Calpak

Technology & Quality
through a new prism

PRISMA

Calpak Prisma®

An innovative, high-tech collector that takes solar water heaters to a new era!

The creation of Prisma® collector makes all of us, at Calpak, very proud. It is an innovative collector that stands out for its technology and manufacturing qualities.

Prisma's smart production platform is fully automated with new robotic systems that are centrally controlled through 5G technology and AI algorithms. It is acknowledged as one of the most advanced solar thermal production platforms in Europe.

The truly resilient water tank combined with the high performing Prisma collector®, ensure an efficient solar water heater that will deliver ample hot water for many years.

What is the Prisma® collector?

It's an innovative, high-tech collector.

What makes it innovative?

The polymeric material Colofast® (BASF®) that is used in its production; a world first achievement.

Where has the Colofast® material been applied to date?

It has been used by the biggest automobile manufacturers in the world for the manufacturing of the car sunroofs.

What are its features and what value does it offer to the Prisma® collector?

- Perfect adhesion with glass and metal, which makes it ideal for their strong bonding
- Great torsional rigidity and, therefore, robustness throughout the structure
- Absolute waterproofing
- Perfect finish

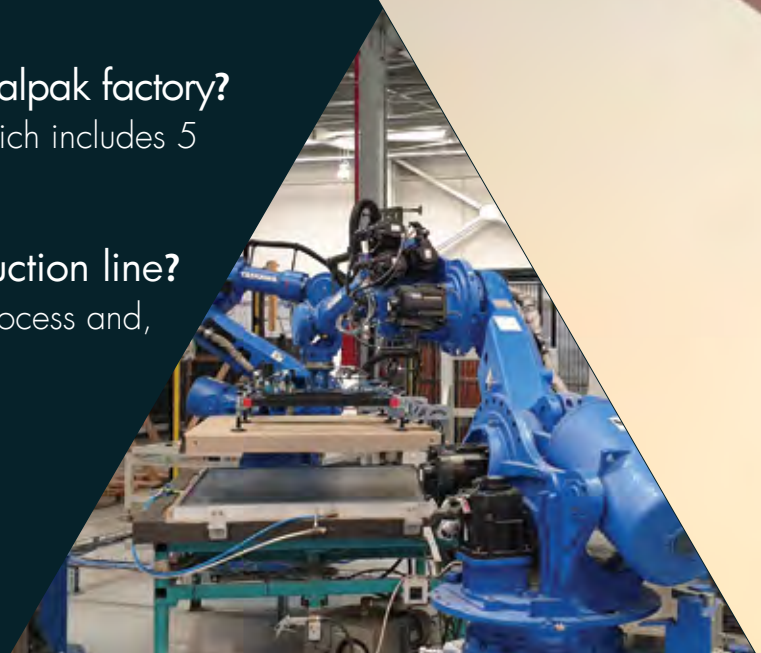
How is the Prisma® collector produced in the Calpak factory?

It is produced by a fully automated production line, which includes 5 robotic arms and high-tech machines.

What are the benefits of an automated production line?

It ensures absolute standardization of the production process and, therefore, the assurance of high quality.

Make the smart choice and enjoy excellent performance and high energy savings!



Prisma® Technical Features

	160/2.0	200/2.0	200/2.5	300/4.0
	3-4 people	4 people	5 people	6-7 people
Collector				
area (m²)	2 m²	2 m²	2,5 m²	4 m²
efficiency / heat loss coefficient	no,b= 78% / a1= 2,99 W/m²K			
maximum output	1524W	1524W	1905W	3048W
absorber	high selective - full plate - laser welded			
frame	colofast® (BASF® patented) & zinc coated alloy steel by Arcellor-Mittal			
insulation	glass wool 30mm			
glass	tempered 3.2mm (safety), low-iron (transparency > 91.5%)			
Tank				
capacity (lt)	155,9	155,9	201,7	275,1
tank material	steel DC-03 2.5mm by Arcelor-Mittal (according to DIN 10130)			
welding method / test	robotics using artificial intelligence / double test at 15bar			
anti-corrosion / cathodic protection	direct enameling (according to DIN 4753/3) / magnesium rod (according to DIN 4753/6)			
antifreeze protection	Calpak Nox (pharmaceutical polypropylene glycol)			
insulation	Injected ecological polyurethane foam (43 kg/m³ density and 50mm thickness)			
electrical resistance	3,5 KW inox (or less)			
connection to boiler	in triple energy models (trien)			

Certifications

Quality	Test Labs	

www.calpak.gr

An OEM partnership for all seasons

Production Facilities of Thermosiphonic Water Tanks

Calpak

Having an in depth understanding of all the factors that make a successful OEM partnership as well as appreciation for your clients' true needs, we can assist your business to grow in the solar thermal sector.

Calpak's OEM approach

With over 38 years of experience in our field, we are in the forefront for the production of a variety of innovative solar thermal equipment. Our range of products comprises of flat plate and vacuum tube collectors, horizontal hot water tanks and complete thermosiphonic systems.

Calpak has invested in a state-of-the-art manufacturing plant with fully automated production lines. We strive to enhance the quality of our existing products as well as develop new products of the highest value. To achieve this we rely on our profound know-how and technological expertise.

Quality to us is sacrosanct. We know however that this virtue cannot stand alone in an OEM partnership. When a project is outsourced to us we also weigh the importance of considerations such as production capacity, product finishing, packaging, customization and differentiation, market protection, certification, punctual deliveries and needless to say, cost.

