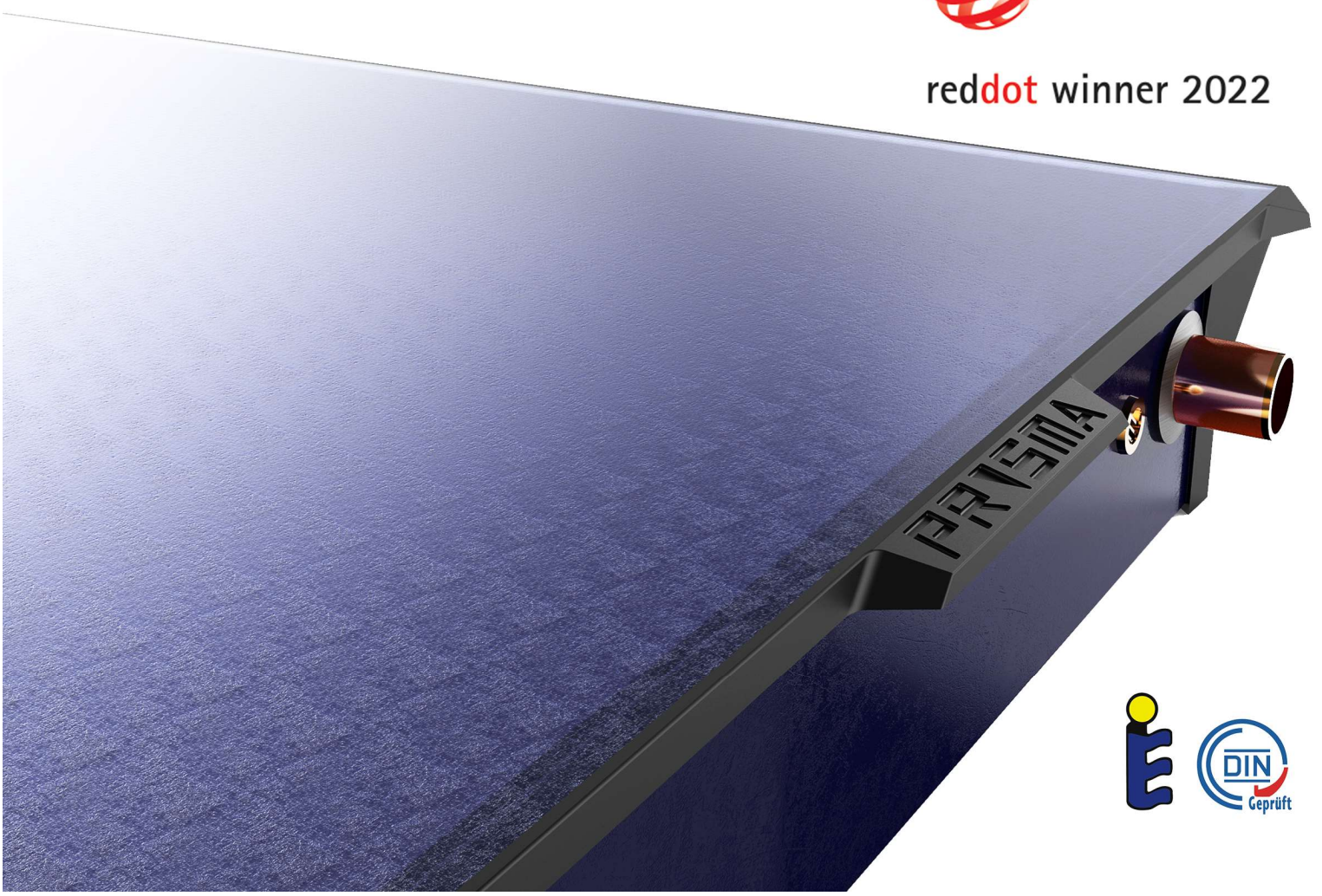


TECHNICAL MANUAL
SOLAR SELECTIVE PANEL

PRISMA



reddot winner 2022



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PRISMA

The Prisma Calpak solar collectors are flat, full plate, vertical collectors, with aluminium absorber, with vertical copper pipes welded onto it, ending at their upper and lower ends, in two horizontal headers. The thermal fluid circulates between the vertical and horizontal pipe grid.

