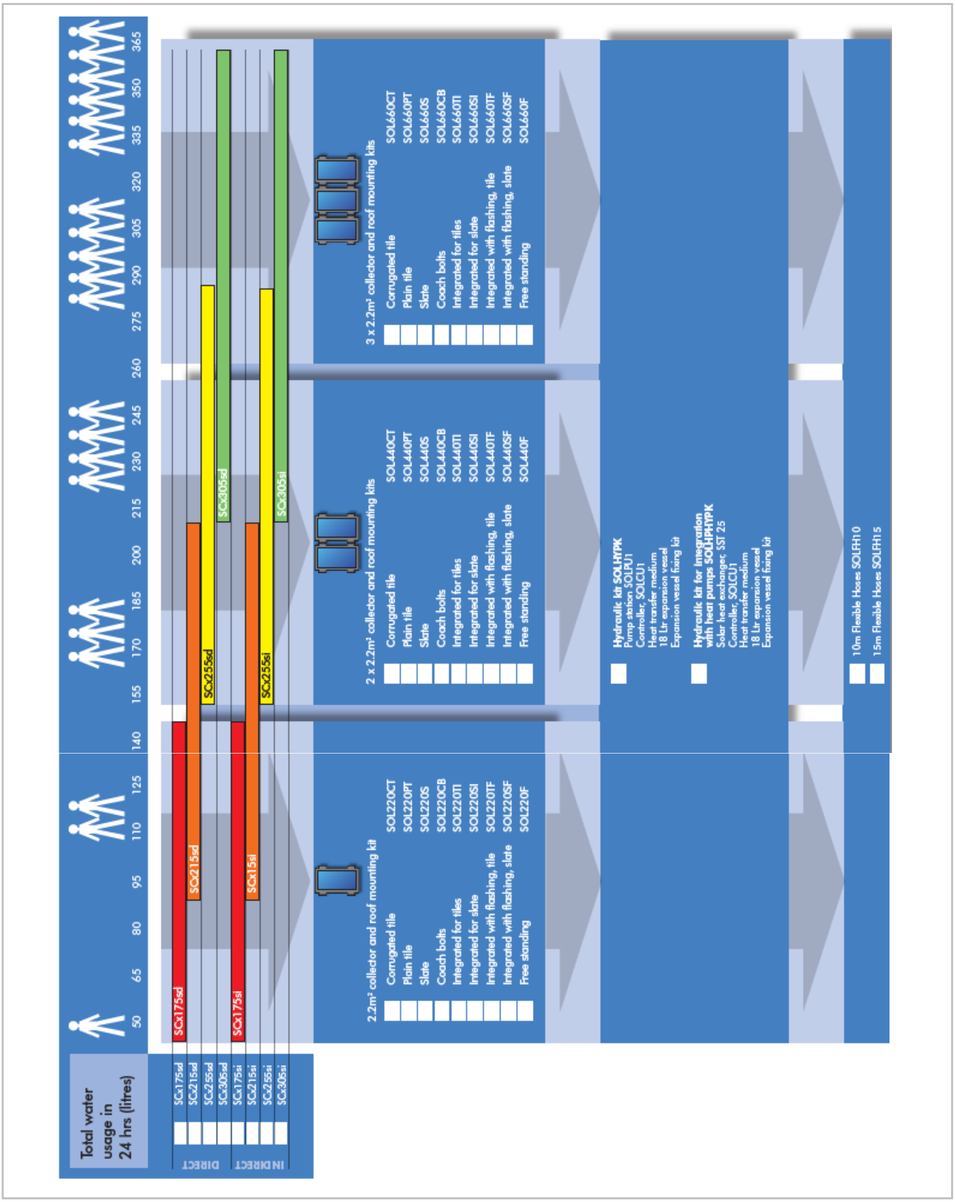


Figure 50 – Dimplex solar initial sizing guide

For an initial assessment the following sizing guide (Figure 50) can be used to discuss the feasibility of solar. It is however recommended, following the completion of the sizing guide to complete the On Site Questionnaire as shown in Figure 49 and Appendix 11.1 to validate the initial sizing with a detailed solar fraction simulation.

The solar fraction achieved using the sizing guide shown in Figure 50 will vary depending on the location of the installation within the UK (see Figure 3), its orientation (see Figure 5) and the actual hot water demand.

6 Pipe work

For installation where the Dimplex solar corrugated stainless hose SOLFH10/15 is not suitable, it is required to specify the correct pipe work for the installation.

6.1 Type of pipe work

Only full metal pipe work must be used in solar thermal installations. Plastic or composite materials are not suitable due to the high temperatures that can occur in solar thermal installations and the compatibility with the heat transfer medium.

Due to its ease of use and the readily available fittings it is recommended to use copper as pipe material. Steel pipe work can also be used when it is ensured that it always terminates into a brass fitting before getting in contact with copper.

The joints of the pipe work must be carried out in such a way that they are suitable for the pressure and the temperatures present in the solar thermal system. For copper pipe work it is recommended to work with brass compression fittings with brass olives.

6.2 Pipe work sizing

The size of the pipe work depends primarily on the flow rate circulating through the pipe work. As discussed in Chapter 4.1.2 each collector requires a specified flow rate to ensure optimum operation and efficiency.

Equation 11 can be used to calculate the minimum required inner pipe diameter ID_min in mm:

$$ID_{\min} = 4.6 \cdot \sqrt{\frac{\dot{V}}{w}} \qquad [9]$$

Where:	ID_{min}	[mm]	minimum required pipe diameter
	4.6	[-]	unit conversion factor
	V	[l/min]	flow rate through pipe
	w	[m/s]	flow velocity through pipe

Due to the higher viscosity of the heat transfer medium in comparison to water the flow velocity w should not exceed 0.5 to 0.7m/s. A number of typical pipe diameters for various collector field sizes are given in Figure 51 with a flow velocity of 0.5 and 0.7m/s.

<table>
<tr><th rowspan="2">No. of collectors</th><th colspan="2">Max. flow velocity w = 0.7 m/s</th><th colspan="2">Max. flow velocity w = 0.5 m/s</th></tr>
<tr><th>Low flow [1 l/min/collector]</th><th>High flow [2 l/min/collector]</th><th>Low flow [1 l/min/collector]</th><th>High flow [2 l/min/collector]</th></tr>
<tr><td>1</td><td rowspan="4">Cu 15 x 1</td><td rowspan="2">Cu 15 x 1</td><td rowspan="3">Cu 15 x 1</td><td>Cu 15 x 1</td></tr>
<tr><td>2</td><td rowspan="3">Cu 22 x 1</td></tr>
<tr><td>3</td><td rowspan="4">Cu 22 x 1</td></tr>
<tr><td>4</td><td rowspan="5">Cu 22 x 1</td></tr>
<tr><td>5</td><td rowspan="6">Cu 22 x 1</td><td rowspan="3">Cu 28 x 1.2</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td rowspan="4">Cu 28 x 1.2</td></tr>
<tr><td>8</td><td rowspan="3">Cu 35 x 1.5</td></tr>
<tr><td>9</td><td rowspan="2">Cu 28 x 1.2</td></tr>
<tr><td>10</td></tr>
</table>

Figure 51 – Suitable pipe diameters for various collector field sizes

6.3 Pipe work pressure drop

To be able to determine the suitability of the circulation pump it is important to be able to calculate the pressure drop of the pipe work. Figure 52 summarises the approximate pressure drop Δp_pipe in 1m of pipe work at 0.5 and 0.7m/s assuming that the glycol pressure drop is 30% higher than that of water.

