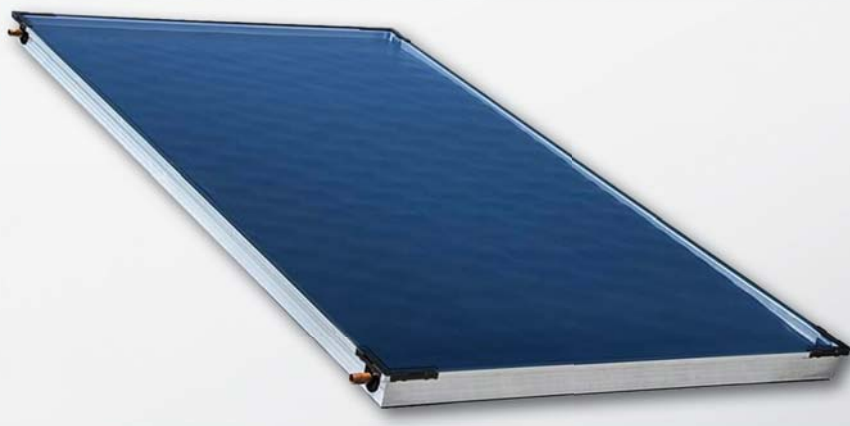


Solar Thermal Systems



solar collectors
pump stations and controllers
accessories



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SOLAR ENERGY UTILIZATION

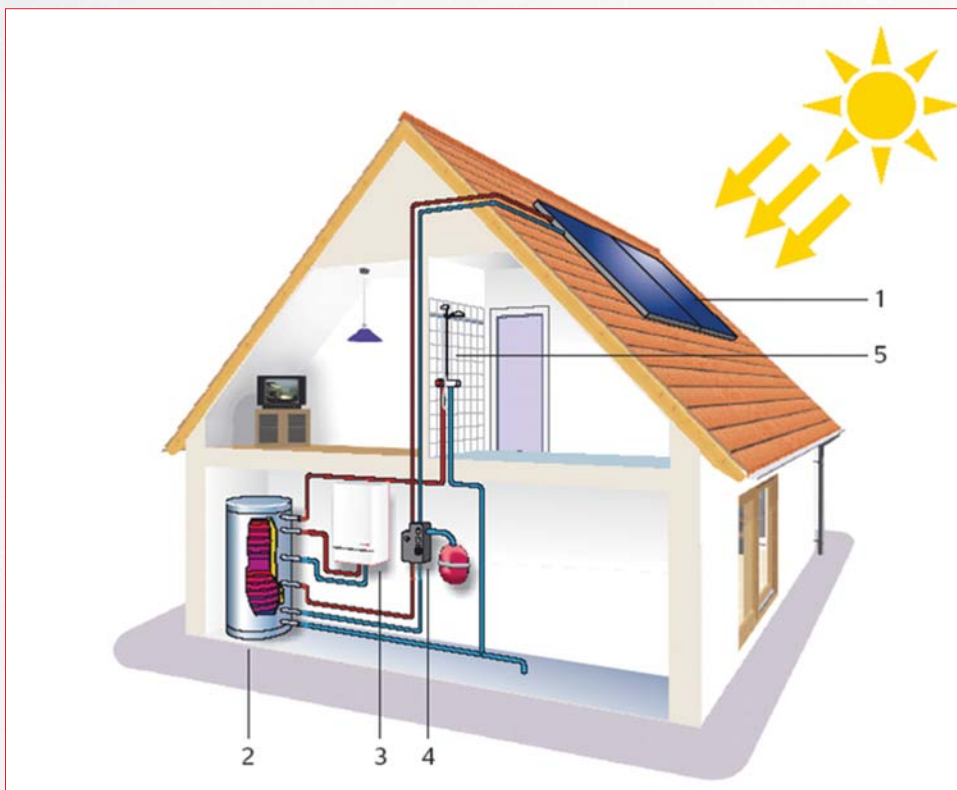
Solar energy represents the majority of energy that is found and utilized on the Earth. The amount of solar energy reaching the Earth every year varies in Europe from 900 kWh/m² in the North to some 1500 kWh/m² in the South. Solar thermal systems are mostly used for DHW (domestic hot water) heating and support space heating. Either flat plate solar collectors or evacuated tube ones are used to transform solar radiation into heat.

MAIN COMPONENTS OF SOLAR THERMAL SYSTEMS

A principle component of a solar thermal system is a solar collector **(1)**, capable of absorbing solar radiation and transforming it to heat. The heat trapped inside the collector is then transferred by special antifreeze solar fluid into a solar thermal appliance **(2)**.

Solar thermal appliances are usually (drinking) hot water storage tanks, Thermal Stores or pools. In a hot water storage tank drinking water is directly heated up, in Thermal Stores it is heating water that is heated up for space heating. A solar thermal system needs to be backed up by an auxiliary source of heat. An electric heating element is usually installed directly into a hot water storage tank or Thermal Store, or tube heat exchangers that utilize energy from other heat sources like gas boilers **(3)**, fireplaces, biomass boilers, heat pumps.

In order to transfer heat from collectors into a hot water storage tank, any solar thermal system shall be equipped with a circulation pump that ensures circulation in a solar circuit. A circulation pump is included in a solar pump station **(4)** that involves also other important components of a solar circuit – a safety valve, flowmeter, non-return valve, filling valves etc. A solar expansion vessel is also connected to a solar pump station. Since a hot water storage tank may be heated up to as much as 90°C by a solar thermal system, a hot water outlet shall be fitted with an anti-scald valve that keeps outgoing water at a safe temperature.



PRINCIPLES OF OPERATION - SOLAR THERMAL SYSTEMS

Solar radiation passes through a solar collector glass and hits the absorber where it is captured by a special selective layer and transformed to heat. The absorber is sealed in a compact frame with efficient insulation. The heat is then transferred to a heat carrying fluid that moves the heat (with the help of a circulation pump) into a building to solar consumers (hot water storage tank, thermal store, pool etc.). The pump is being switched by a controller that monitors temperatures through temperature sensors and evaluates the temperature differences between a collector and a solar consumer. As soon as the controller registers the pre-set temperature difference is exceeded, it starts the solar circulation pump. Warm heat transfer fluid then circulates through the solar circuit, giving away its solar heat into the desired solar consumers. A pressure expansion vessel shall be properly designed and installed in any solar circuit in order to avoid antifreeze fluid leaks through a safety valve in case that the solar circuit gets overheated.

In central Europe, a solar thermal system shall be always amended with an auxiliary heat source that will ensure heating of DHW or heating water to a desired temperature under cloudy weather. For this purpose, current energy sources are used, like gas or electric boilers, solid fuel boilers, heat pumps etc. The specific system layout is then influenced by the type of the auxiliary source, very often there are more auxiliary sources connected into a system, and their interconnection shall be solved e.g. by installing a combination thermal store.

FLAT PLATE SOLAR COLLECTORS

Flat plate collectors feature large glazed surface area and a large absorber

- Absorption area of solar collectors is represented by a highly selective surface. It features high level of solar radiation absorption while its heat radiation into ambient air (heat loss by radiation) is very low.