The surface processing of the aluminium sheet is of selective quality, achieved with the ecological "Sputtering" method by TINOX. These surfaces have the great advantage while absorbing solar energy and operate as black bodies (high absorptivity), when they radiate themselves, they operate as mirrors (minimum radiation $\epsilon \leq 3.5\%$), thus achieving a significant decrease of the collector's thermal losses.

- The copper grid consists of vertical $\Phi 8$ tubes, spaced at 85mm intervals and welded onto the 0,4 mm aluminium sheet with Laser welding. The small distance between the tubes, the thickness of the aluminium and the proper welding, maximizes the heat transfer from the heated aluminium sheet to the vertical pipes and finally to the thermal fluid which circulates inside.
- To reduce flow friction the headers have a $\Phi 22$ diameter.
- The absorbers are placed in a pre-painted, high quality, alloy-steel frame, with 0,42mm thickness.
- On the front, there is a clear safety glass cover (low iron, mistlite, tempered), 3,2mm thick, that is fitted on the pre-painted alloy-steel frame, by injecting the polymeric material Colofast® by BASF.
- The polymeric Colofast® offers flawless permanent connection between glass and steel, robustness and forms a solid peripheral structure for the upper section of the casing. It is also impermeable and offers perfect finish.
- On the back of the absorber, there is glass-wool thermal insulation with 40 kgr/m³ density and 30mm thick.
- The operating pressure of the closed circuit of the collectors can be 6 or 10 bar, depending on the design, considering that collectors can withstand even higher pressures.
- The Calpak Prisma collectors are designed for installation on flat roofs and pitched tiled roofs, by using the appropriate support frames that are available as accessories.

In order to ensure the anti-freeze protection of the collector, we offer the Calpak NOX thermal fluid, which is a product based on the non-toxic pharmaceutical propylene glycol (accessory). This thermal fluid is mixed with water, at a minimum volume ration of 20%.

Minimum ambient temperature	-5	-10	-15	-20	-25	-30	-35
Ratio Calpak NOX water by volume °C	20	23	31	37	43	48	53

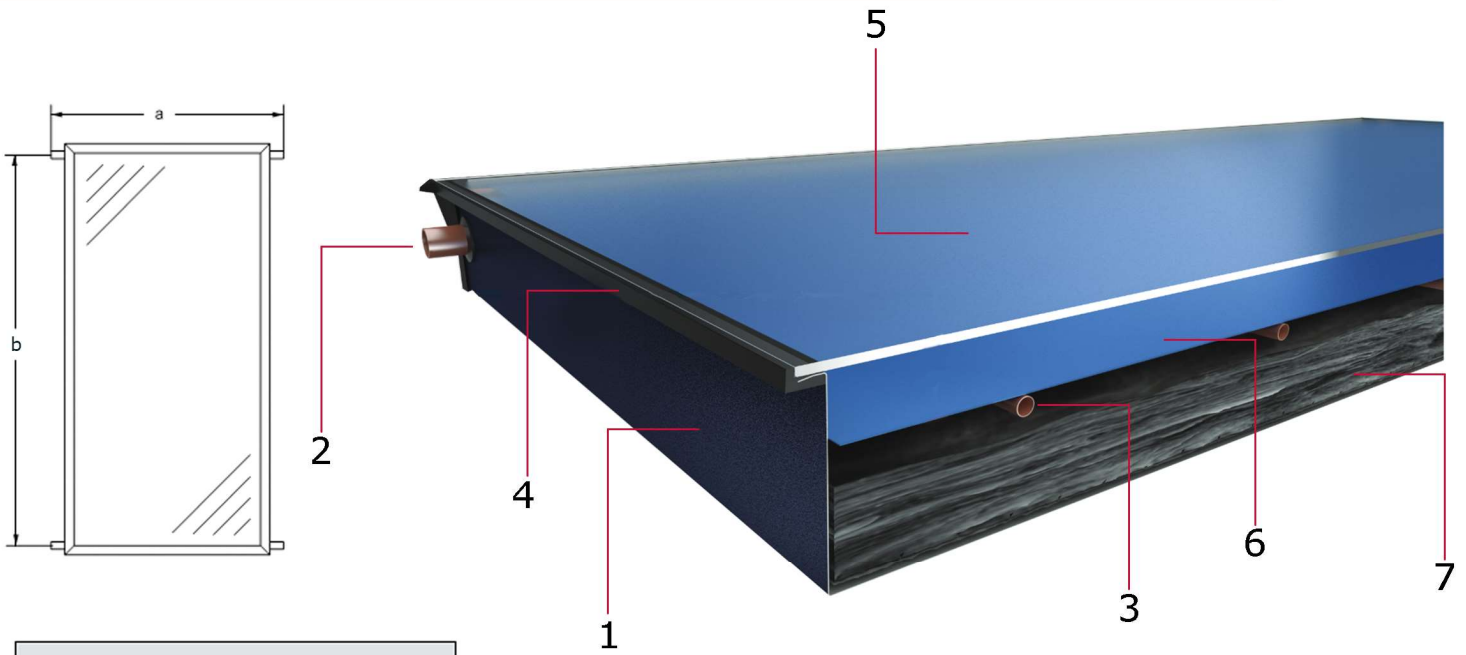
These collectors, due to their selective properties and the reduced thermal losses, are appropriate for producing hot water in countries and regions with cold winters. They also offer the ideal solution for central solar heating systems of premises, for larger scale systems (hotels, hospitals, etc), as well as industrial applications.