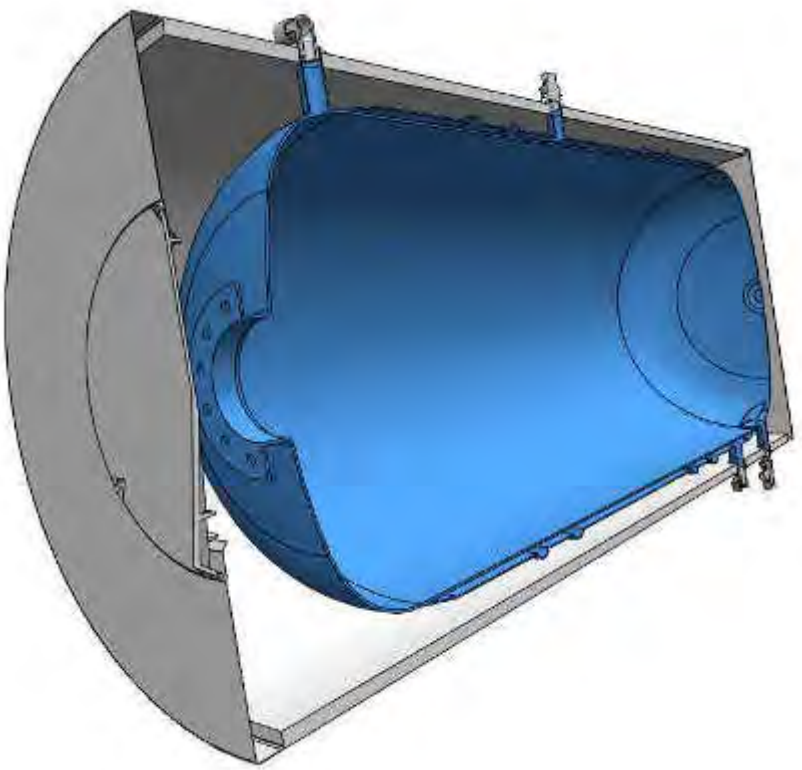
Calpak should be your choice for a manufacturing partner as we have an in depth understanding and appreciation of all the elements which combine to make a successful OEM partnership offering you a competitive advantage in solar thermal products.

Research & Development

Equipped with a wealth of technical know-how and a heritage of Research and Development, our Company had, as far back as 1976, invested in in-house state of the art laboratory facilities. Such enabled the calculation of efficiency measurements prompting further amelioration of the products, at a time when no other organisation was able to do so.

Today, our R&D department is still dedicated to ensuring the continuous enhancement of our existing products and systems as well as the development of new models in cooperation with leading international and domestic research institutes and universities.

The modeling and optimisation of flow inside both circuits of our hot water tanks is one example.

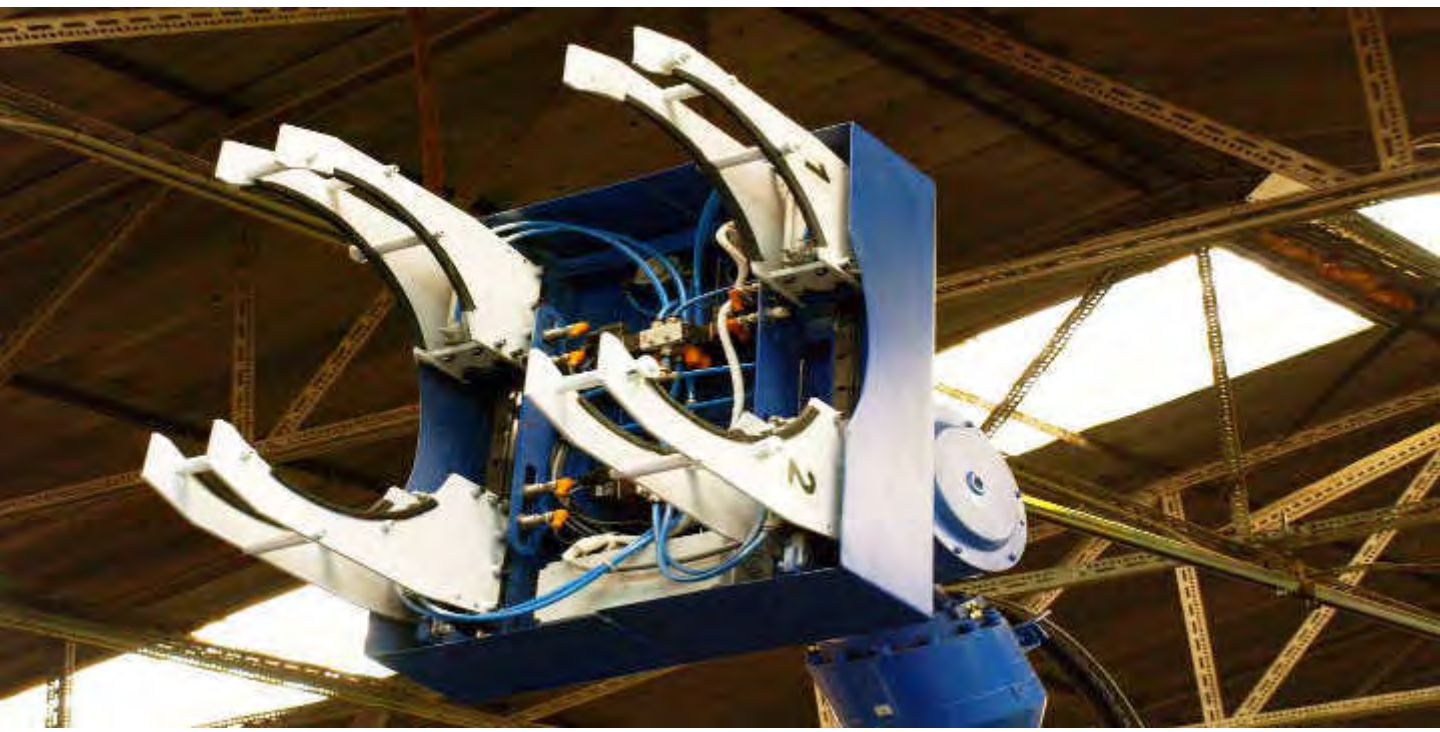


We always aim for higher efficiency, durability and novelty of design. At the same time we remain consistent with our philosophy according to which we add value up to the point that this makes sense from the economical point of view of the end users who expect to rapidly amortize their investment.