Pipe size	$\Delta p_{\_pipe}$ [mbar/m] 0.5 m/s	0.7 m/s
Cu 15 x 1	3.33	6.03
Cu 22 x 1	1.95	3.54
Cu 28 x 1.2	1.43	2.61
Cu 35 x 1.5	1.09	1.99

Figure 52 – Pressure drop copper pipe per metre

6.4 Pipe work liquid content

To be able to reliably determine the liquid content of the system when specifying the required amount of heat transfer medium and when sizing the expansion vessel, Figure 53 summarises the liquid content for the above selection of copper pipe.

Pipe size	Volume [l/m]
Cu 15 x 1	0.1327323
Cu 22 x 1	0.3141593
Cu 28 x 1.2	0.5147185
Cu 35 x 1.5	0.8042477

Figure 53 – Liquid volume of copper pipe for 1 metre length

6.5 Pipe work fixation

When fixing the pipe work to the building structure a number of points should be considered before choosing the fixation method:
- temperature of liquid carried in pipes
- sound transfer from pipe work into building structure
- thermal expansion and contraction of pipe work due to large temperature changes
- safe securing of pipe work to building structure
- fire safety

It is important that the pipe work is secured to the building structure in a safe and proper manner. Only wall/floor fixings that are suitable for the given conditions should be used. When routing the pipe work on the outside of the building also the aesthetic impact of the pipe work on the building should be considered.

The recommended distance between fixation points for various copper pipe sizes are shown in Figure 54.

Pipe size	Distance [m]
Cu 15 x 1	1.25
Cu 22 x 1	2.00
Cu 28 x 1.2	2.25
Cu 35 x 1.5	2.75

Figure 54 – Distance between fixation points of copper pipe work

6.6 Pipe work insulation

Additional requirements are in place for insulation used in solar thermal installations compared with conventional heating and hot water systems. When choosing a suitable insulation the following should be considered:
- the heat transfer medium in the pipe work can reach +150°C
- the insulation has to be UV and weather resistant
- the insulation should be at least 100% of the inner pipe diameter (e.g. a 22mm pipe should be insulated with at least 19mm of insulation).

The Dimplex solar connection hoses which are delivered with the various roof fixing kits and the 10m and 15m flexible pipes SOLFH10/15 are insulated with the appropriate material.

7 Commissioning

The commissioning of a Dimplex solar thermal system is a simple procedure as outlined in Figure 55.