The SOLAR KEYMARK quality and performance label of the Calpak Prisma collectors is a certification awarded by the European Union (CEN). To obtain it, on the one hand, thorough testing by recognized laboratories (e.g. NCSR "Demokritos") or foreign laboratories (Stuttgart University etc.) must take place, based on European standards EN 12975-1-2, and on the other hand, they must be manufactured under conditions set out by the ISO 9001:2015 standards.



SKM 10093.2

PRISMA

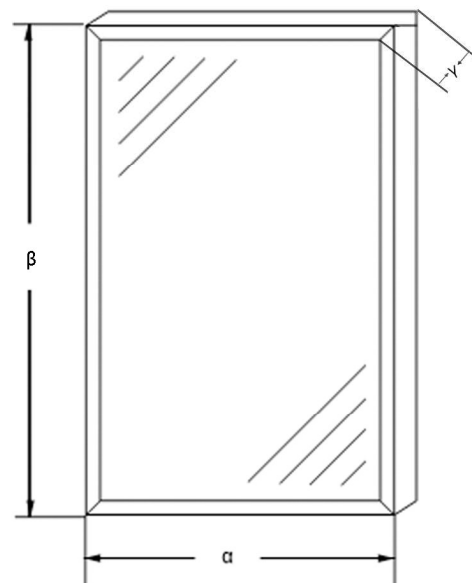


Distances of hydraulic connections		
Collector type	Prisma 2.0	Prisma 2.5
Distance a (mm)	1.255	1.255
Distance b (mm)	1.525	1.920

1. Pre-painted alloy-steel frame 0,42mm thick.
2. $\Phi 22$ absorber header copper pipe.
3. $\Phi 8$ vertical copper pipes, Laser welded.
4. Sealing by the polymeric material Colofast® by BASF.
5. Low iron (T >90,5%), mistlite, tempered, safety glass 3,2mm thick.
6. Absorber of a full plate aluminium sheet 0,4 mm thick, with selective surface process by Tinox ($\alpha=0,95$, $e=0,04$).
7. Glass-wool thermal insulation, 30mm thick, thermal conductivity 0,032 W/mK at 100C and 40 kgr/m3 density