Needless to say, we employ state of the art Computer Aided Design, Engineering and Manufacturing [CAD/CAE/CAM] systems to make sure that we design, test and manufacture our products to the best of our potential.

State of the Art Robotic Manufacturing

Our innovative designs are materialised when our products are manufactured in our vertically organized and robotized premises. The quality of production is guaranteed by standardised procedures and thorough testing controls that are certified under the ISO 9001:2008. Calpak's hot water tanks are certified with numerous international and national quality marks, such as Solar-Keymark, CE, CSTB, SRCC, DCL and SABS that can be utilized by or transferred to your company under certain conditions.



Furthermore, a system of lean manufacturing ensures not only that we can deliver in time with the highest value for money ratio, but also that we do not stock faults thus maintaining a consistent high quality.

Our water tanks specifically are produced in a fully robotized facility where all cutting, forming, welding and handling operations are performed automatically and to the highest possible precision.

Highest Quality Raw Materials

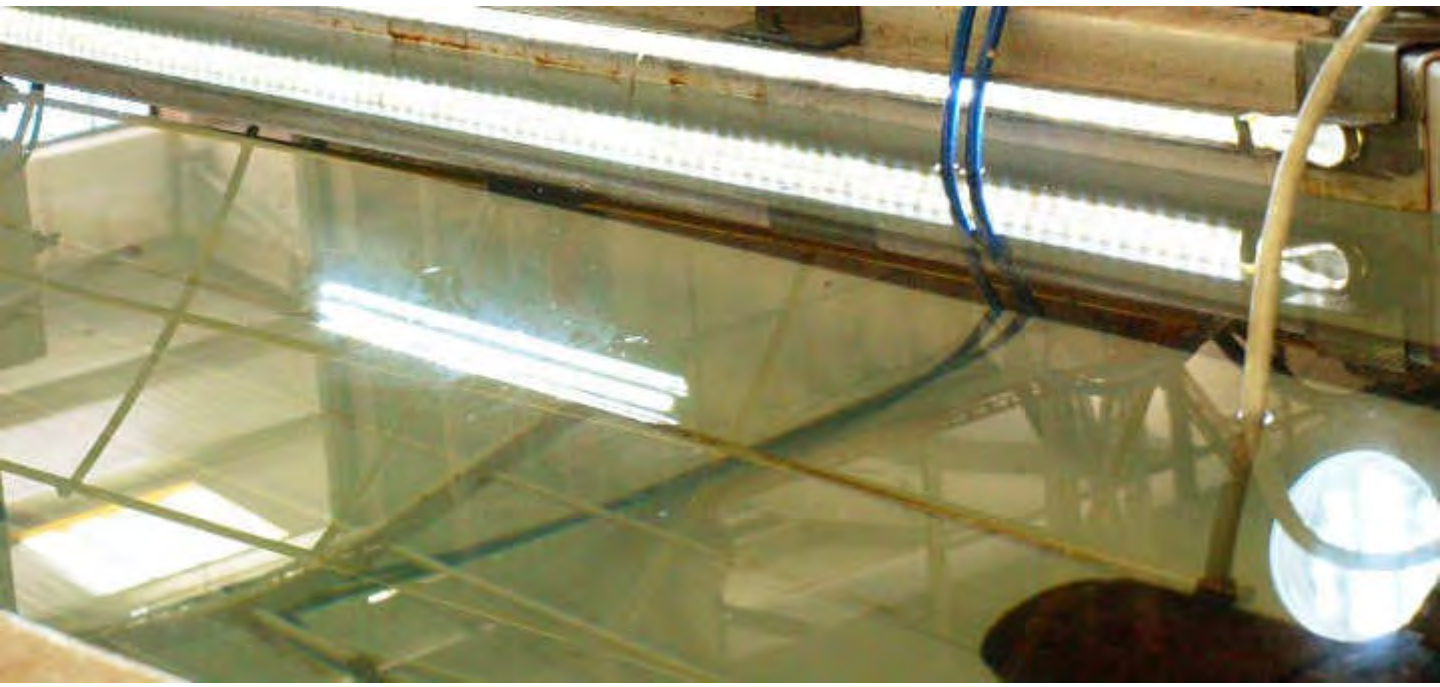
Our water tanks are manufactured from the highest quality raw materials. An example of our commitment to quality, our production line cannot function with raw materials of medium quality.

The steel stock our tanks are made from has to have very specific composition and surface finish for welding and enameling operations while and very small dimensional tolerances for successful cutting, forming and welding.