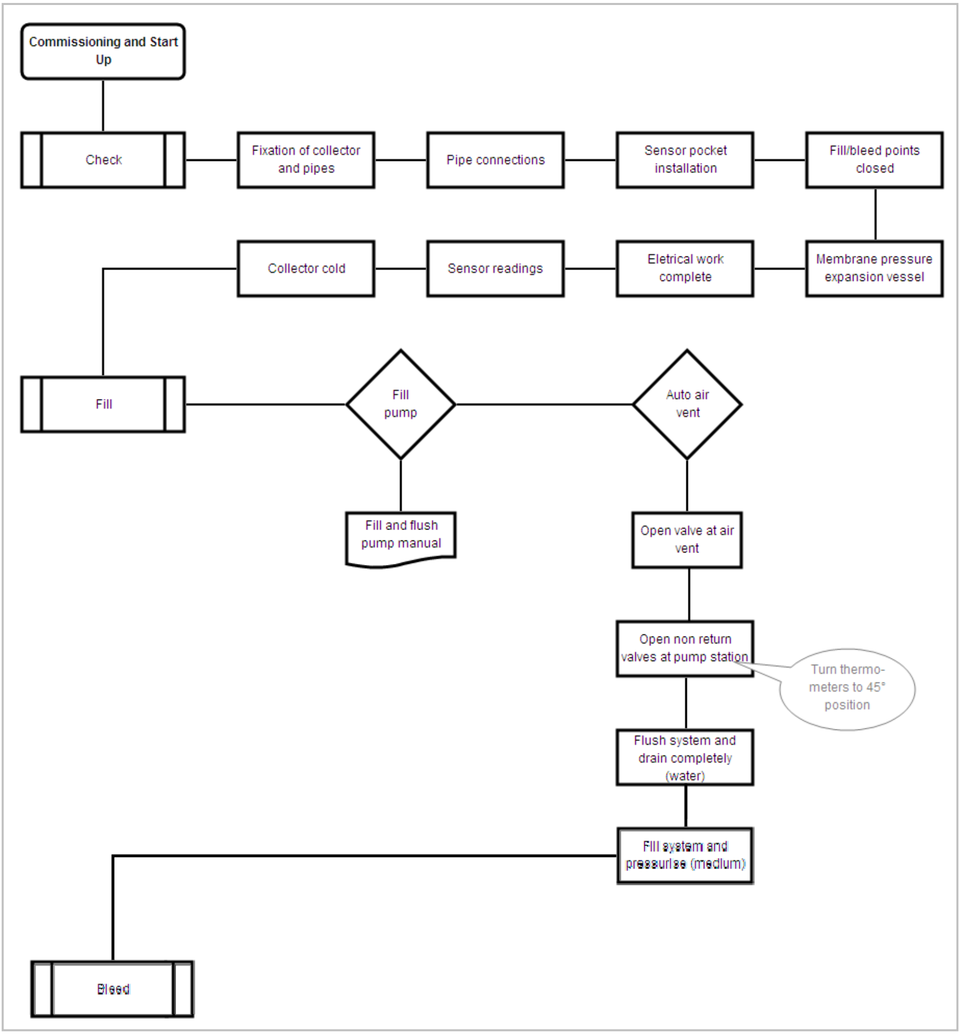


Figure 55 – Dimplex commissioning procedure Part 1

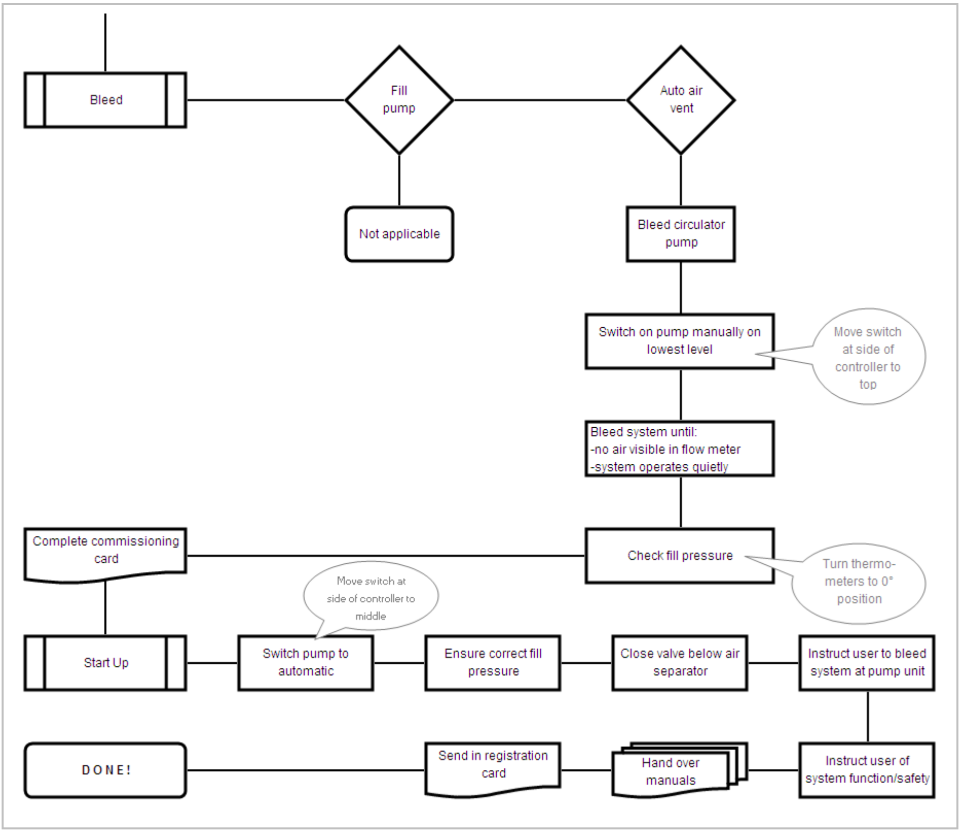


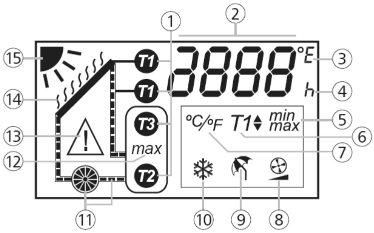
Figure 55 – Dimplex commissioning procedure Part 2

8 Operation

8.1 Control unit

In general the operation of the Dimplex solar thermal system is fully automatic and does not require any user intervention to ensure its efficient, safe and reliable operation. However, the solar control unit offers a number of useful information that might be of interest to the user.
In addition, the following settings and functions can be altered and activated or deactivated as applicable (see Figure 56):
- cylinder temperature setting
- temperature unit °F/°C

- holiday and frost protection function
- variable speed control of circulating pump



1. Symbols of the temperature sensors
   T1 top = collector sensor
   T1 bottom = sensor for tube collector function
   T2 = sensor for lower area of storage tank
   T3 = sensor for upper area of storage tank
2. Display for temperature values, operating hours and fault symbols, e.g. short circuit, interruption (see page 38) or "SYS" = system error (see page 39)
3. Display for temperature unit °C / °F
4. Operating hours
5. Setting the maximum storage tank temperature (max) and display of min / max temperature values
6. Tube collector function
7. Setting the temperature unit °C / °F
8. Speed control
9. Holiday function (see page 34)
10. Anti-freeze function (see page 33)
11. Symbols pumping plant and circluation of heat transfer fluid
12. Displays message "Maximum storage tank temperature has been reached"
13. Warning display if faults occur, e.g. short circuit, interruption (see page 38) or "SYS" = system error (see page 39)
14. The maximum temperature of the collector is achieved, so the controller fluid is eventually evaporated.
15. The display of the starting temperature is achieved, that is "achieved thermal supply"

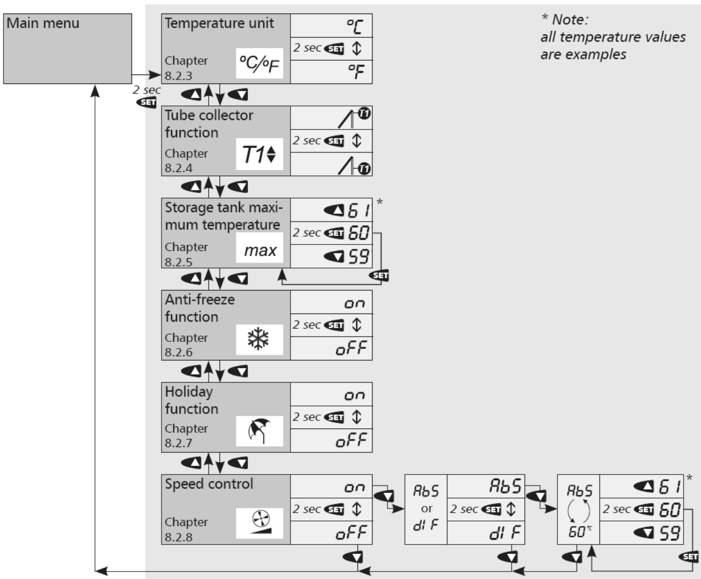
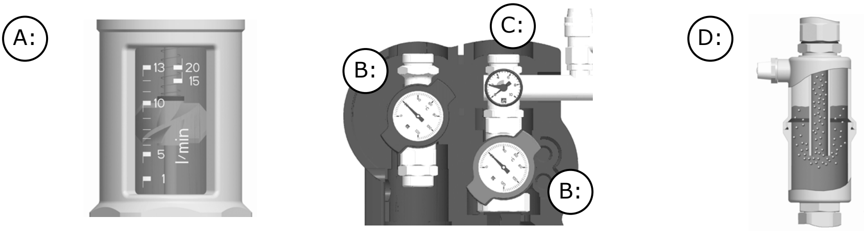


Figure 56 – Display information and menu structure SOLCU1

8.2 Pump unit

As for the whole system no manual intervention is required on the pump unit when the system is operating normally. However, the pump unit offers some useful information detailing the operational status of the solar system (see Figure 57):

A: current flow rate: to be seen on flow meter
B: flow and return temperature: approximate values on flow and return ball valves
C: operating pressure: pressure gauge
D: air – separation: to be carried out on air purger without having to access the roof



Note: thermometers shown in "open" position. During normal operation the handles are to be up-right.

Figure 57 – Operational information provided by Dimplex solar pump unit SOLPU1/2

9 Maintenance

The maintenance effort for the Dimplex solar system is minimal and can ideally be executed when carrying out the mandatory checks on the unvented hot water installation. Figure 58 details the schedule of the maintenance to be carried out.
It is recommended to check the function of the system after the 1st year of operation and then carry out a bi-annual maintenance check. Not all steps have to be undertaken every two years as detailed in Figure 58. All the values measured during the maintenance procedure are to be recorded in the appropriate fields in the maintenance schedule. The following steps are part of the system maintenance:

Check system pressure
The original system pressure can be found on the system commissioning sheet contained in the on site guide. Should the pressure have reduced considerably, the cause is to be investigated.

Check pipe work for leaks
This step is only required if the system pressure dropped considerably. Where readily accessible joints should be checked for signs of small leaks.

Check content discharge vessel
Should any heat transfer medium be deposited in the discharge vessel which was not there from the beginning, the cause is to be established.

Check roof feed-through for leaks
The points at which the pipe work penetrates the primary and secondary protection layer are to be inspected if accessible. No leakage must be found at these points.

Check condition of pipe insulation
As detailed in Chapter 6.6 the pipe work insulation in solar thermal systems must fulfil certain criteria. However, damage due to system overheating, animal and mechanical influences are always possible. Damaged insulation is to be replaced.

Check collector fixations
This work must be carried out with safe access only.

Check electrical connections
This check must only be carried out in a safe manner and by a qualified person.

Check pump function
This check can be carried out by moving the switch on the side of the control unit to its ON position. A flow should be registered on the flow meter in the system. Remember to return the control unit into AUTO when testing is complete.

Check sensor readings
The sensor readings can be checked in the display of the control unit by pressing the up and down buttons. Should any doubt exist about the correct reading, the sensor should be exchanged against another sensor in the system for reference and replaced if required.