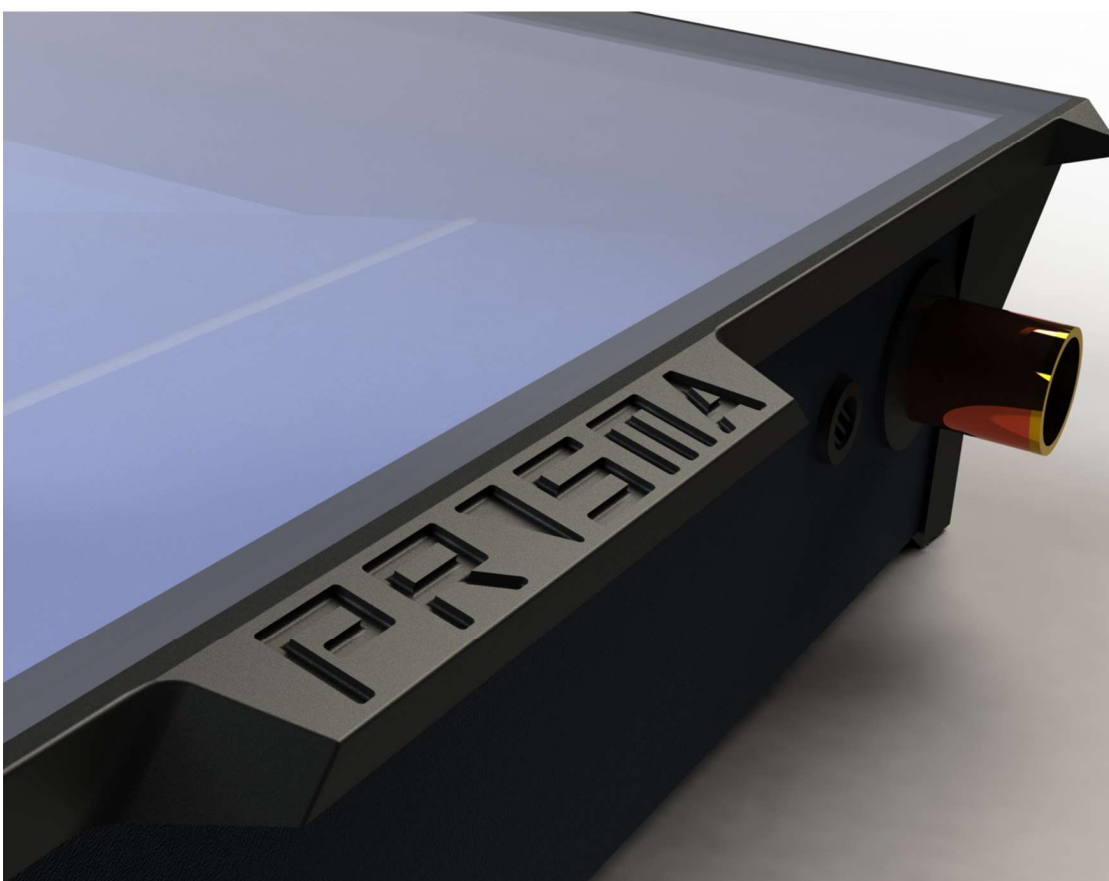
PRISMA

Τύπος Συλλέκτη		Prisma 2.0	Prisma 2.5
Total surface	m ²	2,00	2,49
Window surface	m ²	1,91	2.39
Absorber surface	m ²	1,90	2,37
Width (α)	mm	1.233	
Height (β)	mm	1.624	2.021
Thickness (γ)	mm	86	
Weight (empty)	kgr	29,15	35,4
Weight of thermal fluid	kgr	1,38	1,55
Maximum operation temperature	kPa/bar	1.000/10	
Hydraulic connections (copper pipe)	mm	Φ22	
Stagnation temperature	°C	180	
Effective thermal capacity	KJ/k	21,13	23,59
Time constant	sec	59,7	60,3
Thermal output	kW	1.526	1.919



Annual energy performance of collector according to the mean temperature of the thermal fluid (kWh)

Location	Athens		Wurzburg	
	25°C	50°C	25°C	50°C
Prisma 2.0	2.393	1.723	1.470	947
Prisma 2.5	2.991	2.154	1.837	1.184



The Prisma collector is made in one completely automated production line consisting of 5 high-tech robotic arms and machines.