The highly selective blue absorber coating is made of ceramics/metal compound (TiNO_x) and represents the best in present selective materials. The concentration of metallic particles decreases towards the surface. The surface shows a high solar absorptance and low losses by heat emission. Metal passivation together with the ceramic layer works efficiently as a diffusion barrier, also protecting the surface from corrosion. This ensures a long-time stability of solar parameters, absorption $\alpha=95\%$ and emissivity $\epsilon=5\%$, and a long service life of the absorber.

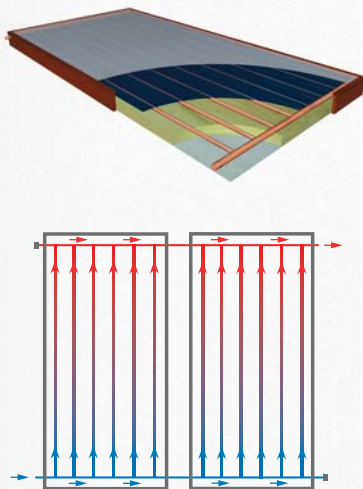
- Tempered solar glass in all models excels in high shatter resistance and high solar permeability.

Regulus flat plate solar collectors can have 2 principal types of absorber design.

» Harp type collectors

Antifreeze fluid enters the collector through the bottom manifold and is distributed into the separate vertical tubes, welded directly on the absorber. The fluid flowing through the vertical tubes then enters the horizontal header, leaving the collector.

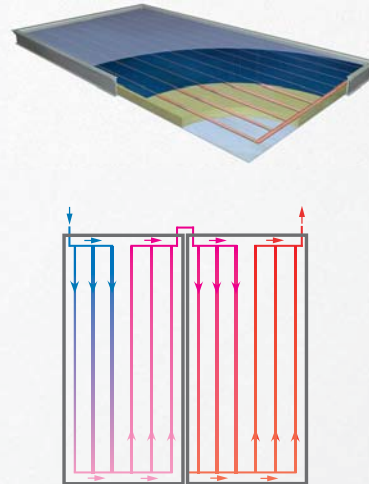
Collectors are mutually connected in a so called series-parallel connection that permits as many as 8 collectors to be connected into one array, without increasing their pressure drop and without the need to use a strong circulation pump.



» Double-harp type collectors

This collector is divided into 2 hydraulic halves; in one half the fluid flows towards the collector bottom where it runs through a horizontal manifold to the other collector half where the fluid flows upwards to the collector outlet.

Collectors are connected in series connection – an outlet from one collector becomes the inlet into the next one. The advantage of this connection type is the high temperature difference that can be reached between the inlet and outlet of a collector array (this is useful in systems where a higher outlet temperature shall be reached quickly). However a higher outlet temperature means a slight decrease in the collector array efficiency. The collector connection in series increases pressure drop, for this reason it is permitted to connect only 4 collectors this way.



KPG1 SOLAR COLLECTOR



Flat plate solar collector designed for either portrait or landscape on-roof installation. Harp absorber with highly selective TiNOx surface is laser welded to copper tubing. The insulation consists of 10 mm mineral wool. Connection points are located laterally on the top and bottom.

Code: 10336

Solar Keymark Certified 

Dimensions and weight

height x width x thickness	2151x1170x84 mm
installation width	2010 mm
total area	2.517 m ²
aperture area	2.392 m ²
absorber area	2.309 m ²
empty weight	47 kg

Glazing

material	tempered low-iron glass
thickness	3.2 mm

Absorber

material	Al, 0.5mm thick
surface finish	TiNOx
design type	harp type, laser welded
material and size of connection pipes	copper 4 x Ø 22 mm x 0.8 mm
material and size of absorber tubes	copper 12 x Ø 8 mm x 0.5 mm
max. working pressure	10 bar
max. working temperature	120°C
stagnation temperature	234°C
heat transfer fluid	water solution of monopropylene glycol 1:1, 1.7l
recommended flow rate	60 - 120 l/h

Thermal insulation

insulation material	mineral wool
insulation thickness	40 mm

Frame

frame material	aluminum alloy
frame color	silver
rear sheet	aluminum alloy, 0.5 mm thick

Collector efficiency parameters related to aperture/absorber surface area

η_{0a}	0.759 / 0.794
a_{1a}	3.48 / 3.639 W/m ² K
a_{2a}	0.0161 / 0.0168 W/m ² K ²

Mount and connection kits (portrait mount)

	Code
Connection kit	7710
Kit for 1 collector	[for 4 roof anchors or 2 supports + 1 strut] 10538
Kit for 2 collectors	[for 6 roof anchors or 3 supports + 1 strut] 10539
Kit for 3 collectors	[for 8 roof anchors or 4 supports + 1 strut] 10540
Kit for 4 collectors	[for 10 roof anchors or 5 supports + 1 strut] 10541
Kit for 5 collectors	[for 12 roof anchors or 6 supports + 1 strut] 14067
Mount and interconnection kit for 1 collector	[for 4 roof anchors or 2 supports + 1 strut] 11986

Mount and connection kits (landscape mount)

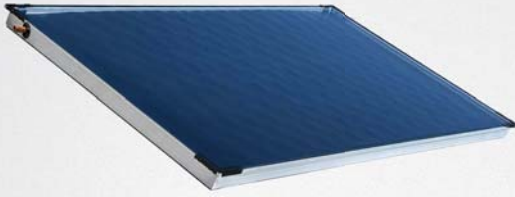
	Code
Connection kit	14134
Kit for 1 collector	[for 4 roof anchors or 2 supports + 1 strut] 10700

The Connection kit contains an inlet elbow (Cu22 x 3/4" F), outlet pipe cross (Cu22 x 3/4" F + 3/8" F for an air vent valve and 1/2" F for a temperature sensor sheath), sheath with a temperature sensor and 2 straight adapters (Cu22 x 3/4" F) with plug and gasket.



The mount and connection kits consist of aluminum mounting rails, retaining hooks for bottom mounting rails, retaining side clamps, bolts and nuts, straight couplers (2 and more collectors) and pipe insulation.

KPG1H SOLAR COLLECTOR



Flat plate collector of 1816 W output (at 1000 W/m² irradiance), designed for on-roof landscape installation. A double-harp absorber with highly selective TiNOx surface is laser welded to the copper pipes. The insulation consists of 40 mm mineral wool. Connections are located on both sides on the top.

Code: 11427

Dimensions and weight

height x width x thickness	1170x2150x84 mm
total area	2.517 m ²
aperture area	2.392 m ²
absorber area	2.309 m ²
empty weight	47 kg

Glazing

material	tempered low-iron glass
thickness	3.2 mm

Absorber

material	Al, 0.5mm thick
surface finish	TiNOx
design type	double harp type, laser welded
material and size of connection pipes	copper 2 x Ø 22 mm x 0.8 mm
material and size of absorber tubes	copper 12 x Ø 8 mm x 0.5 mm
max. working pressure	10 bar
max. working temperature	120°C
stagnation temperature	234°C
heat transfer fluid	water solution of monopropylene glycol 1:1, 1.7l
recommended flow rate	60 - 120 l/h

Thermal insulation

insulation material	mineral wool
insulation thickness	40 mm

Frame

frame material	aluminum alloy
frame color	silver
rear sheet	aluminum alloy, 0.5 mm thick

Collector efficiency parameters related to aperture/absorber surface area

η_{0a}	0.759 / 0.794
a_{1a}	3.48 / 3.639 W/m ² K
a_{2a}	0.0161 / 0.0168 W/m ² K ²

Mount and connection kits (landscape mount)

		Code
Connection kit		14618
Kit for 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	10700
Kit for 2 collectors	[for 6 roof anchors or 3 supports + 1 strut]	14517
Mount and interconnection kit for 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	14518

The Connection kit contains an inlet elbow (Cu22 x 3/4" F), outlet pipe cross (Cu22 x 3/4" F + 3/8" F for an air vent valve and 1/2" F for a temperature sensor sheath), sheath with a temperature sensor.