Check frost protection and pH value of heat transfer medium
The SOLHTTK test kit is to be used to ensure the heat transfer medium retained its properties. To access the heat transfer medium in the system slacken the bleed screw of the circulating pump and allow 1 or 2 drops of liquid to escape to carry out the testing.

Check charge pressure expansion vessel
This can only be carried out when the expansion vessel is hydraulically disconnected from the solar loop. It must therefore not be undertaken when the system is hot or will heat up in the foreseeable future. This check must only be carried out when any doubt exists that the charge pressure has reduced such as reduced fill pressure, pressure fluctuation between cold and hot system.

At the end of the maintenance routine it is imperative to ensure the system is back in its automatic operation and that the user is informed of what has been undertaken.

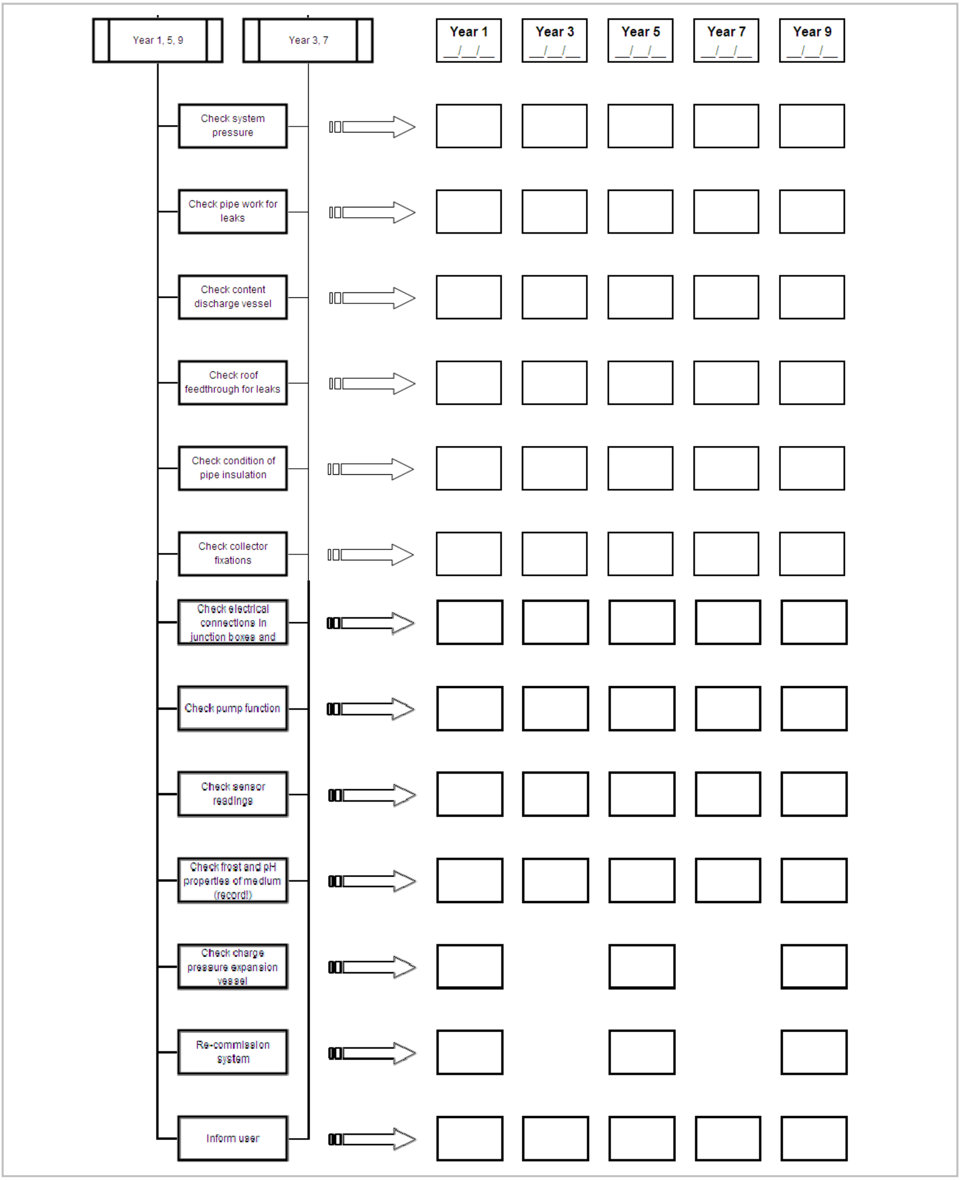


Figure 58 – Overall view Dimplex solar maintenance procedure

10 Product and kit listings

The Dimplex solar product range is offered as kit or as individual components. The following listings detail all the kits and the individual components available.

10.1 Dimplex solar kits

The Dimplex solar kits are packaged in such a way that all the required components are contained in the kit. Optional components are available but are not contained in the standard kits. Furthermore, the kits are structured to allow a 1st fix and 2nd fix installation should the installation be done in stages such as in new build situations.
The cylinders are to be ordered separately as they differ in type, direct and indirect auxiliary heating, and the size of cylinder relative to the collector area can vary. The kits are summarised in Figure 59, the cylinders are listed in Figure 60 along side the individual solar kit components.

	Content	Fixation type		Model no. 2.2m² (1 collector)	4.4m² (2 collectors)	6.6m² (3 collectors)
1st fix kit (everything to go on the roof)	- collector - collector fixing kit - collector sensor	on roof	corrugated tile	SOL220CT	SOL440CT	SOL660CT
			plain tile	SOL220PT	SOL440PT	SOL660PT
			slate tile	SOL220S	SOL440S	SOL660S
			coach bolt	SOL220CB	SOL440CB	SOL660CB
			free standing	SOL220F	SOL440F	SOL660F
		in roof	tile (corrugated/plain)	SOL220TI	SOL440TI	SOL660TI
			slate	SOL220SI	SOL440SI	SOL660SI
			tile with flashing (corrugated/plain)	SOL220TF	SOL440TF	SOL660TF
			slate with flashing	SOL220SF	SOL440SF	SOL660SF
2nd fix kit	- control unit SOLCU1 - pump unit SOLPU1 - heat transfer medium - 18 l exp. vessel - exp. vessel fixing kit			SOLHYPK		

Figure 59 – Dimplex solar kits overall view

10.2 Dimplex solar components

For systems larger than 6.6 m² (3 collectors) or should additional components be required the individual components can be chosen from Figure 60.

	Content	Auxiliary heating type	Model no. 175 litre	215 litre	255 litre	305 litre
Dimplex solar cylinders	- cylinder - inlet group - exp. vessel - exp. vessel fixing kit - tundish - immersion heater(s) - thermostat - two port valve (SCx … SI)	- direct electric	SCx 175 SD	SCx 215 SD	SCx 255 SD	SCx 305 SD
		- indirect (wet)	SCx 175 SI	SCx 215 SI	SCx 255 SI	SCx 305 SI