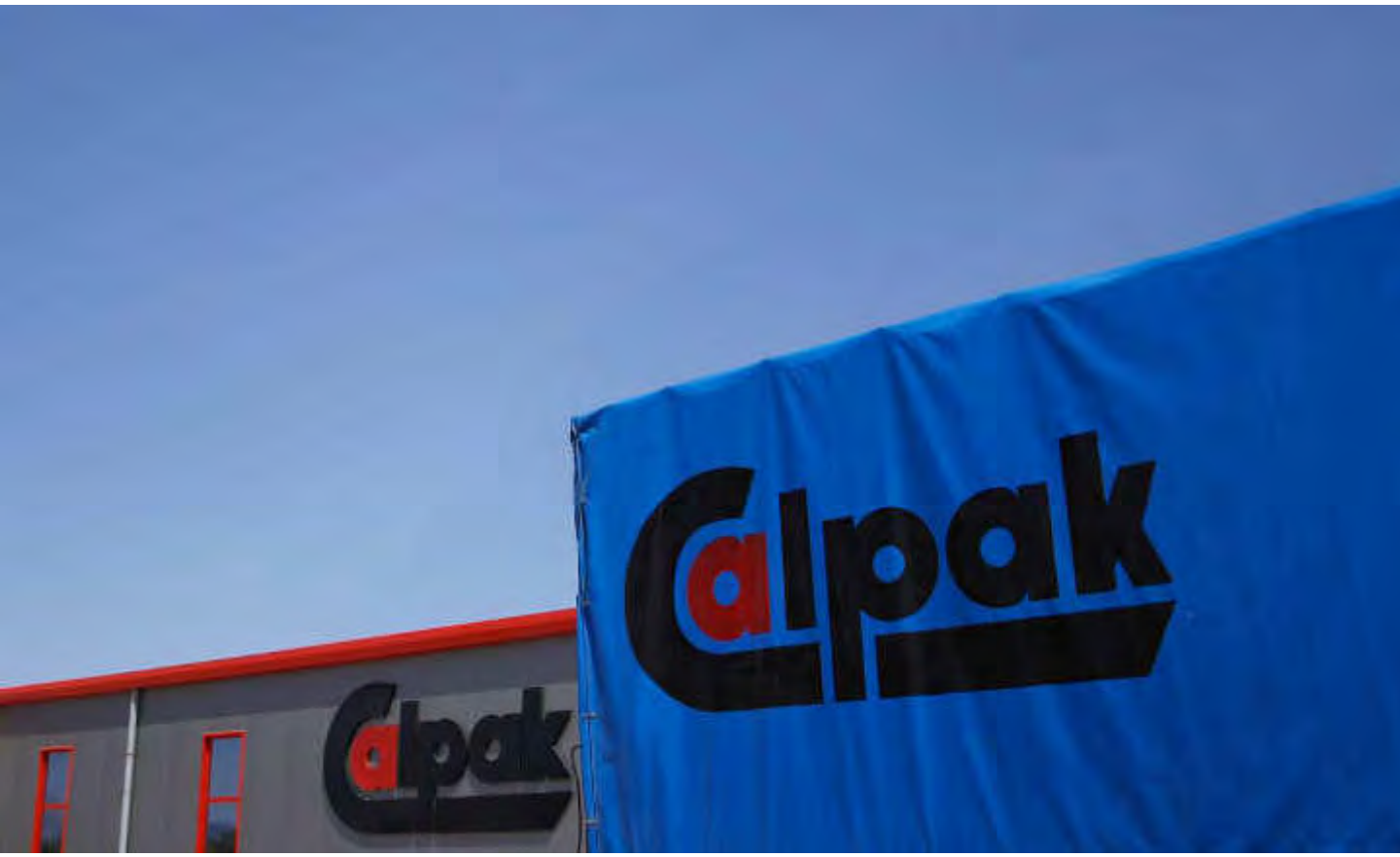
Our liquid enameling is performed in dedicated facilities with ROHS certified German raw materials, is certified under the EMAIL quality mark and follows the DIN 4753/3 standard. It is a process that has been developed in a period spanning almost 3 decades, where both the process parameters as well as the geometry of the water tank have been fine-tuned to perfection.

Strict Quality Control

All our hot water tanks undergo strict quality control at every step of the process. Our system of lean manufacturing ensures that a fault is discovered before it is replicated and stocked.



Our pressure tests for example are in-line with the manufacturing process. Having said that we cannot really put a figure on the fail rate because no tank has been found to fail the test yet!



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An OEM partnership for all seasons

Flat plate collectors
Vacuum tube collectors
Thermosiphonic systems

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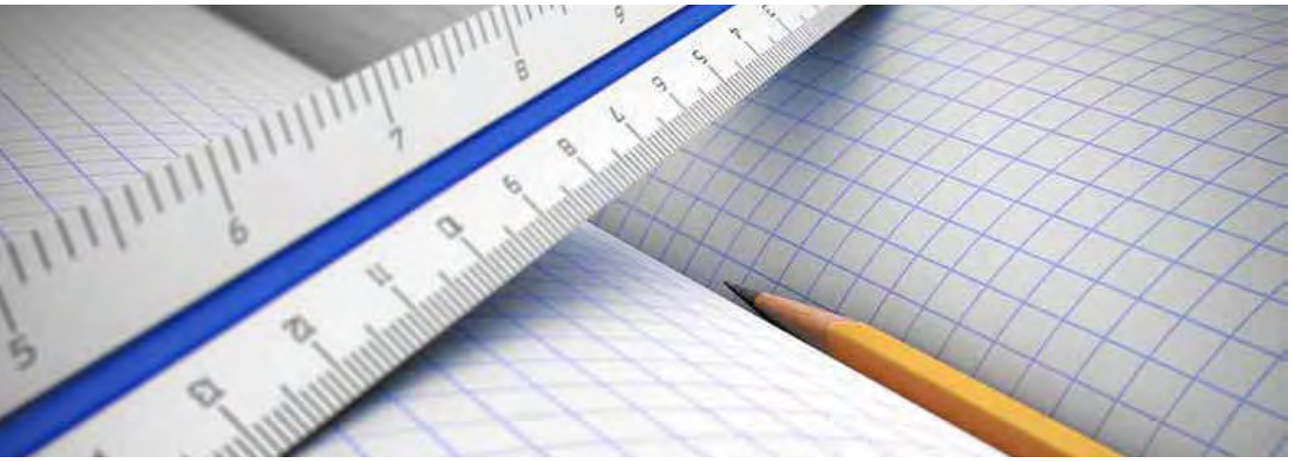

We pride ourselves on our cutting-edge technology and innovative designs which will allow you to differentiate and will appeal to your clients.