The mount and connection kits consist of aluminum mounting rails, retaining hooks for bottom mounting rails, retaining side clamps, bolts and nuts, straight couplers (2 and more collectors) and pipe insulation.

KPS1 SOLAR COLLECTOR



Flat plate collector of 1481 W output (at 1000 W/m² irradiance), designed for on-roof portrait installation. A harp absorber with highly selective TiNOx surface is laser welded to the copper pipes. The insulation consists of 40 mm mineral wool. Connections are located on both sides on the top and bottom.

Code: 16277

Solar Keymark Certified 

BAFA registered (Germany), valid since 2018

Dimensions and weight

height x width x thickness	2037 x 1036 x 90 mm
installation width	1096 mm
total area	2.11 m ²
aperture area	1.907 m ²
absorber area	1.887 m ²
empty weight	38 kg

Glazing

material	tempered prismatic glass
thickness	3.2 mm

Absorber

material	Al, 0.5mm thick
surface finish	TiNOx
design type	harp type, laser welded
material and size of connection pipes	copper 4 x Ø 22 mm x 0.7 mm
material and size of absorber tubes	copper 9 x Ø 8 mm x 0.5 mm
max. working pressure	10 bar
max. working temperature	110°C
stagnation temperature	200°C
heat transfer fluid	water solution of propylene glycol, 1.37 l
recommended flow rate	60 - 120 l/h

Thermal insulation

insulation material	mineral wool
insulation thickness	40 mm

Frame

frame material	aluminum alloy
frame color	grey
rear sheet	aluminum alloy, 0.5 mm thick

Collector efficiency parameters related to aperture area

η_{0a}	0.777 / 0.785
a_{1a}	4.35 / 4.40 W/m ² K
a_{2a}	0.0073 / 0.0074 W/m ² K ²

Mount and connection kits (portrait mount)

		Code
Connection kit		7710
Kit for 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	12178
Kit for 2 collectors	[for 6 roof anchors or 3 supports + 1 strut]	12179
Kit for 3 collectors	[for 8 roof anchors or 4 supports + 1 strut]	12180
Kit for 4 collectors	[for 10 roof anchors or 5 supports + 1 strut]	12181
Mount and interconnection kit for 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	12183

The Connection kit contains an inlet elbow (Cu22 x 3/4" F), outlet pipe cross (Cu22 x 3/4" F + 3/8" F for an air vent valve and 1/2" F for a temperature sensor sheath), sheath with a temperature sensor and 2 straight couplers (Cu22x3/4" F) with a plug and gaskets.



The mount and connection kits consist of aluminum mounting rails, retaining hooks for bottom mounting rails, retaining side clamps, bolts and nuts, straight couplers (2 and more collectors) and pipe insulation.

KPS11 SOLAR COLLECTOR



Flat plate collector of 1802 W output (at 1000 W/m² irradiance), designed for on-roof portrait installation. A harp absorber with highly selective TiNOx surface is laser welded to the copper pipes. The insulation consists of 40 mm mineral wool. Connections are located on both sides on the top and bottom.

Code: 16278

Solar Keymark Certified 

BAFA registered (Germany), valid since 2018

Dimensions and weight

height x width x thickness	2037 x 1235 x 90 mm
installation width	1295 mm
total area	2.516 m ²
aperture area	2.295 m ²
absorber area	2.278 m ²
empty weight	45 kg

Glazing

material	tempered prismatic glass
thickness	3.2 mm

Absorber

material	Al, 0.5mm thick
surface finish	TiNOx
design type	harp type, laser welded
material and size of connection pipes	copper 4 x Ø 22 mm x 0.7 mm
material and size of absorber tubes	copper 11 x Ø 8 mm x 0.5 mm
max. working pressure	10 bar
max. working temperature	110°C
stagnation temperature	200°C
heat transfer fluid	water solution of propylene glycol, 1.7 l
recommended flow rate	60 - 120 l/h

Thermal insulation

insulation material	mineral wool
insulation thickness	40 mm

Frame

frame material	aluminum alloy
frame color	grey
rear sheet	aluminum alloy, 0.5 mm thick

Collector efficiency parameters related to aperture area

η_{0a}	0.785 / 0.791
a_{1a}	4.44 / 4.47 W/m ² K
a_{2a}	0.0068 / 0.0069 W/m ² K ²

Mount and connection kits (portrait mount)

		Code
Connection kit		7710
Kit for 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	12184
Kit for 2 collectors	[for 6 roof anchors or 3 supports + 1 strut]	12185
Kit for 3 collectors	[for 8 roof anchors or 4 supports + 1 strut]	12186
Kit for 4 collectors	[for 10 roof anchors or 5 supports + 1 strut]	12187
Mount and interconnection kit for 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	12188

The Connection kit contains an inlet elbow (Cu22 x 3/4" F), outlet pipe cross (Cu22 x 3/4" F + 3/8" F for an air vent valve and 1/2" F for a temperature sensor sheath), sheath with a temperature sensor and 2 straight couplers (Cu22x3/4" F) with a plug and gaskets.



The mount and connection kits consist of aluminum mounting rails, retaining hooks for bottom mounting rails, retaining side clamps, bolts and nuts, straight couplers (2 and more collectors) and pipe insulation.

KPI1 SOLAR COLLECTOR



Flat plate collector of 1808 W output (at 1000 W/m² irradiance), designed for in-roof portrait installation. A double-harp absorber with highly selective TiNOx surface is laser welded to the copper pipes. The insulation consists of 50 mm mineral wool. Connections are vertical on the top.

Code: 11237

Dimensions and weight

height x width x thickness	2061x1225x107 mm
height with 22mm pipes connected	2104 mm
total area	2.52 m ²
aperture area	2.33 m ²
absorber area	2.29 m ²
empty weight	49 kg

Glazing

material	tempered low-iron glass
thickness	3.2 mm

Absorber

material	Al, 0.5mm thick
surface finish	TiNOx
design type	double harp type, laser welded
material and size of connection pipes	copper 2 x Ø 22 mm x 0.8 mm
material and size of absorber tubes	copper 12 (2x6) x Ø 8 mm x 0.5 mm
max. working pressure	10 bar
max. working temperature	120°C
stagnation temperature	234°C
heat transfer fluid	water solution of monopropylene glycol 1:1, 1.7l
recommended flow rate	60 - 120 l/h

Thermal insulation

insulation material	mineral wool
insulation thickness	50 mm

Frame

frame material	wood, intended for in-roof installation only
frame color	depends on the roof flashing
rear sheet	wood

Collector efficiency parameters related to aperture area

η_{0a}	0.776
a_{1a}	3.293 W/m ² K
a_{2a}	0.011 W/m ² K ²

Mount and connection kits (portrait mount)

	Code
Connection kit	11374
Kit for 1 collector	11335
Kit for 2 collectors in a row	11329
Kit for 3 collectors in a row	11336
Kit for 4 collectors in a row	11336
Kit for 2 collectors on top of each other	11338
Kit for 4 collectors - two in two rows on top of each other	11339
Kit for 6 collectors - three in two rows on top of each other	11340

The Connection kit contains two adapters G 1" x 3/4" M/M for inlet and outlet with gaskets.