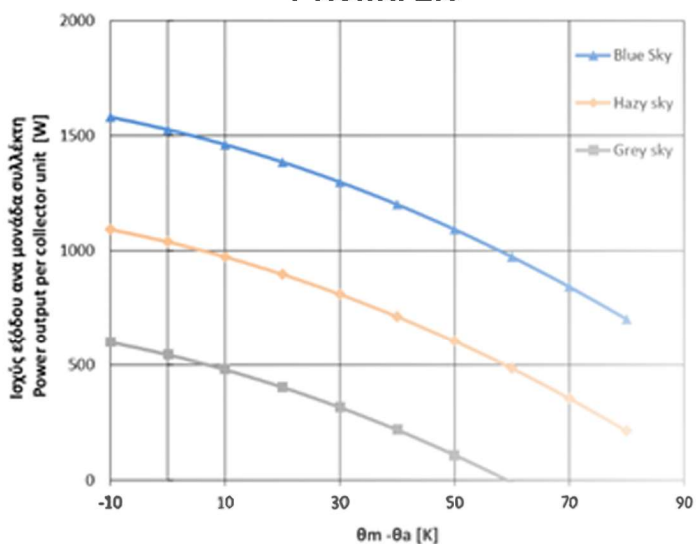


Colofast polymer material provides perfect adhesion for glass and metal and therefore absolute waterproofing. The ventilation hole $\Phi 8$ is equipped with grilles to avoid the entry of insects.

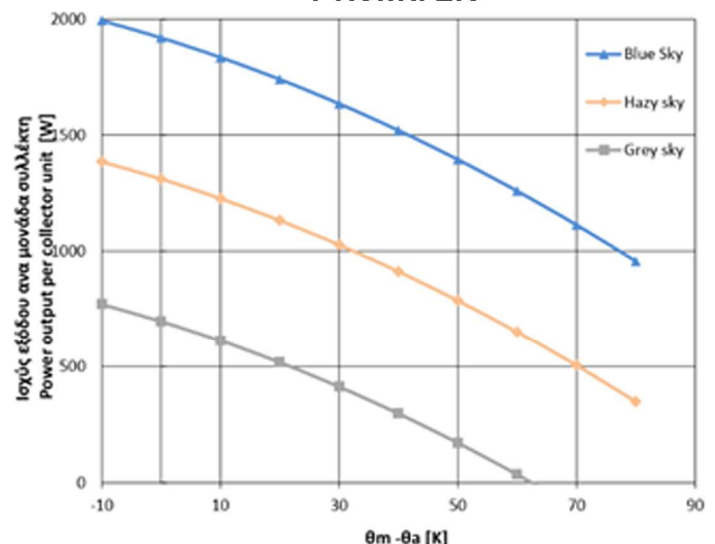


Coefficient	Explanation	Units	PRISMA 2.0	PRISMA 2.5	Standard deviation
$\eta_{0, hem}$	Maximum collector efficiency based on the total solar irradiance	-	0,762	0,77	0,001-0,002
$\eta_{0, b}$	Maximum collector efficiency based on the direct solar irradiance	-	0,777	0,783	-
k_d	Incidence angle modifier for diffused solar irradiance	-	0,874	0,892	-
α_1	Heat loss coefficient	W/(m ² K)	2,99	3,18	0,19
α_2	Temperature dependence of heat loss coefficient	W/(m ² K ²)	0,027	0,021	0,003
C/A	Effective thermal capacity per sqm of collector surface	KJ/(m ² K)	10,55	9,47	-