Product group	Description	Model no.
Collector	2.2m² flat plate collector	SOLC220
On roof fixing kits	Tile corrugated basic kit	SOL220RCT
	Tile corrugated extension kit	SOL220RCTE
	Tile plain basic kit	SOL220RPT
	Tile plain extension kit	SOL220RPTE
	Slate basic kit	SOL220RSB
	Slate extension kit	SOL220RSE
	Sheet basix kit	SOL220RST
	Sheet extension kit	SOL220RSTE
	Free standing basic kit	SOL220RF
	Free standing extension kit	SOL220RFE
In roof fixing kits	Tile integrated roof kit 2m²	SOL220RTI
	Tile integrated roof kit 4m²	SOL440RTI
	Tile integrated roof kit 6m²	SOL660RTI
	Tile integrated roof kit +2m² extension	SOL220RTIE
	Slate integrated roof kit 2m²	SOL220RSI
	Slate integrated roof kit 4m²	SOL440RSI
	Slate integrated roof kit 6m²	SOL660RSI
	Slate integrated roof kit +2m² extension	SOL220RSIE
	Tile flashing kit 2m²	SOL220RTF
	Tile flashing kit 4m²	SOL440RTF
	Tile flashing kit 6m²	SOL660RTF
	Tile flashing kit +2m² extension	SOL220RTFE
	Slate flashing kit 2m²	SOL220RSF
	Slate flashing kit 4m²	SOL440RSF
	Slate flashing kit 6m²	SOL660RSF
	Slate flashing kit +2m² extension	SOL220RSFE
Control units	Control unit with 3 inputs and 1 output	SOLCU1
	Control unit with 5 inputs and 2 output	SOLCU2
	Control unit with 6 inputs and 3 output	SOLCU3
Pump units	Pump unit, 1 to 20 l/min, 6m	SOLPU1
	Pump unit, 5 to 40 l/min, 7m	SOLPU2
Expansion vessels	Expansion vessel 18 litre	SOLEV18
	Expansion vessel 24 litre	SOLEV24
	Expansion vessel 35 litre	SOLEV35
	Expansion vessel 50 litre	SOLEV50
	Expansion vessel 80 litre	SOLEV80
	Expansion vessel fixing kit (≤24 litre)	SOLVK1
Heat transfer medium	Heat transfer medium 20 litres ready mixed	SOLHT20
Accessories	Free standing rear strut <45° (x2)	SOLRKFRS
	Free standing bottom bar 1140mm (x2)	SOLRKFBB
	Feed through tile tile/slate (x1)	SOLFTT
	Feed through tile sheet metal (x1)	SOLFTM
	Flow meter 1 to 20 l/min	SOLFM120
	Flow meter 2 to 40 l/min	SOLFM240
	Solar sensor PT1000, 6mm, 1.5m cable	SOLSEN
	Motorised two port valve 3/4"	SOLM2034
	Motorised two port valve 1 1/4"	SOLM2114
	Motorised three port valve 3/4"	SOLM3034
	Hot water thermostatic mixing valve 22mm	SOLMV22
	Collector cover for one collector	SOL220CC
	Collector lifting hook	SOL220LH
	Suction lifter (x2)	SOL2SL
	Flush and fill pump 110 V	SOLFFP110
	Flush and fill pump 240 V	SOLFFP240
	Flexible hose pre insulated, sensor cable 10m	SOLFH10
	Flexible hose pre-insulated, sensor cable 15m	SOLFH15
	Air separator automatic with shut off valve	SOLAS1
	Heat transfer medium test kit	SOLHTTK

Figure 60 – Dimplex solar components overall view

11 Dimplex literature structure

Dimplex solar offers a range of literature to provide relevant information at all stages of the product life cycle from planning and design, installation and maintenance to operation and troubleshooting. Figure 61 summarises the available documents and their relevance at the various stages of the product's application.

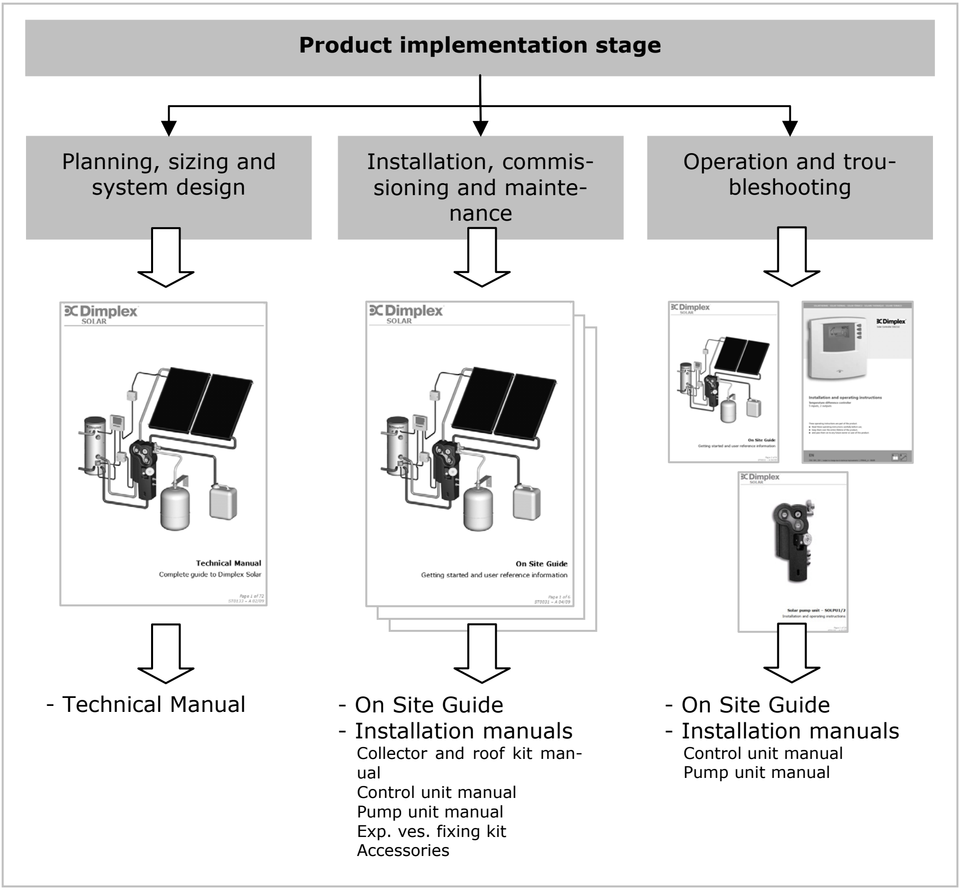


Figure 61 – Dimplex solar literature structure

12 Appendix

12.1 On site questionnaire

Dimplex® Solar Thermal

On Site Questionnaire v.4

Date DD/MM/YY Time hh:mm

On behalf of GD ____________________

Customer

Name ______________________

No. and street ______________________

Town ______________________

Post Code ______________________

Contact tel. no. ______________________

e-mail address ______________________

Location if different from customer

Name ______________________

No. and street ______________________

Town ______________________

Post Code ______________________

User

No. of beds _____________

showers _____________

baths _____________

required hot water temperature ______ °C

expected solar contribution ______ %

Unvented hot water

System parameters static pres. _____ bar

dyn. pres. _____ bar

flow rate _____ l/min

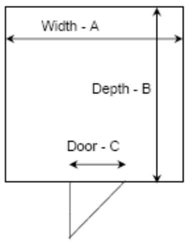
Available space

A = ________ m

B = ________ m

C = ________ m

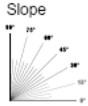
Height = ____ m



Solar thermal

Orientation

Slope



Available mounting area (l x w) ____ x ____ m

Roof type ☐ T ☐ S ☐ F ☐ I

Static height of system ________ m

App. total length of pipe run ________ m

Shading ______________________________

Structural integrity ____________________

Auxiliary heating ☐ Oil ☐ Gas

☐ Electric ☐ ________

Current hot water supply system/cylinder size

____

____

Routing of discharge pipe? ______________

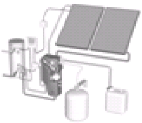
Actions

____

____

Dimplex SOLAR

12.2 On site inspection



Dimplex® Solar Thermal

Installation inspection sheet

Date D D / M M / Y Y Time h h : m m

On behalf of GD ____________________

Dimplex SOLAR

Please note: This commissioning inspection does not verify that the installation in its entirety or in individual details conform with current legislation nor does it inspect the skill of the installer. This inspection only confirms that the Dimplex products are being used as intended. Only the specific points listed below were assessed. Glen Dimplex does not take any responsibility for damage or harm resulting from this installation.