Mount kits contain installation battens, attachment brackets, screws, metal retainers, connecting bends, gaskets and a cover section.



EVACUATED TUBE COLLECTORS

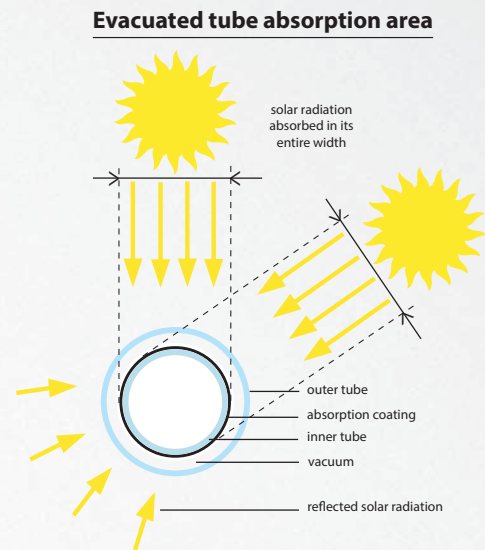
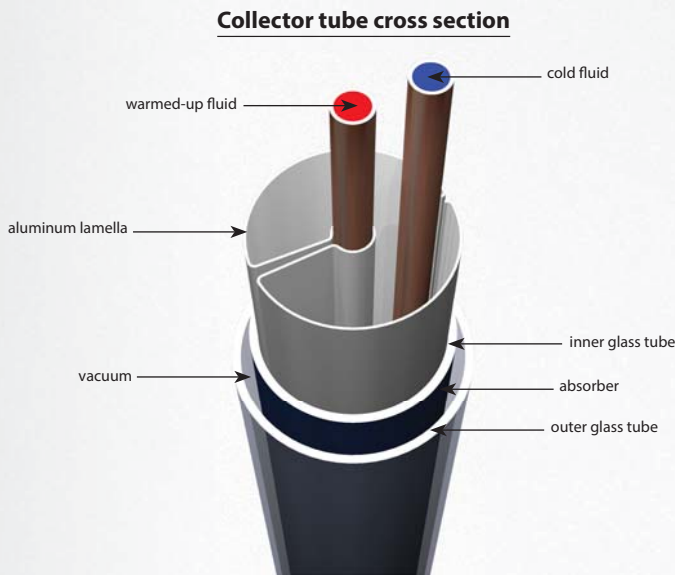
Solar tube collectors enable highly effective heat gain from solar radiation even under extreme conditions.

They excel namely at:

- » low outdoor temperatures
- » heating DHW to a high temperature
- » a low intensity of solar radiation
- » diffusion of radiation - cloudy skies

For these reasons, evacuated tube collectors are suitable for:

- » support heating with DHW heating
- » all-year-round pool and DHW heating
- » DHW heating to a high temperature



A tube consists of 2 coaxial glass tubes with vacuum between them. The ends of the tubes are sealed so the vacuum stability is guaranteed for a long time. So the collector absorber is placed in vacuum which is ideal insulation and minimizes heat losses like e.g. a vacuum flask. Thanks to that, even the smallest heat gain during bad weather doesn't get lost and warms up the fluid in the collector.

The absorption surface that changes the incident radiation to heat has a tubular shape. The collector exposes the same surface area to the incident sunshine in the morning, at midday and in the evening. Unlike in flat plate collectors, its heat output does not decrease because of a small angle of incidence. The tubular absorption area makes it possible to gain heat also from the diffuse solar radiation. The absorption surface area for diffuse radiation is more than 3 times bigger than that for direct sunshine. Thanks to this, KTU collectors offer heat gains even under bad weather.

We develop and manufacture Regulus solar collectors in the Czech Republic. Their excellent parameters and mechanical resistance are verified by a Certificate from an authorized body according to the European standard EN 12975-2. This standard involves among others also measurement of the output and efficiency, of mechanical resistance incl. hail resistance and long-term weather resistance.



KTU 10 SOLAR COLLECTOR



Evacuated tube collector of 727 W output (at 1000 W/m² irradiance), designed for on-roof portrait installation. A tube consists of 2 coaxial glass tubes with vacuum between them. An aluminum lamella fitting closely to the glass tube collects heat from the whole inner surface of the evacuated tube, giving it away into solar fluid inside the copper pipe. These copper pipes join the collector header, insulated with 30 mm of mineral wool.

Code: 7126

Dimensions and weight

height x width x thickness	1970 x 920 x 141 mm
installation width	1000 mm
total area	1.81 m ²
aperture area	1.01 m ²
absorber area	0.81 m ²
empty weight	41 kg

Glazing

material	borosilicate glass - 10 evacuated tubes
thickness	1.8 mm

Absorber

material	borosilicate glass
surface finish	AIN/AI-N/AI-N/AI-N/AI-N
design type	evacuated tube
material and size of connection pipes	copper 4 x Ø 22 mm x 1 mm
material and size of absorber tubes	copper 10 x Ø 8 mm x 0.5 mm
max. working pressure	10 bar
max. working temperature	120°C
stagnation temperature	309.9°C
heat transfer fluid	water solution of monopropylene glycol 1:1, 1.7l
recommended flow rate	60 - 120 l/h

Thermal insulation

absorber	vacuum
header	mineral wool, 30 mm

Frame

frame material	aluminum alloy and steel AISI 304 SS
frame color	silver
case material	steel AISI 304 SS, 0.8 mm thick

Collector efficiency parameters related to aperture/absorber surface area

η_{0a}	0.733/0.894
a_{1a}	2.237/2.73 W/m ² K
a_{2a}	0.0025/0.0031 W/m ² K ²

Mount and connection kits (portrait mount)

		Code
Connection kit		7710
Kit for 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	7415
Kit for 2 collectors	[for 6 roof anchors or 3 supports + 1 strut]	7241
Kit for 3 collectors	[for 8 roof anchors or 4 supports + 1 strut]	7242
Kit for 4 collectors	[for 10 roof anchors or 5 supports + 1 strut]	7243
Extension kit for mounting and connecting 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	7244

The Connection kit contains an inlet elbow (Cu22 x 3/4" F), outlet pipe cross (Cu22 x 3/4" F + 3/8" F for an air vent valve and 1/2" F for a temperature sensor sheath), sheath with a temperature sensor and 2 straight couplers (Cu22x3/4" F) with a plug and gaskets.



The mount and connection kits consist of aluminum mounting rails, retaining clamps, bolts and nuts, straight couplers (2 and more collectors) and pipe insulation.

KTU 15 SOLAR COLLECTOR



Evacuated tube collector of 1090 W output (at 1000 W/m² irradiance), designed for on-roof portrait installation. A tube consists of 2 coaxial glass tubes with vacuum between them. An aluminium lamella fitting closely to the glass tube collects heat from the whole inner surface of the evacuated tube, giving it away into solar fluid inside the copper pipe. These copper pipes join the collector header, insulated with 30 mm of mineral wool.