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[M4] Flat plate collector

Sturdy and clean-cut structure

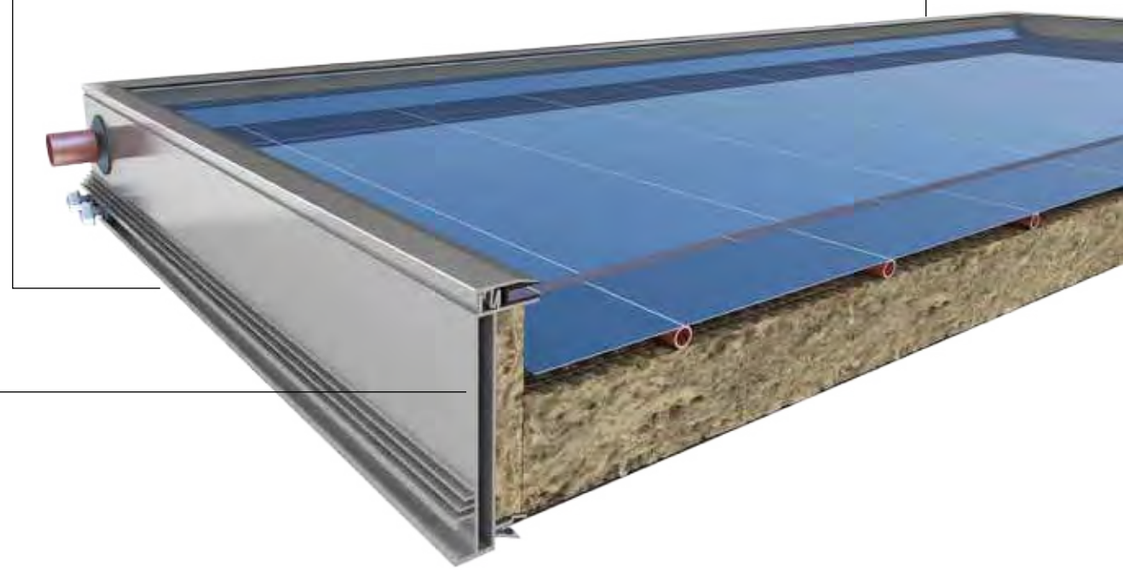
When we started designing from scratch the new M4 model we had only one thing in mind; a flat plate collector that would redefine the standards of sturdiness and durability. Having done so, the M4 is definitely the collector that will boost your competitiveness in the field of selective collectors.

Innovative characteristics

Double-wall frame profiles for increased strength and insulation:
The anodized double-walled aluminium profile offers increased durability and enhanced insulation.

Boltless construction for ease of assembly and clean look:
The glass and aluminium base are compressed so as to form a sturdy totality with a prism-like facade.

Integrated support attacments for ease of intallation and universal compatibility:
This collector can easily and safely be adjusted on different types of inclined or flat roof supports. In addition, its specially designed elastomeric and engineering plastic parts ensure complete sealing protection



Customization options

- special label and your logo on product
- custom manual
- different colour of aluminium frame and clip
- different colour of back side of collector
- different design of aluminium frame
- ultrasonic or laser welded absorber
- full plate or multi-fin absorber
- harp or meandric absorber
- low-iron or AR glass (3,2mm)
- your solar-keymark certification
- available in 2, 2.1, 2.5, 2.6 and 3 m²

[VTS] U-pipe vacuum tube collector

Unprecedented performance and reliability

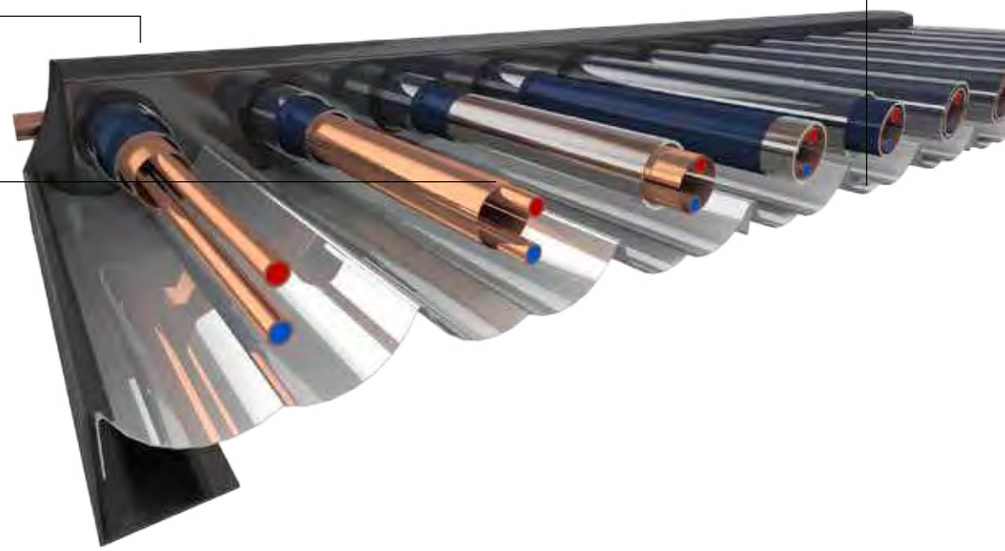
The VTS is a Calpak collector of unique design using ultrasonic welding of the copper fins on the copper u-pipe thereby providing outstanding performance and reliability.

Innovative characteristics

Ultrasonic welding of the copper fins on the copper U-pipe:
This contributes to the significant enhancement of thermal conductivity between the copper fins and the copper u-pipes. In addition, the use of copper fins considerably improves the resilience of the collectors to strong thermal shocks