A Customer

Name ____________________
No. and street ____________________
Town ____________________
Post Code ____________________
Contact tel. no. ____________________
e-mail address ____________________

B Location if different from customer

Name ____________________
No. and street ____________________
Town ____________________
Post Code ____________________

C Installed system information

Serial no.: Collector(s) ______________________________ Cylinder ____________________

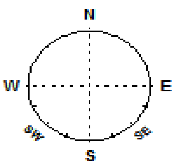
Cylinder type:

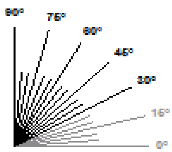
Direct	Indirect
☐ SCx175sd	☐ SCx175si
☐ SCx215sd	☐ SCx215si
☐ SCx255sd	☐ SCx255si
☐ SCx305sd	☐ SCx305si

Expansion Vessel: ☐ 18 litre ☐ 24 litre

Membrane pressure: ____________ bar

Collector orientation (please indicate):





System cold fill pressure ____________________ bar
System liquid content ____________________ litre
System static height ____________________ m

D Installer information

G3 registration number: ____
Solar installation qualification: ____

Actions

____
____

Dimplex® Solar Thermal

Commissioning inspection sheet

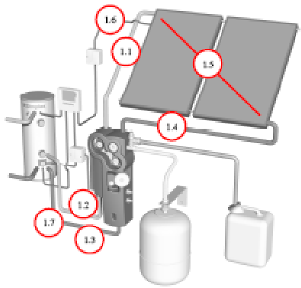
Date D D / M M / Y Y   Time h h : m m

On behalf of GD ___________________

E Commissioning inspection (✓ for yes, ✗ for no)

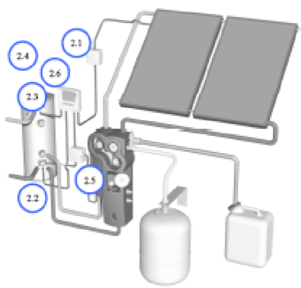
E.1 Pipe work

- ☐ 1.1 The system flow leaves the collector at the highest point and connects to the top left hand side connection on the pump unit.
- ☐ 1.2 The system flow leaves the pump unit at the lower end on the left hand side and connects to the top connection point of the solar coil in the cylinder.
- ☐ 1.3 The system return leaves the cylinder at the lower connection of the coil and connects to the lower end of the right hand side of the pump unit.
- ☐ 1.4 The system return connects from the top right hand side connection of the pump unit to the lower connection of the collector.
- ☐ 1.5 The collector connections are diagonal for 2 and 3 panel installation, single sided or diagonal for 1 panel installation.
- ☐ 1.6 The collector sensor is located in the sensor pocket beside the flow connection.
- ☐ 1.7 Drain point installed at lowest point of solar loop.



E.2 Electrical

- ☐ 2.1 The collector sensor is positioned and connected using the overvoltage protection and the control unit displays _________ °C.
- ☐ 2.2 The lower cylinder sensor is positioned and connected and the control unit displays _________ °C.
- ☐ 2.3 The upper cylinder sensor is positioned and connected and the control unit displays _________ °C.
- ☐ 2.4 A fused switch spur feeds the control unit, fused at 5A.
- ☐ 2.5 The solar circulation pump is connected using the 4 way wiring centre through the cylinder thermostat.
- ☐ 2.6 The control unit is in automatic mode (switch on side in middle position).

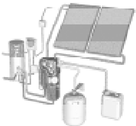


Comments

____

____

____



Dimplex® Solar Thermal

Commissioning inspection sheet

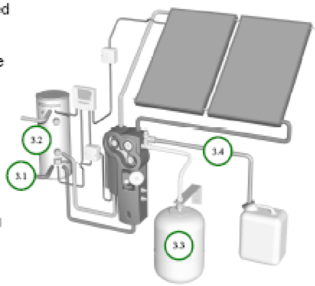
Date D D / M M / Y Y   Time h h : m m

On behalf of GD ____________________

Dimplex® SOLAR

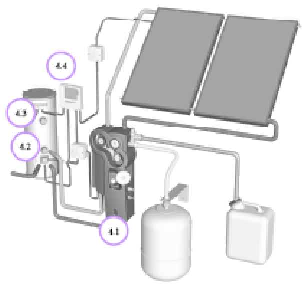
E.3 Safety

- ☐ 3.1 The cold water feed into the cylinder is equipped with the supplied inlet group and the expansion vessel.
- ☐ 3.2 The pressure relief and the temperature and pressure relief valve are both installed and a discharge pipe connected (verifies only that discharge is connected, not that connected correctly).
- ☐ 3.3 The solar expansion vessel is connected correctly, i.e. vessel lower than connection point, all metal connection, no isolation possible.
- ☐ 3.4 The solar pressure relief valve discharge is installed in 22mm Cu and discharges safely into a container or drain.



E.4 Operation

- ☐ 4.1 When the control unit is switched on manually ON (switch at side to top) what flow rate is being shown on flow meter _________ l/min (put control unit back into AUTO).
- ☐ 4.2 Auxiliary heating connected to cylinder.
- ☐ 4.3 Boost heating connected to cylinder.
- ☐ 4.4 Readability/line of sight of control unit.



