

## Holder/Issued to/Manufacturer

### Haining Fadi Solar Energy Co., Ltd.

NO.18, DINGYUAN ROAD, HAINING CITY, ZHEJIANG P.R, 314400, CHINA

## Product name and description

Vacuum tube solar thermal collectors for water heating.  
For technical information see Appendix (2 pages).

Models:	FD-SC-10	FD-SC-12	FD-SC-18
	FD-SC-20	FD-SC-24	FD-SC-30

## Performance specification

The product is found to comply with the requirements in EN 12975-1:2006+A1:2010 Solar collectors, Part 1: General requirements and the Specific CEN Keymark Scheme Rules for Solar Thermal Products and are based on test results according to EN ISO 9806:2013 Solar thermal collectors – Test methods.

## Marking

Products conforming to this certificate shall be marked in accordance with the requirements in the Specific CEN Keymark Scheme Rules for Solar Thermal Products. The marking shall, together with the Keymark logo, show the identification code of the empowered certification body (RISE Research Institutes of Sweden AB, No. 012), also see CEN-CENELEC Internal Regulations Part 4 Certification, Annex A.

## Validity

This certificate is valid until 2023-05-31 provided that the conditions in the Solar Keymark Rules are fulfilled and the standard or rules are not modified significantly. The validity of the certificate can be checked in the database, see Solar Keymark website <http://www.solarkeymark.org>.

## Miscellaneous

The manufacturer's factory production control procedures are under surveillance by the responsibility of RISE. RISE certification rules SPCR 402 for Keymark – Solar Thermal Products applies.

Johan Åkesson

Magnus Stuesson

Certificate No. SC0059-19 | issue 1 | 2019-02-20


RISE Research Institutes of Sweden AB | Certification  
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2017-08-08



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<b>Annex to Solar Keymark Certificate</b>						<b>Licence Number</b>		<b>SC0059-19</b>				
						<b>Date issued</b>		<b>2019-02-20</b>				
						<b>Issued by</b>		<b>RISE</b>				
<b>Licence holder</b>		<b>HAINING FADI SOLAR ENERGY CO., LTD.</b>			<b>Country</b>		<b>China</b>					
<b>Brand (optional)</b>		<b>FADI</b>			<b>Web</b>		<b>WWW.FADIENERGY.COM</b>					
<b>Street, Number</b>		<b>NO.18,DINGYUAN ROAD</b>			<b>E-mail</b>		<b>INFO@FADIENERGY.COM</b>					
<b>Postcode, City</b>		<b>314400, HAINING, ZHEJIANG</b>			<b>Tel</b>		<b>+86 573 87013118</b>					
<b>Collector Type</b>						<b>Evacuated tubular collector</b>						
<b>Collector name</b>		<b>Gross height</b>	<b>Gross area (A<sub>G</sub>)</b>	<b>Gross length</b>	<b>Gross width</b>	<b>Aperture area (A<sub>a</sub>)</b>	<b>Power output per collector</b> G <sub>b</sub> = 850 W/m <sup>2</sup> , G <sub>d</sub> = 150 W/m <sup>2</sup> & u = 1.3 m/s $\vartheta_m - \vartheta_a$					
							0 K	10 K	30 K	50 K	70 K	92 K
							W	W	W	W	W	W
<b>mm</b>	<b>m<sup>2</sup></b>	<b>mm</b>	<b>mm</b>	<b>m<sup>2</sup></b>								
<b>FD-SC-10</b>	160	1,58	1 962	803	0,94	715	696	649	592	526	440	
<b>FD-SC-12</b>	160	1,86	1 962	950	1,13	844	821	766	699	620	520	
<b>FD-SC-18</b>	160	2,75	1 962	1 400	1,70	1 248	1 214	1 133	1 034	917	768	
<b>FD-SC-20</b>	160	3,04	1 962	1 550	1,89	1 380	1 342	1 252	1 143	1 014	849	
<b>FD-SC-24</b>	160	3,63	1 962	1 850	2,26	1 647	1 602	1 495	1 364	1 211	1 014	
<b>FD-SC-30</b>	160	4,52	1 962	2 303	2,83	2 051	1 995	1 862	1 699	1 507	1 263	
<b>Power output per m<sup>2</sup> gross area</b>						<b>454</b>	<b>441</b>	<b>412</b>	<b>376</b>	<b>333</b>	<b>279</b>	
<b>Performance parameters test method</b>		<b>Steady state - outdoor</b>										
<b>Performance parameters (related to A<sub>G</sub>)</b>		$\eta_{0, b}$	a1	a2	a3	a4	a5	a6	a7	a8	Kd	
<b>Units</b>		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	J/(m <sup>2</sup> K)	s/m	W/(m <sup>2</sup> K <sup>4</sup> )	W/(m <sup>2</sup> K <sup>4</sup> )	-	
<b>Test results</b>		<b>0,449</b>	<b>1,16</b>	<b>0,008</b>	<b>0,000</b>	<b>0,000</b>	<b>0,000</b>	<b>0,000</b>	<b>0,000</b>	<b>0,000</b>	<b>1,07</b>	
<b>Incidence angle modifier test method</b>		<b>Steady state - outdoor</b>										
<b>Incidence angle modifier</b>		<b>Angle</b>	<b>10°</b>	<b>20°</b>	<b>30°</b>	<b>40°</b>	<b>50°</b>	<b>60°</b>	<b>70°</b>	<b>80°</b>	<b>90°</b>	
<b>Transversal</b>		K <sub>θT, coll</sub>	<b>1,04</b>	<b>1,07</b>	<b>1,19</b>	<b>1,30</b>	<b>1,37</b>	<b>1,43</b>	<b>0,95</b>	<b>0,48</b>	<b>0,00</b>	
<b>Longitudinal</b>		K <sub>θL, coll</sub>	<b>1,00</b>	<b>0,99</b>	<b>0,98</b>	<b>0,96</b>	<b>0,92</b>	<b>0,86</b>	<b>0,72</b>	<b>0,31</b>	<b>0,00</b>	
<b>Heat transfer medium for testing</b>						<b>Water-Glycole</b>						
<b>Flow rate for testing (per gross area, A<sub>G</sub>)</b>						dm/dt	<b>0,020</b>	kg/(sm <sup>2</sup> )				
<b>Maximum temperature difference during thermal performance test</b>						( $\vartheta_m - \vartheta_a$ ) <sub>max</sub>	<b>62,02</b>	K				
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; <math>\vartheta_a = 30^\circ\text{C}</math>)</b>						$\vartheta_{stg}$	<b>230</b>	°C				
<b>Maximum operating temperature</b>						$\vartheta_{max, op}$	<b>98</b>	°C				
<b>Maximum operating pressure</b>						p <sub>max, op</sub>	<b>600</b>	kPa				
<b>Testing laboratory</b>		<b>Intertek Testing Services Shenzhen Ltd. Guangzhou</b>				<b>http://www.intertek.com</b>						
<b>Test report(s)</b>		<b>190104135GZU-001</b>				<b>Dated</b>		<b>2019.01.28</b>				
<b>Comments of testing laboratory</b>						Datasheet version: 6.0, 2018-10-30						
<i>No Comments.</i>												
<b>RISE Research Institutes of Sweden AB   Certification</b> <b>Box 857, SE-501 15 Borås, Sweden, Phone: +46 10-516 50 00, certifiering@ri.se   www.ri.se</b>												