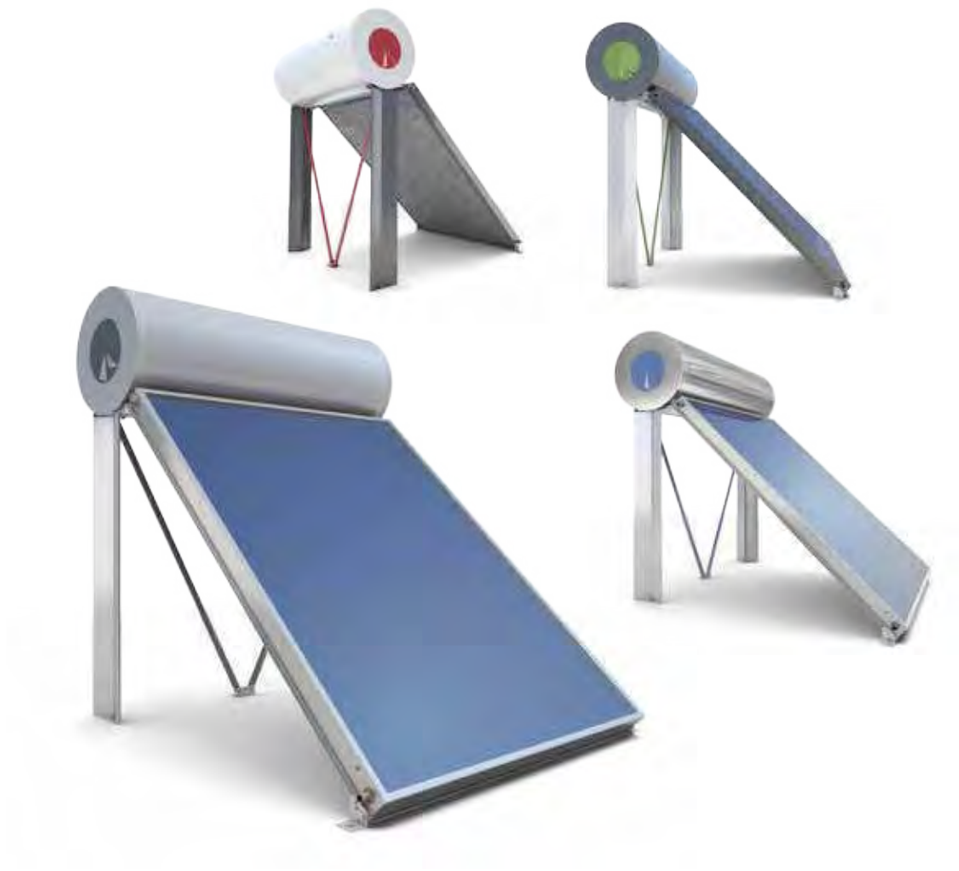
Specially designed parabolic reflector (CPC):
The carefully calculated radius of the parabolic shape of our reflectors enhances the exploitation of diffused radiation

Aluminium header and side profiles:
The aluminium profiles used for the header and the side parts of the VTS collector contribute notably to the sturdiness of its structure



Customization options

- special label on product
- your logo on the header
- custom manual
- your logo on packaging
- different colour of plastic cups
- different colour of header and side profile
- different design of aluminium header
- A class or mid-temp vacuum tubes
- your logo (laser printed) on the vacuum tubes
- your solar-keymark certification
- available in a variety of sizes from 6 to 16 tubes



[Mark4] Thermosiphonic system

Novel design for superior aesthetics and swift installation

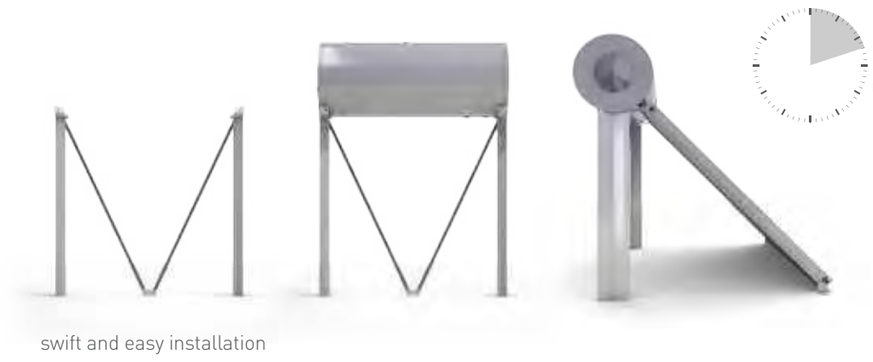
We at CALPAK, with our many years of experience, thought outside the box and dared to pioneer. In so doing, we remained committed to safe-guarding the traditional values of our thermosiphonic systems, namely exceptional performance and durability.

Innovative characteristics

Design, with attention to every detail, safety and functionality:
Our R&D department delivered a design that not only stands out for its aesthetics but also for its functionality, stability and user-friendliness

Inner tank designed by Interdomo for supreme durability:
The thoroughly designed inner tank which complies with the DIN 10130 standard ensures perfect application of the direct enameling process (DIN 4753/3) due to the deep side cups and the accurate covered welding

Support structure made completely of aluminium:
The first solar thermosiphonic system with an aluminium support structure for both flat and inclined roofs. This allows easy installation, superior aesthetics and unparalleled durability



swift and easy installation

Customization options

- special label on product
- your logo printed on tank
- custom manual
- different colour of side plastic cap
- different shape of side plastic cap
- your 3D logo pressed on the side of the tank
- different colour of tank's cover
- different material of tank's cover
- different material and colour of supports
- multi-layer or inox-flexib connecting pipes
- your solar-keymark certification and CE mark

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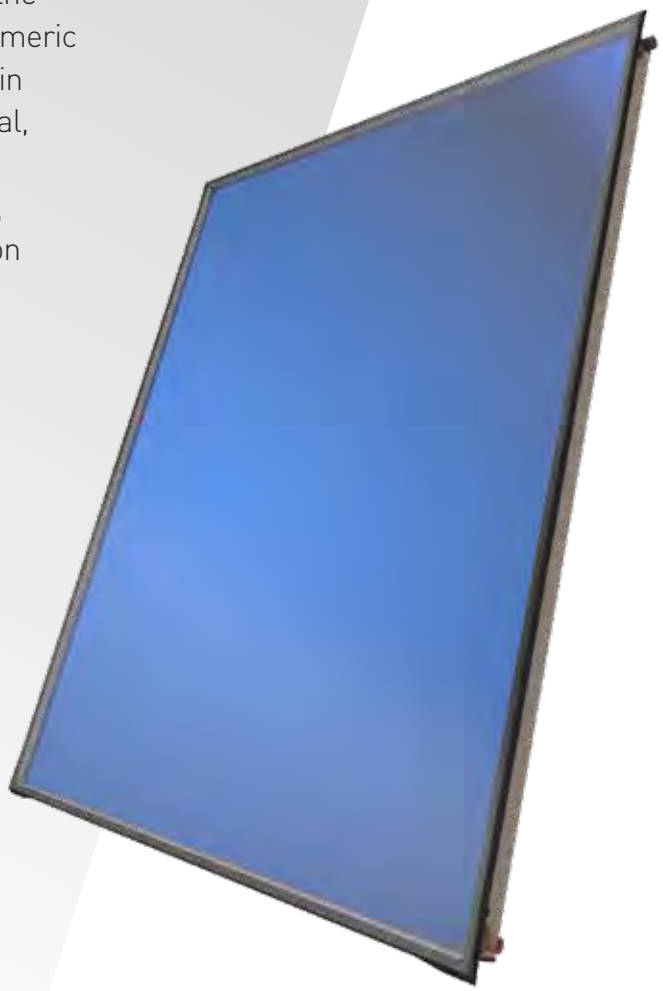
PRISMA