Code: 7127

Dimensions and weight

height x width x thickness	1970 x 1350 x 141 mm
installation width	1430 mm
total area	2.660 m ²
aperture area	1.49 m ²
absorber area	1.220 m ²
empty weight	60 kg

Glazing

material	borosilicate glass - 15 evacuated tubes
thickness	1.8 mm

Absorber

material	borosilicate glass
surface finish	AIN/AI-N/AI-N/AI-N/AI-N
design type	evacuated tube
material and size of connection pipes	copper 4 x Ø 22 mm x 1 mm
material and size of absorber tubes	copper 15 x Ø 8 mm x 0.5 mm
max. working pressure	10 bar
max. working temperature	120°C
stagnation temperature	309.9°C
heat transfer fluid	water solution of monopropylene glycol 1:1, 2.4l
recommended flow rate	60 - 120 l/h

Thermal insulation

absorber	vacuum
header	mineral wool, 30 mm

Frame

frame material	aluminum alloy and steel AISI 304 SS
frame color	silver
case material	steel AISI 304 SS, 0.8 mm thick

Collector efficiency parameters related to aperture/absorber surface area

η_{0a}	0.733/0.894
a_{1a}	2.237/2.73 W/m ² K
a_{2a}	0.0025/0.0031 W/m ² K ²

Mount and connection kits (portrait mount)

		Code
Connection kit		7710
Kit for 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	7414
Kit for 2 collectors	[for 6 roof anchors or 3 supports + 1 strut]	7245
Kit for 3 collectors	[for 8 roof anchors or 4 supports + 1 strut]	7246
Kit for 4 collectors	[for 10 roof anchors or 5 supports + 1 strut]	7247
Extension kit for mounting and connecting 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	11990

The Connection kit contains an inlet elbow (Cu22 x 3/4" F), outlet pipe cross (Cu22 x 3/4" F + 3/8" F for an air vent valve and 1/2" F for a temperature sensor sheath), sheath with a temperature sensor and 2 straight couplers (Cu22x3/4" F) with a plug and gaskets.



The mount and connection kits consist of aluminum mounting rails, retaining clamps, bolts and nuts, straight couplers (2 and more collectors) and pipe insulation.

KTU 6R2 SOLAR COLLECTOR



Evacuated tube collector of 1012 W output (at 1000 W/m² irradiance), designed for on-roof portrait installation, with a large shaped reflector that concentrates solar radiation to the absorption surface of evacuated tubes. A tube consists of 2 coaxial glass tubes with vacuum between them. An aluminium lamella fitting closely to the glass tube collects heat from the whole inner surface of the evacuated tube, giving it away into solar fluid inside the copper pipe. These copper pipes join the collector header, insulated with 30 mm of mineral wool.

Code: 7343

Dimensions and weight

height x width x thickness	1970 mm x 920 mm x 141 mm
installation width	1000 mm
total area	1.81 m ²
aperture area	1.43 m ²
absorber area	0.49 m ²
empty weight	32 kg

Glazing

material	borosilicate glass - 6 evacuated tubes
thickness	1.8 mm

Absorber

material	borosilicate glass
surface finish	AlN/Al-N/Al-N/Al-N/Al-N
design type	evacuated tube with reflector sheet
material and size of connection pipes	copper 4 x Ø 22 mm x 1 mm
material and size of absorber tubes	copper 6 x Ø 8 mm x 0.5 mm
reflector material	aluminum alloy with highly reflective surface
reflector dimensions	1695 mm x 840 mm x 0.5 mm
reflectivity	92 %
max. working pressure	10 bar
max. working temperature	120°C
stagnation temperature	255°C
heat transfer fluid	water solution of monopropylene glycol 1:1, 0.92 l
recommended flow rate	60 - 120 l/h

Thermal insulation

absorber	vacuum
header	mineral wool, 30 mm

Frame

frame material	aluminum alloy and steel AISI 304 SS
frame color	silver
case material	steel AISI 304 SS, 0.8 mm thick

Collector efficiency parameters related to aperture/absorber surface area

η_{ga}	0.708 / 2,085
a_{1a}	1.570 / 4.620 W/m ² K
a_{2a}	0.007 / 0.019 W/m ² K ²

Mount and connection kits (portrait mount)

		Code
Connection kit		7710
Kit for 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	7415
Kit for 2 collectors	[for 6 roof anchors or 3 supports + 1 strut]	7241
Kit for 3 collectors	[for 8 roof anchors or 4 supports + 1 strut]	7242
Kit for 4 collectors	[for 10 roof anchors or 5 supports + 1 strut]	7243
Extension kit for mounting and connecting 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	7244

The Connection kit contains an inlet elbow (Cu22 x 3/4" F), outlet pipe cross (Cu22 x 3/4" F + 3/8" F for an air vent valve and 1/2" F for a temperature sensor sheath), sheath with a temperature sensor and 2 straight couplers (Cu22x3/4" F) with a plug and gaskets.



The mount and connection kits consist of aluminum mounting rails, retaining clamps, bolts and nuts, straight couplers (2 and more collectors) and pipe insulation.

KTU 9R2 SOLAR COLLECTOR



Evacuated tube collector of 1522 W output (at 1000 W/m² irradiance), designed for on-roof portrait installation, with a large shaped reflector that concentrates solar radiation to the absorption surface of evacuated tubes. A tube consists of 2 coaxial glass tubes with vacuum between them. An aluminium lamella fitting closely to the glass tube collects heat from the whole inner surface of the evacuated tube, giving it away into solar fluid inside the copper pipe. These copper pipes join the collector header, insulated with 30 mm of mineral wool.

Code: 7342

Dimensions and weight

height x width x thickness	1970 mm x 1350 mm x 141 mm
installation width	1430 mm
total area	2.66 m ²
aperture area	2.15 m ²
absorber area	0.73 m ²
empty weight	44 kg

Glazing

material	borosilicate glass - 9 evacuated tubes
thickness	1.8 mm

Absorber

material	borosilicate glass
surface finish	AIN/Al-N/Al-N/Al-N/Al-N
design type	evacuated tube with reflector sheet
material and size of connection pipes	copper 4 x Ø 22 mm x 1 mm
material and size of absorber tubes	copper 9 x Ø 8 mm x 0.5 mm
reflector material	aluminum alloy with highly reflective surface
reflector dimensions	1695 mm x 1270 mm x 0.5 mm
reflectivity	92 %
max. working pressure	10 bar
max. working temperature	120°C
stagnation temperature	255°C
heat transfer fluid	water solution of monopropylene glycol 1:1, 1.37l
recommended flow rate	60 - 120 l/h

Thermal insulation

absorber	vacuum
header	mineral wool, 30 mm

Frame

frame material	aluminum alloy and steel AISI 304 SS
frame color	silver
case material	steel AISI 304 SS, 0.8 mm thick

Collector efficiency parameters related to aperture/absorber surface area

η_{0a}	0.708 / 2.085
a_{1a}	1.570 / 4.620 W/m ² K
a_{2a}	0.007 / 0.019 W/m ² K ²

Mount and connection kits (portrait mount)

		Code
Connection kit		7710
Kit for 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	7414
Kit for 2 collectors	[for 6 roof anchors or 3 supports + 1 strut]	7245
Kit for 3 collectors	[for 8 roof anchors or 4 supports + 1 strut]	7246
Kit for 4 collectors	[for 10 roof anchors or 5 supports + 1 strut]	7247
Extension kit for mounting and connecting 1 collector	[for 4 roof anchors or 2 supports + 1 strut]	11990

The Connection kit contains an inlet elbow (Cu22 x 3/4" F), outlet pipe cross (Cu22 x 3/4" F + 3/8" F for an air vent valve and 1/2" F for a temperature sensor sheath), sheath with a temperature sensor and 2 straight couplers (Cu22x3/4" F) with a plug and gaskets.