Prisma 2.0



Prisma 2.5



- Solar irradiation on flat Collectors (W/m^2) in Athens

tilt	0	10	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
Jan	66	80	91	96	100	104	107	109	111	112	113	112	111	109	107	104	100
Feb	75	84	91	93	96	97	99	99	99	99	98	96	94	91	88	84	80
Mar	104	112	116	118	119	119	119	118	116	114	111	108	104	99	94	89	83
Apr	146	151	152	152	151	149	147	143	139	134	129	123	116	108	101	92	84
May	182	183	181	178	175	170	165	159	153	145	137	128	119	109	100	90	79
Jun	200	200	195	191	185	180	173	166	158	149	139	128	118	108	96	85	75
Jul	213	214	210	205	199	194	187	180	171	162	151	139	128	117	105	91	80
Aug	200	206	206	204	202	199	194	188	182	174	165	155	144	132	121	109	96
Sep	156	168	176	179	180	181	180	178	175	171	166	161	154	146	138	128	118
Oct	106	120	130	134	138	140	142	143	142	142	140	137	134	130	125	119	113
Nov	66	77	86	90	94	96	99	100	101	102	102	101	99	97	95	92	88
Dec	53	63	72	76	79	82	85	87	88	89	89	89	88	87	85	83	80
S1	1567	1658	1706	1716	1718	1711	1697	1670	1635	1593	1540	1477	1409	1334	1252	1165	1075
S2	1203	1242	1250	1243	1230	1213	1188	1157	1120	1077	1027	971	913	850	784	714	645
S3	364	416	456	473	488	498	509	513	515	516	513	506	496	484	468	450	430

The tilt is in degrees ($^{\circ}$) to horizontal

S1= Annual total solar irradiation

S2= Total solar irradiation from April 1st to October 31st

S3= Total solar irradiation from November 1st to March 31st

- Optimum tilt angle for collectors depending on use

Usage	Optimum tilt angle
Production of Hot Water for use (throughout the year)	$30^{\circ} - 45^{\circ}$
Production of Hot Water for use (summer season, Apr - Oct)	$15^{\circ} - 30^{\circ}$
Hot Water for use (throughout the year) + space heating	$45^{\circ} - 60^{\circ}$
Hot Water for use (throughout the year) + swimming pool	$30^{\circ} - 45^{\circ}$
Hot Water for use (throughout the year) + space heating + swimming pool	$45^{\circ} - 60^{\circ}$

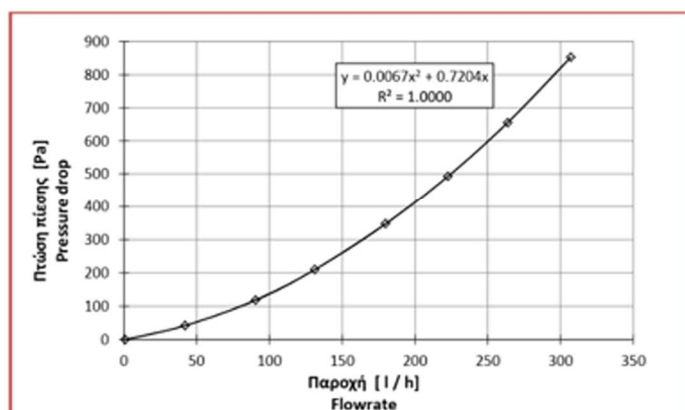
- Indicative table for anticipated performance drops based on orientation

SOUTH	SOUTH-EAST	SOUTH-WEST	EAST	WEST
0%	-11%	-7%	-35%	-30%

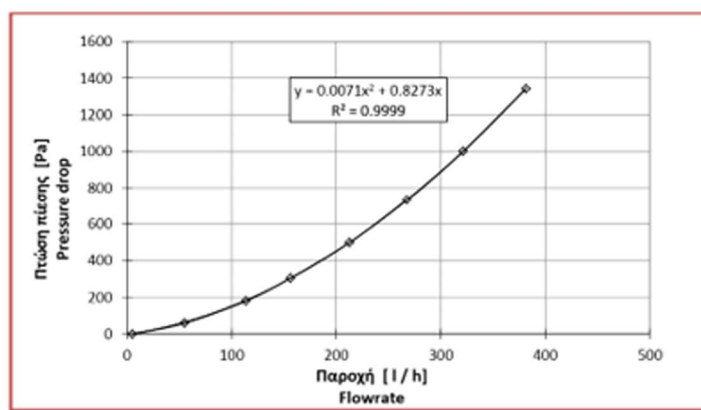
Note: For summer season operation only, the change in the horizontal tilt from 45° to 15° does not affect significantly the thermal performance of the solar system.