Innovative & Smart

Prisma is an innovative flat plate collector patented by Calpak. It introduces in the solar thermal industry a unique polymeric material, primarily known and used in the automotive industry. This material, applied in the collector's casing, strengthens its composite structure, achieves absolute humidity protection and offers a perfect finishing.

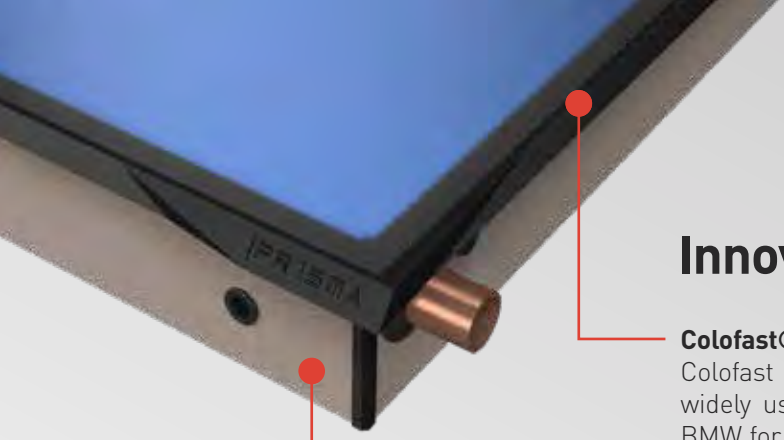
Prisma is the result of a demanding and lengthy R&D process whereby Calpak closely collaborated with high-end technology experts. It is created by Calpak's fully robotized production plant that ensures standardized quality.

Prisma is the smart choice for adding value to your solar thermal installation!



In a nutshell, the Prisma offers:

1. Overall higher manufacturing quality
2. Increased strength and durability
3. Perfect sealing against humidity
4. Supreme energy performance
5. Unparalleled finish (clean-cut look)



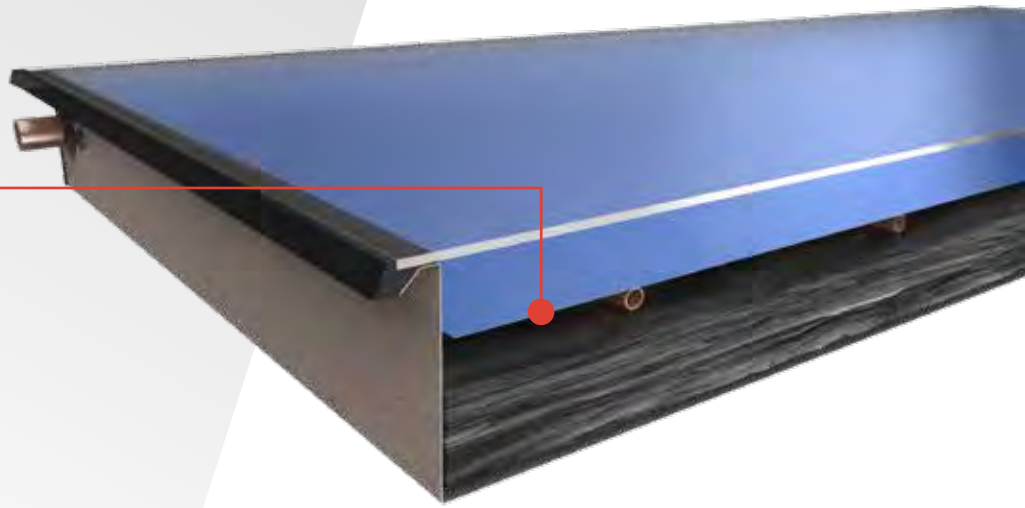
Innovative characteristics

Colofast® (BASF®)
Colofast is a special polymeric material, patented by BASF and widely used by prominent car manufactures such as AUDI and BMW for the perfect adherence of sunroofs. Colofast is applied by Calpak's fully automated production line in one final assembly step to precisely and permanently connect the collector casing with the glass facade. In addition, it forms a solid peripheral structure for the upper section of the casing.

The connection point is consequently very strong, impermeable and gives the Prisma a clean look. The glass is fused with the casing, without any sealing rubber gaskets, making this collector truly unique.

Casing
The casing of the collector is structured with a single piece external trough made of high quality alloy-steel. This monolithic design offers robust construction and protection against corrosion, eliminates thermal bridges and has a clean-cut look.

Full plate high selective absorber
The absorber is composed of a high selective aluminum surface, laser welded to a dense copper-harp, offering supreme energy performance.