The mount and connection kits consist of aluminum mounting rails, retaining clamps, bolts and nuts, straight couplers (2 and more collectors) and pipe insulation.

SOLAR COLLECTOR MOUNT

Sloping roof mounting system



For solar collector installation onto a sloping roof, roof anchors are used that shall be fastened to rafters, or to an auxiliary board. Roof anchors shall be selected with respect to the roofing type and composition. The most popular and suitable for current roofing types are roof anchors in stainless steel or hot dip steel. For flat roofs, these are bolts with clamp for fastening H beams. See below for the suitability of roof anchors for a specific roofing type.



Roof anchor in stainless steel or zinc-plated steel

- Ceramic roof tiles
- Concrete roof tiles



Bolt with clamp for fixing mounting rails onto a roof

- Metal roofing
- Shingle roofing
- Bitumen and slate roofing



Roof anchors for sloping roofs

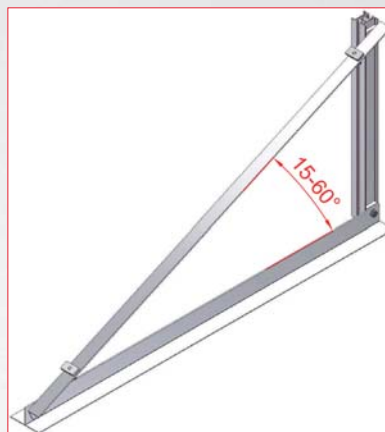
	Code
Roof anchor for pantiles, in stainless steel	6857
Roof anchor for pantiles, in hot dip galvanized steel	7929
Roof anchor for slate tiles, in stainless steel	11574
Roof anchor for pantiles for rafters, in stainless steel, incl. self tapping screws	10159
Roof anchor for pantiles for rafters, in aluminum, height adjustable	6932
Bolt with clamp for fastening mounting rails onto a roof	7320
Roof bolt rubber gasket	8891

For low slope roofs, special supports can be mounted on roof anchors that adjust the collector tilt to a desired value.

Collector tilt adjustment supports	Code
15° Triangle Support	10748
25° Triangle Support	8805
45° Triangle Support	10094
60° Triangle Support	9631

Collector tilt adjustment supports for landscape installation of KPG1 and KPG1H	Code
15° Triangle Support	11070
25° Triangle Support	11071
45° Triangle Support	11072

Flat roof mounting system



The installation of solar collectors onto flat roofs is the same as on sloping roofs, only the sloping roof and roof anchors are substituted by a triangle support structure. That can be selected depending on the desired tilt in 15°, 25°, 45° and 60° pitch. Stability of the structure is achieved either by applying a load (ballast), or by anchoring into the roof structure (usually a reinforced concrete roof panel). Any designed anchoring or added ballast shall be checked by a mechanical static engineer. For increased rigidity, the system of triangle supports is reinforced with a wind brace.

Ballasted support structure



Support structure fixed into the roof



Collector supports for flat roof

	Code
15° Triangle Support	11979
25° Triangle Support	10975
45° Triangle Support	6859
Wind brace incl. screws	9563

Flat roof installation, up to 8m high roof

1 solar collector	290 kg
2 solar collectors	580 kg
3 solar collectors	870 kg
4 solar collectors	1160 kg

Collector supports for flat roofs, for landscape KPG1 and KPG1H

	Code
25° Triangle Support	10907
45° Triangle Support	10921
Wind brace incl. screws	10908

Wall installation

Landscape collector wall supports

	Code
15° Support (75° collector tilt angle)	14792
25° Support (65° collector tilt angle)	14793
45° Support (45° collector tilt angle)	14794

SOLAR PIPING

For an easy connection of solar thermal collectors, pump stations, and hot water storage tanks and thermal stores in a utility room, copper or stainless steel piping shall be used that resists glycol and temperatures up to 160°C. Pre-insulated pipes in EPDM mean a great advantage. The pipe diameter corresponds to the number of solar collectors connected and to the flow rate in question. Indicative values for the min. cross section area of pipes related to the number of collectors and flow rate in harp type collectors is shown in the chart:



Number of collectors	Connection type array x collector	Max. recommended flow rate	Connection pipes	
			in copper	Kombiflex
1	1 x 1	2 l/min	Cu 15 x 1	DN 12
2	1 x 2 in series	4 l/min	Cu 15 x 1	DN 16
3	1 x 3 in series	6 l/min	Cu 18 x 1	DN 16
4	1 x 4 in series	8 l/min	Cu 18 x 1	DN 20
6	2 x 3 in parallel	12 l/min	Cu 22 x 1	DN 25
8	2 x 4 in parallel	16 l/min	Cu 28 x 1.5	DN 25
9	3 x 3 in parallel	18 l/min	Cu 28 x 1.5	DN 25
12	3 x 4 in parallel	24 l/min	Cu 28 x 1.5	-

Max. 30 m in the flow and return piping altogether

SOLARFLEX A - DUO - twinway flexible stainless steel pipe, separable, for an easy connection of solar thermal collectors, pump station, hot water storage tank etc. With a 2x0.75 mm² silicone cable to connect a temperature sensor. They are insulated with 13 mm thick EPDM insulation with a protective surface layer.

Stainless steel pipes can be supplied with the necessary connection elements. Those can be also ordered separately, like wall clamps for pipes.

SOLARFLEX A - DUO (13 mm thick insulation)

	Code
Twinway stainless-steel pipe DN12, 10 m, incl. 4 nuts with lock rings and hex nipple	12929
Twinway stainless-steel pipe DN12, 15 m, incl. 4 nuts with lock rings and hex nipple	12919
Twinway stainless-steel pipe DN12, 50 m	14901
Twinway stainless-steel pipe DN16, 10 m, incl. 4 nuts with lock rings and hex nipple	9916
Twinway stainless-steel pipe DN16, 15 m, incl. 4 nuts with lock rings and hex nipple	9619
Twinway stainless-steel pipe DN16, 50 m	10564
Twinway stainless-steel pipe DN20, 10 m, incl. 4 nuts with lock rings and hex nipple	9917
Twinway stainless-steel pipe DN20, 15 m, včetně 4 ks matic s měsíčky a vsuvkou	9620
Twinway stainless-steel pipe DN20, 50 m	10565



Code - 14841 (DN12)
Code - 9644 (DN16)
Code - 9645 (DN20)



Code - 9641 (DN 12-20)

SOLARFLEX A - MONO - single flexible stainless steel pipe insulated with either 13 or 19mm thick EPDM insulation with a protective surface layer.