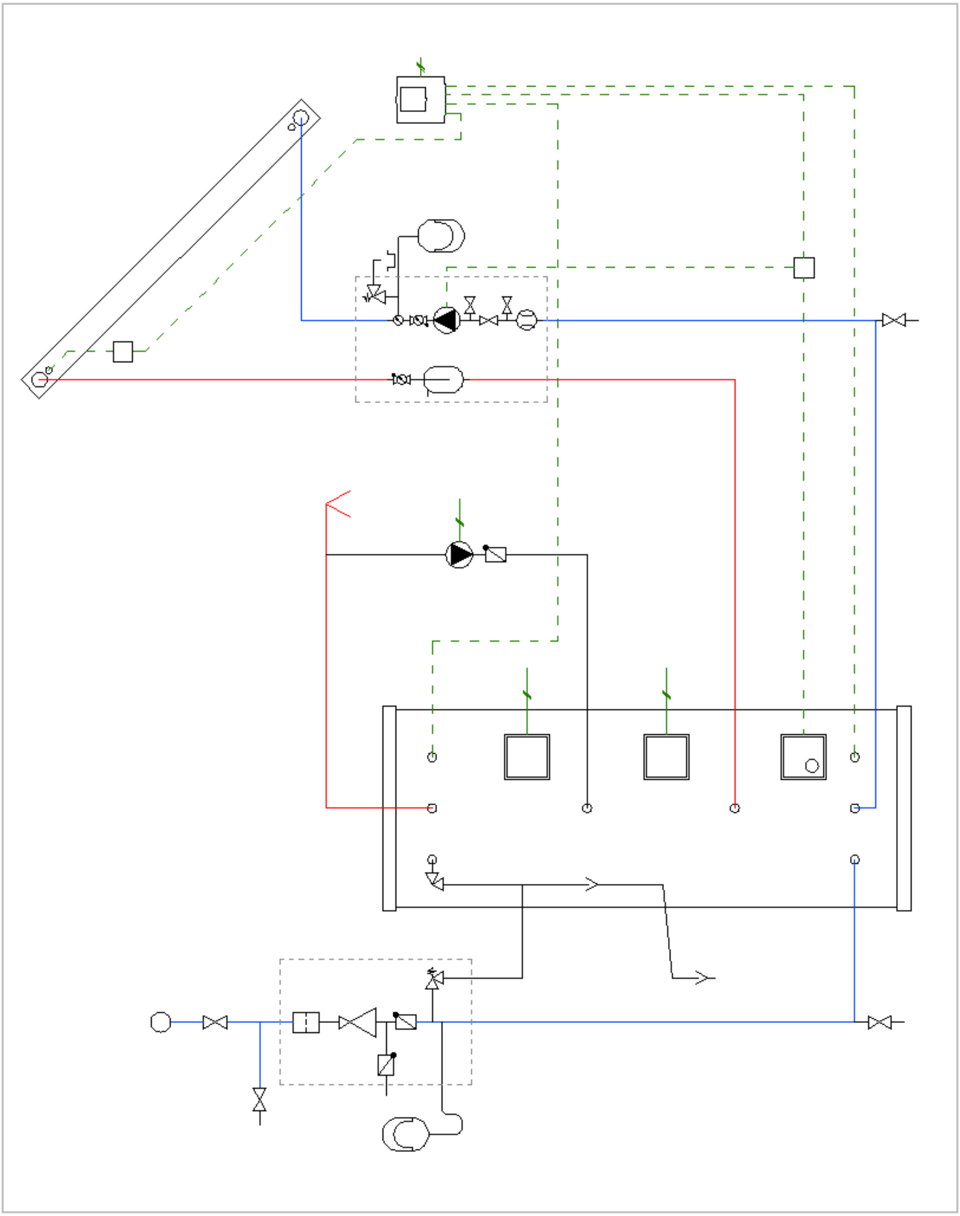
Comments

____

____

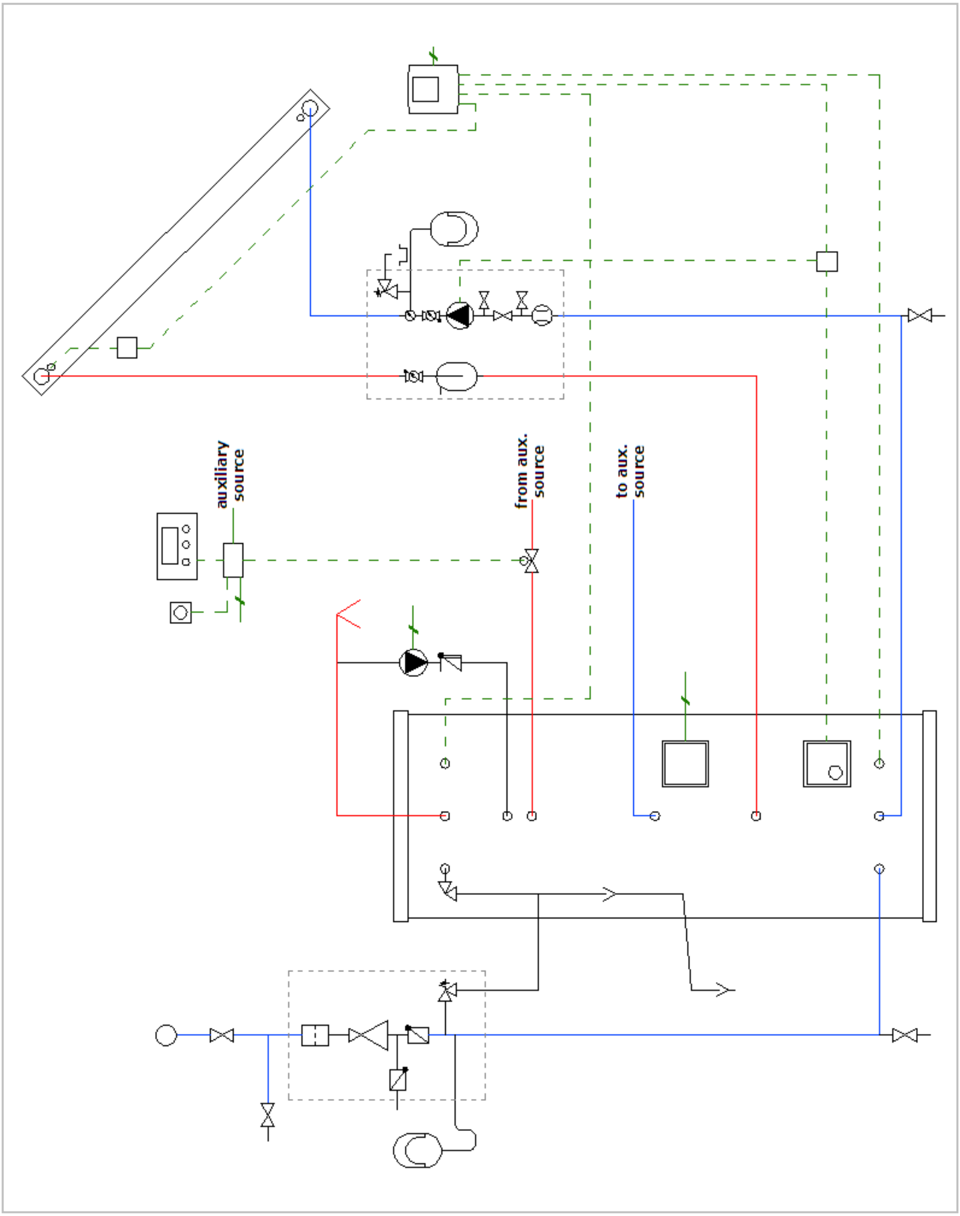
Date, signature customer: ______________________ Date, signature Glen Dimplex: ______________________

12.3 Dimplex solar system direct – overall view



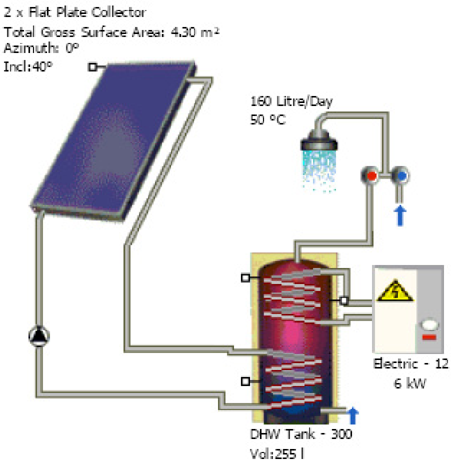
Dimplex SOLAR

12.4 Dimplex solar system indirect – overall view



12.5 Example Dimplex solar simulation report

Line 1: Comfort by Design.
Line 2: Solar thermal solutions.
Appendix 11.5
Variant1