Technical Specifications		prisma 2.0	prisma 2.5
Dimensions	Length (mm)	*1641*	*2035*
	Width (mm)	*1243*	*1243*
	Heigth (mm)	*86*	*86*
	Weight (kg)	*31*	*38*
Aperture Area (m²)		*2,04 / 1,91*	*2,53 / 2,38*
Absorber quality		*Full Plate - High Selective*	
Absorber material		*Copper Harp / Aluminium Surface*	
Absorber welding		*Laser*	
Absorption coefficient		*a > 95%*	
Emmission coefficient		*e < 3%*	
Casing material		*Pre-painted zinc coated alloy-steel (ArcelorMittal) & Colofast (BASF)*	
Insulation		*40mm Glass-wool of 50 kg/m³ density*	
Glass cover		*Tempered 3,2mm, Low-iron prismatic (T >91,5%)*	

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Annex to Solar Keymark Certificate

Licence Number	**SKM 10093.2**
Date issued	**2020-09-10**
Issued by	**DQS Hellas**

Licence holder	**CICERO HELLAS S.A.**	**Country**	Greece
Brand (optional)	CALPAK	**Web**	www.calpak.gr
Street, Number	9, Sygrou Ave.	**E-mail**	export@calpak.gr
Postcode, City	11743, 'Athens	**Tel**	30 2109247250 / 2109231616

Collector Type: Flat plate collector

Collector name	Gross area (A_G)	Gross length	Gross width	Gross height	Power output per collector Gb = 850 W/m2, Gd = 150 W/m2 & u = 1.3 m/s $\vartheta_m - \vartheta_a$ 0 K	10 K	30 K	50 K	70 K	85 K
	m^2	mm	mm	mm	W	W	W	W	W	W
PRISMA 2.0	2.00	1,625	1,235	85	1,524	1,459	1,296	1,090	841	624
PRISMA 2.5	2.50	2,020	1,235	85	1,905	1,823	1,620	1,363	1,052	780
Power output per m^2 gross area					762	729	648	545	421	312

Performance parameters test method	Steady state - outdoor									
Performance parameters (related to A_G)	η0, b	a1	a2	a3	a4	a5	a6	a7	a8	Kd
Units	-	W/(m²K)	W/(m²K²)	J/(m³K)	-	J/(m²K)	s/m	W/(m²K⁴)	W/(m²K⁴)	-
Test results	0.777	2.99	0.027	0.000	0.00	0	0.000	0.00	0.0E+00	0.87

Incidence angle modifier test method		Steady state - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.00	1.00	0.98	0.96	0.91	0.82	0.68	0.43	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	0.98	0.96	0.91	0.82	0.68	0.43	0.00

Heat transfer medium for testing	Water		
Flow rate for testing (per gross area, A_G)	dm/dt	0.020	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	55.14	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	180	°C
Maximum operating temperature	$\vartheta_{max\ op}$	-	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	NCSR Demokritos / Solar & other Energy System	www.solar.demokritos.gr	
Test report(s)	4272 DE1	**Dated**	20/7/2020
	4273 DE1		20/7/2020
	4274 DQ1		6/8/2020

Comments of testing laboratory

Datasheet version: 6.1, 2019-09-26

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SOLAR ENERGY LABORATORY
Tel: +210 6503815 - Fax: +210 6544592
P.O. BOX 60037, 15310 Ag. Paraskevi, Greece

Annex to Solar Keymark Certificate	Licence Number	SKM 10093.2
Supplementary Information	Issued	2020-09-10

Annual collector output in kWh/collector at mean fluid temperature ϑ_m

Standard Locations	Athens			Davos			Stockholm			Würzburg		
Collector name / ϑ_m	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
PRISMA 2.0	2,393	1,723	1,068	1,845	1,248	714	1,355	878	492	1,470	947	522
PRISMA 2.5	2,991	2,154	1,335	2,306	1,560	893	1,694	1,097	615	1,837	1,184	652
Annual output per m² gross area	1,197	862	534	923	624	357	677	439	246	735	474	261
Annual efficiency, η_a	68%	49%	30%	57%	38%	22%	58%	38%	21%	59%	38%	21%
Fixed or tracking collector	Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane	1765 kWh/m²			1630 kWh/m²			1166 kWh/m²			1244 kWh/m²		
Mean annual ambient air temperature	18.5°C			3.2°C			7.5°C			9.0°C		
Collector orientation or tracking mode	South, 25°			South, 30°			South, 45°			South, 35°		

The collector is operated at constant temperature ϑm (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Ver. 6.1 (September 2019). A detailed description of the calculations is available at http://www.estif.org/solarkeymarknew/

Additional Information

Collector heat transfer medium				Water-Glycole	
The collector is deemed to be suitable for roof integration				No	
The collector was tested successfully under the following conditions:					
Climate class (A+, A, B or C)				A	--
G (W/m²) >	1000	ϑ_a (°C) >	20	H_X (MJ/m²) >	600
Maximum tested positive load				3000	Pa
Maximum tested negative load				3000	Pa
Hail resistance using steel ball (maximum drop height)				2	m

Additional collector attribute(s)

☐ Using external power source(s) for normal operation
☐ Active or passive measure(s) for self-protection
☐ Co-generating thermal and electrical power
☐ Façade collector(s)

Energy Labelling Information

	Reference Area, A_{sol} (m²)
PRISMA 2.0	2.00
PRISMA 2.5	2.50

Data required for CDR (EU) No 811/2013 - Reference Area

Collector efficiency (η_{col})	60%

Remark: Collector efficiency (ηcol) is defined in CDR (EU) No 811/2013 as collector efficiency of the solar collector at a temperature difference between the solar collector and the surrounding air of 40 K and a global solar irradiance of 1000 W/m², expressed in % and rounded to the nearest integer. Deviating from the regulation ηcol is based on reference area (Asol) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.

Additional Informative Technical Data

Hydraulic Designation Code	Aperature Area, A_a (m²)
12-VH-1234S-A:7.2,1525-	1.91
12-VH-1234S-A:7.2,1920-	2.39

Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}

Zero-loss efficiency (η_0)	0.76	--
First-order coefficient (a_1)	2.99	W/(m²K)
Second-order coefficient (a_2)	0.027	W/(m²K²)
Incidence angle modifier IAM (50°)	0.91	--

Remark: The data given in this section are related to collector reference area (A_{sol}) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806. Consistent data sets for either aperture or gross area can be used in calculations like in the regulation 811 and 812 and simulation programs.

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