<b>Annex to Solar Keymark Certificate</b>	<b>Licence Number</b>	<b>SC0059-19</b>
<b>Supplementary Information</b>	<b>Issued</b>	<b>2019-02-20</b>

Annual collector output in kWh/collector at mean fluid temperature $\vartheta_m$													
Collector name	Standard Locations $\vartheta_m$	Athens			Davos			Stockholm			Würzburg		
		25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
FD-SC-10		1 357	1 142	911	1 124	915	707	819	649	488	884	702	524
FD-SC-12		1 601	1 348	1 075	1 327	1 079	834	967	766	576	1 044	828	619
FD-SC-18		2 368	1 993	1 589	1 962	1 596	1 234	1 429	1 132	852	1 543	1 225	915
FD-SC-20		2 617	2 204	1 757	2 169	1 764	1 364	1 580	1 251	941	1 706	1 354	1 011
FD-SC-24		3 125	2 631	2 098	2 590	2 107	1 628	1 887	1 494	1 124	2 037	1 617	1 207
FD-SC-30		3 892	3 276	2 612	3 225	2 623	2 028	2 349	1 860	1 400	2 536	2 013	1 504
Annual output per m <sup>2</sup> gross area		861	725	578	713	580	449	520	412	310	561	445	333
Fixed or tracking collector		Fixed (slope = latitude - 15°, rounded to nearest 5°)											
Annual irradiation on collector plane		1765 kWh/m <sup>2</sup>			1714 kWh/m <sup>2</sup>			1166 kWh/m <sup>2</sup>			1244 kWh/m <sup>2</sup>		
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  $\vartheta_m$  (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Ver. 6.0 (October 2018). A detailed description of the calculations is available at [www.solarkeymark.org/scenocalc](http://www.solarkeymark.org/scenocalc)

### 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)	C
G (W/m <sup>2</sup> ) >	800
$\vartheta_a$ (°C) >	10
$H_x$ (MJ/m <sup>2</sup> ) >	420
Maximum tested positive load	2400
Maximum tested negative load	2400
Hail resistance using steel ball (maximum drop height)	0,8

### Additional collector attribute(s)

<input type="checkbox"/> Using external power source(s) for normal operation	<input type="checkbox"/> Active or passive measure(s) for self-protection
<input type="checkbox"/> Co-generating thermal and electrical power	<input type="checkbox"/> Wind and/or infrared sensitive collector(s) (WISC)
<input type="checkbox"/> Façade collector(s)	

### Energy Labelling Information

	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Hydraulic Designation Code
FD-SC-10	1,58	1-H-12S-C:36,803-D
FD-SC-12	1,86	1-H-12S-C:36,953-D
FD-SC-18	2,75	1-H-12S-C:36,1403-D
FD-SC-20	3,04	1-H-12S-C:36,1553-D
FD-SC-24	3,63	1-H-12S-C:36,1853-D
FD-SC-30	4,52	1-H-12S-C:36,2303-D

### Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$

Collector efficiency ( $\eta_{col}$ )	39%
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### Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$

Zero-loss efficiency ( $\eta_0$ )	0,45	--
First-order coefficient ( $a_1$ )	1,16	W/(m <sup>2</sup> K)
Second-order coefficient ( $a_2$ )	0,008	W/(m <sup>2</sup> K <sup>2</sup> )
Incidence angle modifier IAM (50°)	1,22	--

Remark: Collector efficiency ( $\eta_{col}$ ) 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/m<sup>2</sup>, expressed in % and rounded to the nearest integer. Deviating from the regulation  $\eta_{col}$  is based on reference area ( $A_{sol}$ ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.

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.