SOLARFLEX A - MONO (13 mm thick insulation)

	DN 12	DN 16	DN 20
Stainless-steel pipe, 10 m, incl. insulation, 4 nuts with lock rings and hex nipple	12895	12899	12903
Stainless-steel pipe, 20 m, incl. insulation, 4 nuts with lock rings and hex nipple	12897	12900	12904
Stainless-steel pipe, 30 m, incl. insulation, 4 nuts with lock rings and hex nipple	12896	12901	12905
Stainless-steel pipe, 50 m, incl. insulation	12898	12902	12906

Besides that also uninsulated flexible stainless-steel pipes are available for solar thermal systems.

SOLARTEN SOLAR FLUID

In order to allow all year round use of a solar thermal system for domestic water heating, special antifreeze fluid shall be used for heat transfer from solar collectors to a hot water storage tank or thermal store. The fluid will ensure protection of the whole system against freezing and frost damage in the winter.

It is recommended to use SOLARTEN antifreeze fluid in Regulus solar thermal systems.

We offer two types of solar fluid. Solarten Super (based on mono propylene glycol) for current installations, and Solarten HT (based on heavy glycols) for thermally highly stressed solar thermal systems. Both the fluids contain corrosion inhibitors and stabilizers for an increased thermal stability and extended lifetime.

Fluids properties	Solarten Super	Solarten HT
Freezing point	-28 °C	-28 °C
Operating temperature	up to 230 °C	up to 260 °C
Short-term overheating	300 °C	320 °C
Colour	yellow	colourless

Fluid packaging:

Plastic container 5l, 10l, 25l

Barrel 60l and 200l

It is recommended to check the freezing point every 2 years.

Antifreeze solar fluid	Solarten Super	Solarten HT
5l	10109	14951
10l	10110	14095
25l	10069	14096
60l	10111	14952
200l (upon order)	10112	14953



60l and 200l barrels



1000l container



In a truck tank

Accessories to handle antifreeze fluid



Filling push cart with a powerful pump designed for professional filling and air venting of sealed systems like solar thermal systems, floor and wall heating circuits.

Code: 9561



Manual filling pump suitable for smaller solar thermal systems. It may stay installed in a system for a solar fluid top-up when needed.

Code: 15111



Electric filling and top-up pump, involving a reliable low-noise piston pump that is easy to use.

Code: 9688



402 ATC Manual Refractometer (frost protection measurer) for freezing point measurement of antifreeze fluids.

Code: 6933

AIR REMOVAL FROM SOLAR THERMAL SYSTEMS

Important components of all solar thermal systems are air removal elements. These are components securing trouble-free operation of a solar thermal system working under high temperatures that prevent possible reduction of their efficiency caused by the presence of air.



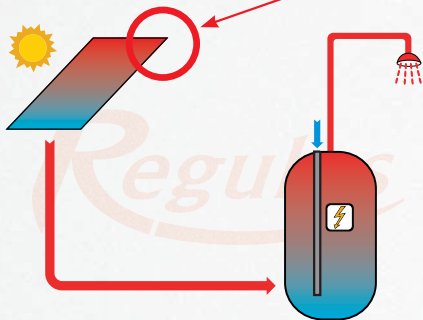
They are designed to remove air from a sealed solar thermal system, especially during its filling and commissioning. An air vent valve shall be placed at its highest point, usually directly at a collector outlet or to a pipe near the collector. In order to reach very good air separation, slower speed of fluid is necessary at the air vent. This is usually done by installing an air separator that brings a wider pipe diameter at the spot which ensures better separation of air bubbles from the fluid. The air removal itself from the solar thermal system is then performed through air vent valves, either manual or automatic ones.

For even more perfect air removal from solar thermal systems, another (vertical) air separator is usually fitted in compact solar pump stations incl. an air vent valve.

After the system has been filled, air vent valves shall be closed in order to avoid undesirable leaks of solar fluid during operation.



Typical location for an air vent valve



Valves for solar thermal systems

	Code
Air vent valve, 3/8", bottom connection, up to 150°C	6118
Ball valve, 3/8" M/F, up to 160°C, under air vent valve	7250
Safety valve, 1/2" F, 6bar, up to 140°C, for solar thermal systems	1616
Safety valve 1/2"x3/4" M/F, 6 bar, up to 150 °C, for solar thermal systems	16680

Air separators and accessories

	Code
SPVS Air separator G 3/4" M, in brass, horizontal, connections 2x 3/4" M, 3/8" F to air vent valve	11591
Air separator, horizontal, 2x Cu22 connections, with stainless steel strainer, 3/8" F outlet for air vent valve	8510
Vertical air separator with G 3/4" MF manual air vent valve	11224

Air vent kits

	Code
Kit of air separator and air vent valve for solar thermal systems	13308
Insulation set for air separator and air vent valve	13197

PUMP STATIONS

Pump stations are equipped with a solar circulation pump with PWM speed control, thermometer, pressure gauge, solar safety valve, fill and drain valves, shut-off valve, check valve, flow indicator, outlet for expansion tank connection, and some even with an air separator and solar controller.

Pump stations are fully assembled and tested, placed in a two-part thermoinsulation case, with a rigid back plate for a quick installation on a wall or a hot water storage tank.

Pump station for a solar return line, no controller



Code	Pump model	Flow rate	Connection
14861	UPM3 25/7,5	2-12 l/min	3/4" M
14865	UPM3 25/7,5	8-28 l/min	1" M

Pump station for a solar return line with integrated controller

Pump stations with a controller are hard wired and fitted with a power supply cable with plug.



Code	Pump model	Flow rate	Controller	Number of solar consumers	Number of sensors	Connection
14870	YP ST 25/7	2-12 l/min	STDC E ext	1	2	3/4" M
14871	YP ST 25/7	2-12 l/min	STDC E	1	2	3/4" M
14533	YP ST 25/7	2-12 l/min	SRS2 TE ext	1	3	3/4" M
14532	YP ST 25/7	2-12 l/min	SRS3 E ext	2	3	3/4" M

Pump stations for solar return and feed lines, no controller

Unlike single pipe pump stations, twin-pipe models are equipped with an extra thermometer and air separator.



Code	Pump model	Flow rate	Connection
14866	UPM3 25/7,5	2-12 l/min	3/4" M
14867	UPM3 25/7,5	8-28 l/min	1" M
14868	Stratos Para 25/1-8	20-70 l/min	6/4" M
9911	12V DC (FV panels)	2-12 l/min	3/4" M

Pump stations for solar return and feed lines with integrated controller

Unlike single pipe pump stations, twin-pipe models are equipped with an extra thermometer and air separator.

Pump stations with a controller are hard wired and fitted with a power supply cable with plug.