Diagrams of Average Pressure Drop of thermal fluid in Prisma collectors

Prisma 2.0



Prisma 2.5

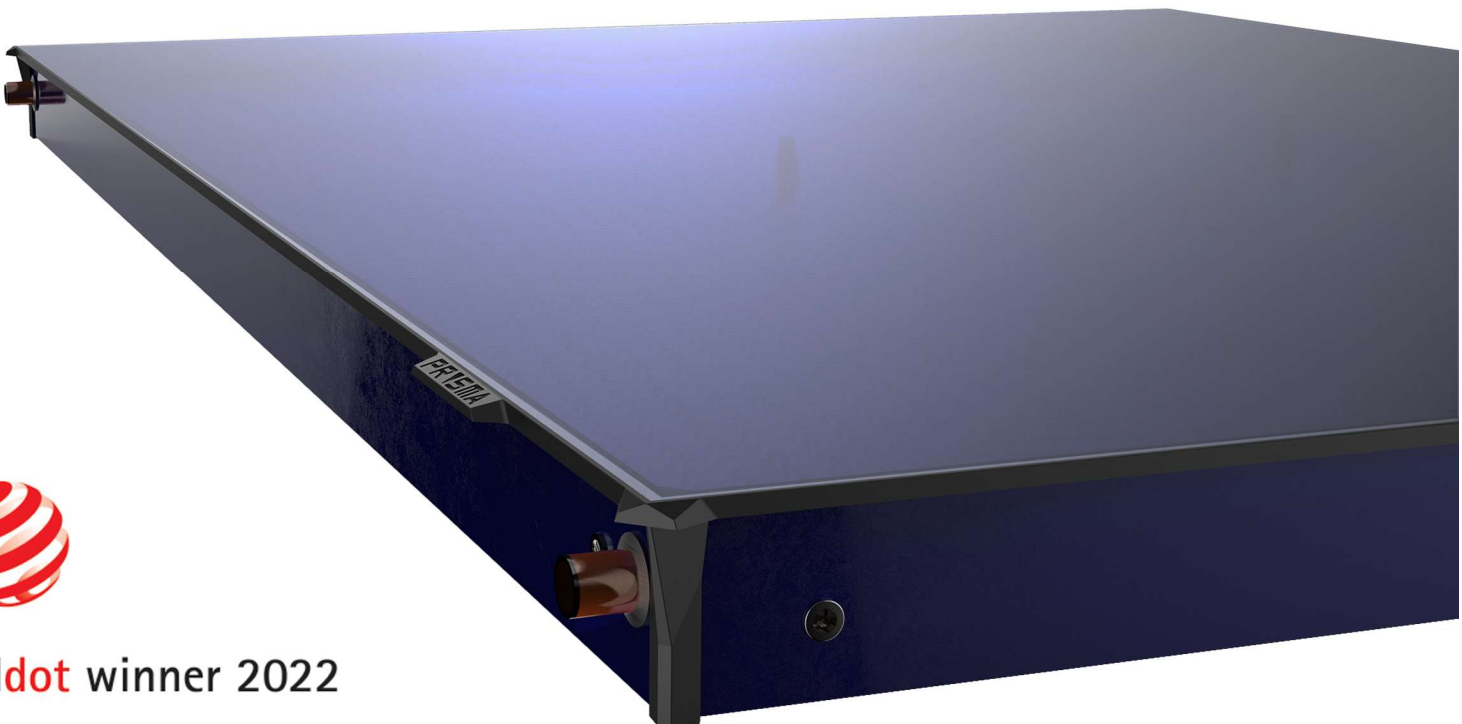


The following accessories are provided, to facilitate installation:

- Sheet steel supports for flat roofs
- Sheet steel supports for tiled roofs
- Set of $\Phi 22$ connectors
- Special collector covers for the vest protection and prevention of overheating of the solar system, in the summer, if it is not in use.
- Calpak NOX thermal fluid, based on non-toxic pharmaceutical propylene glycol, packaged in 1, 2, 5 and 10lt canisters.
- Automatic air vents
- "T" joints, protection pockets and temperature sensors
- Full range of solar stations for controlling the operation of forced circulation solar systems, with or without circulator.

PRISMA

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