Results of Annual Simulation

Installed Collector Power:	3.01 kW	
Installed Gross Solar Surface Area:	4.3 m²	
Collector Surface Area Irradiation:	4.26 MWh	1,058.55 kWh/m²
Energy Produced by Collectors:	1,842.79 kWh	458.40 kWh/m²
Energy Produced by Collector Loop:	1,583.35 kWh	393.87 kWh/m²
DHW Heating Energy Requirement:	2719.95 kWh	
DHW Heating Energy Supply:	2278.24 kWh	
Solar Contribution to DHW:	1583.35 kWh	
Energy from Auxiliary Heating:	968.56 kWh	
Electricity Savings:		**1,769.5 kWh**
CO2 Emissions Avoided:		**1,178.47 kg**
DHW Solar Fraction:		**62.0 %**
Fractional Energy Saving (EN 12976):		**69.5 %**
System Efficiency:		**37.2 %**

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Line 1: Comfort by Design.
Line 2: Solar thermal solutions.
Appendix 11.5
Variant1

Basic Data

Climate File	
Location:	LONDON
Climate Data Record:	"LONDON"
Total Annual Global Radiation:	942.58 kWh
Latitude:	51.5 °
Longitude:	0.17 °
Domestic Hot Water	
Average Daily Consumption:	160 l
Desired Temperature:	50 °C
Load Profile:	Detached House (evening max)
Cold Water Temperature:	February:8 °C / August:12 °C

System Components

Collector Loop	
Manufacturer:	Glen Dimplex
Type:	Flat Plate Collector
Number:	2.00
Total Gross Surface Area:	4.3 m²
Total Active Solar Surface Area:	4.02 m²
Tilt Angle:	40 °
Azimuth:	0 °
Bivalent (Twin Coil) DHW Tank	
Manufacturer:	T*SOL Database
Type:	DHW Tank - 300
Volume:	255 l
Auxiliary Heating	
Manufacturer:	T*SOL Database
Type:	Electric - 12
Nominal Output:	6 kW

Legend

Original T*SOL Database
With Test Report
Solar Keymark

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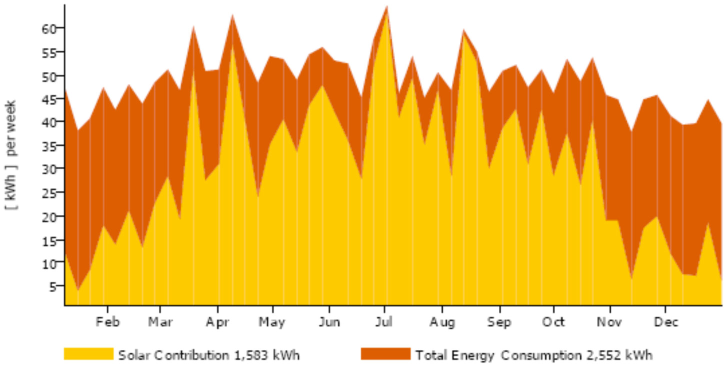
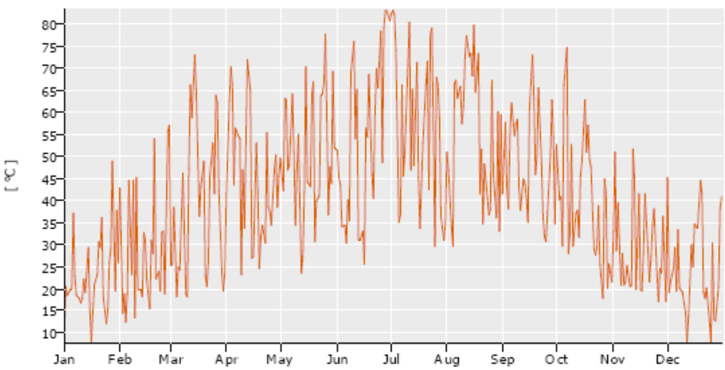
Solar Energy Consumption as Percentage of Total Consumption



Daily Maximum Collector Temperature



These calculations were carried out by T*SOL Expert 4.5 - the Simulation Programme for Solar Thermal Heating Systems. The results are determined by a mathematical model calculation with variable time steps of up to 6 minutes. Actual yields can deviate from these values due to fluctuations in climate, consumption and other factors.The system schematic diagram above does not represent and cannot replace a full technical drawing of the solar system.

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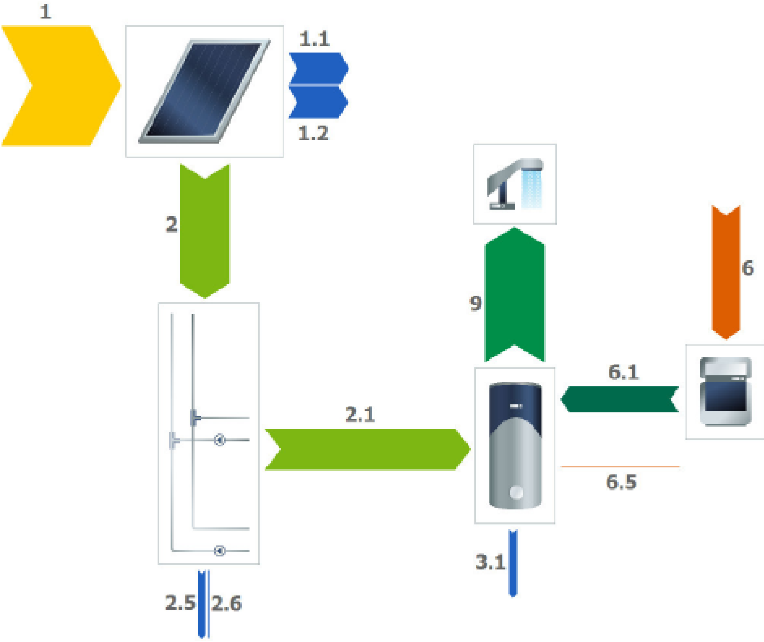
Energy Balance Schematic



Legend

1	Collector Surface Area Irradiation	4,552 kWh
1.1	Optical Collector Losses	1,186 kWh
1.2	Thermal Collector Losses	1,226 kWh
2	Energy from Collector Array	1,843 kWh
2.1	Solar Energy to Storage Tank	1,583 kWh
2.5	External Piping Losses	224 kWh
2.6	Internal Piping Losses	35 kWh
3.1	Tank Losses	274 kWh
6	Final Energy	1,045 kWh
6.1	Supplementary Energy to Tank	969 kWh
6.5	Heating Element	0 kWh
9	DHW Energy from Tank	2,278 kWh

Line 1: Comfort by Design.
Line 2: Solar thermal solutions.
Appendix 11.5
Variant1

Glossary

1 Collector Surface Area Irradiation
Energy Irradiated onto Tilted Collector Area (Active Solar Surface)

1.1 Optical Collector Losses
Reflection and Other Losses

1.2 Thermal Collector Losses
Heat Conduction and Other Losses

2 Energy from Collector Array
Energy Output at Collector Array Outlet (i.e. Before the Piping)

2.1 Solar Energy to Storage Tank
Energy from Collector Loop to Storage Tank (Minus Piping Losses)

2.5 External Piping Losses
External Piping Losses

2.6 Internal Piping Losses
Internal Piping Losses

3.1 Tank Losses
Heat Losses via Surface Area

6 Final Energy
Final Energy Current into System. This can flow in as natural gas, oil or electricity (not including solar energy) taking efficiency levels into account

6.1 Supplementary Energy to Tank
Supplementary Energy (e.g. Boiler) to Tank

6.5 Heating Element
Energy from Heating Element

9 DHW Energy from Tank
Heat for DHW Appliances from Tank

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13 Notes and sketches