Code	Pump model	Flow rate	Controller	Number of solar consumers	Number of sensors	Connection
15045	YP ST 25/7	2-12 l/min	SRS2 TE	1	3	3/4" M
14860	YP ST 25/7	2-12 l/min	SRS3 E	2	3	3/4" M
14872	YP ST 25/7	2-12 l/min	SRS3 E	2	3	Cu 22
14875	YP ST 25/7	2-40 l/min	SRS6 EP	2	5	1" M

■ SOLAR CONTROLLERS

These controllers are intended to control solar thermal systems with one or two solar collector arrays and up to 3 solar consumers. The solar consumers may be hot water storage tanks, pool heat exchangers, or thermal stores designed for heating. They involve functions for efficient operation of solar thermal systems and permit solar pump speed control. They are user-friendly, featuring help function and menu in various languages. The graphic screen enables easy display and selection from typical solar thermal systems. They can be used as universal differential thermostats or as time- and temperature-switched thermostats. SRS controllers are also equipped with CAN bus that permits to connect mutually 2 or more controllers or connect a controller with a datalogger to share data.

Main advantages:

- both graphics and texts on a backlit display
- simple viewing of the current measurement values
- analysis and monitoring of the system also by means of statistical graphics
- extensive setting menus with explanations
- menu lock can be activated to prevent unintentional setting changes
- usual preset parameters in factory setting

STDC E SOLAR CONTROLLER

STDC E controller is designed for use with single-array solar thermal systems with one heat consumer.

Two Pt1000 temperature sensors are included.

SRS2 TE SOLAR CONTROLLER

SRS2 TE controller is designed for use with solar thermal systems with one solar array and one solar consumer, permitting to switch directly an auxiliary heat source of up to 3.5 kW power input (electric heating element, gas boiler, heat pump) and a circulation pump.

Three Pt1000 temperature sensors are included.

SRS3 E SOLAR CONTROLLER

SRS3 E controller is designed for use with solar thermal systems with 2 independent solar arrays and one solar consumer or one solar array and up to 2 solar consumers or for 2 independent solar thermal systems. When connected with one solar array and one solar consumer also other functions can be used – auxiliary source, heating circuit return preheating, solid-fuel boiler control, heat exchange, cooling....

Three Pt1000 temperature sensors are included.

SRS6 EP SOLAR CONTROLLER

SRS6 EP controller is designed for use with solar thermal systems with 2 independent solar arrays and one or two solar consumers or one solar array and up to 3 solar consumers or for 2 independent solar thermal systems.

In simple hydraulic variants where some outlets remain free, also other functions can be used – auxiliary source, heating circuit return preheating, solid-fuel boiler control, heat exchange, cooling...

The controller enables 2 flowmeters to be connected.

Five Pt1000 temperature sensors are included.

Solar thermal systems can be controlled also by IR 12 weather compensated controllers that are designed to control heating system as well.



SOLAR CONTROLLERS - PARAMETER OVERVIEW



Name	STDC E	SRS2 TE	SRS3 E	SRS6 EP
Code	13164	14388	13166	13168
Application	control of 2 outputs (1 mech. relay, 1 optional 0-10V or PWM), 3 inputs for Pt1000 temperature sensors	control of 4 outputs (3 mech. relays, 1 optional 0-10V or PWM), 4 inputs for Pt1000 temperature sensors	control of 3 outputs (2 mech. relays, 1 optional 0-10V or PWM), 4 inputs for Pt1000 temperature sensors	control of 5 outputs (3 mech. relays, 2 optional 0-10V or PWM), 6 inputs for Pt1000 temperature sensors
Number of hydraulic variants for solar thermal and heating systems	9	8	27	42
Solar features				
1 separate collector array	YES	YES	YES	YES
2 separate collector arrays	NO	NO	YES *1	YES
1 solar consumer	YES	YES	YES	YES
2 solar consumers	NO	NO	YES *4	YES
3 solar consumers	NO	NO	NO	YES *4
2 separate solar thermal systems	NO	NO	YES *6	YES *6
Collector protective cooling (pump cycles)	YES	YES	YES	YES
Solar consumer night cooling	YES	YES	YES	YES
Cooling by external heat exchanger	NO	NO	YES *1*4	YES *1*4
CAN port	NO	YES	YES	YES
Free differential function	NO	NO	YES *5	YES *5
VFS flowmeter input	NO	NO	NO	2 x
PWM circulation pump speed control	YES	YES	YES	2 x
Features parallel with solar thermal system (one of them only)				
Switching of DHW heating by auxiliary heat source	NO	YES *2	YES	YES
DHW heating from thermal store	NO	NO	YES	YES *7
DHW recirculation	NO	YES	NO	NO
Solid-fuel boiler function *8	NO	NO	YES	YES
Heating circuit return preheating	NO	NO	YES	YES *7
Features instead of solar thermal system (one of them only)				
Switching of DHW heating by auxiliary heat source	YES *3	NO	YES	YES
DHW heating from thermal store	YES	NO	YES	YES
Solid-fuel boiler function *8	YES	NO	YES	YES
Universal thermostat	YES	NO	YES	YES
dT differential function	YES	NO	YES	YES
Heating circuit return preheating	YES	NO	YES	YES

- *1 systems with one solar consumer only
- *2 direct switching of AC3 power output up to 3 kW
- *3 without universal thermostat timer functions
- *4 systems with one solar array only
- *5 only as heating circuit return preheating or heat exchange functions
- *6 one collector to one solar consumer only
- *7 combination with DHW aux heating possible
- *8 switching of a circulation pump in a solid-fuel boiler primary circuit based on a temperature difference

EXPANSION VESSELS

The function of pressure expansion vessels is to compensate for fluid volume changes caused by temperature changes, and to keep the system pressure within the necessary limits. The vessels are made of high quality steel and treated with anti-corrosion surface coating. The steel vessel is fitted with an impermeable, highly elastic membrane resistant to high temperatures. In vessels of 50 l volume and more, the inner membrane is replaceable. An expansion vessel in solar thermal systems shall be sized for a temperature difference between the min. winter temperature and max. summer temperature, and it shall be able to contain the fluid of all collectors in case of stagnation.

Data sheets for solar collectors involve the recommended sizes of expansion vessels depending on the number of collectors for elevation up to 20 m and for the total length of the feed and return pipes up to 30 m.

In all other cases the expansion vessel size shall be calculated. A wrongly sized expansion vessel may cause damage to life, health, property or environment.

Wall hung models



Code	Name	Volume	Connection	Max. working pressure
13720	SL012 Expansion vessel	12	3/4"	8
13721	SL018 Expansion vessel	18	3/4"	8
13722	SL025 Expansion vessel	25	3/4"	8
13723	SL040 Expansion vessel	40	3/4"	8

2.5 bar pre-charge pressure, up to 130° C working temperature

Floor standing models, with replaceable membrane



Code	Name	Volume	Connection	Max. working pressure
13724	SL050 Expansion vessel	50	3/4"	10
13725	SL080 Expansion vessel	80	3/4"	10
13726	SL100 Expansion vessel	100	1"	10
13727	SL150 Expansion vessel	150	6/4"	10
13728	SL200 Expansion vessel	200	6/4"	10
13729	SL300 Expansion vessel	300	6/4"	10
13730	SL500 Expansion vessel	500	6/4"	8

2.5 bar pre-charge pressure, up to 130° C working temperature

Wall brackets for expansion vessels



Expansion vessel bracket and connection kit - code: 7766

Connection valve (with G 3/4" F and M threads) with a double check valve, permitting quick and safe expansion vessel disconnection without any leaks.



Wall bracket - code: 12174

Connection valve

3/4" - code: 8770

1" - code: 12295

6/4" - code: 14492

More components for solar thermal systems can be found in our **Thermal Stores** catalogue.

