



<b>Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate</b>	<b>Certificate No.</b>	<b>011-7S2181 F</b>
	Date of issue	01-08-2012

<b>Company</b>	Bosch Thermotechnik GmbH	<b>Country</b>	Germany
<b>Brand (optional)</b>		<b>Website</b>	www.bosch-thermotechnology.com
<b>Street, number</b>	Junkersstraße 20 - 24	<b>E-mail</b>	Maik.saphoerster@bosch.com
<b>Postal Code</b>	73249	<b>Tel.</b>	+49 (0)2557/9399-61
<b>City</b>	Wernau	<b>Fax</b>	+49 (0)2557/9399-55

<b>Collector Type (flat plate / evacuate tubular / un-glazed)</b>	Flat plate collector
---	----------------------

<b>Integration in the roof possible ?</b>	No
---	----

Collector name	Aperture area (Aa) [m <sup>2</sup> ]	Gross length [mm]	Gross width [mm]	Gross height [mm]	Gross area (Ag) [m <sup>2</sup> ]	Power output per collector unit G = 1000 W/m <sup>2</sup> Tm-Ta :				
						0 K	10 K	30 K	50 K	70 K
						[W]	[W]	[W]	[W]	[W]
Bosch FCC220-2V	1.936	2 026	1 032	67	2.091	1 473	1 392	1 215	1 020	806

<b>Collector efficiency parameters related to aperture area (Aa)</b>	$\eta_{0a}$	0.761	-
Type of fluid and flow rate see note 1	$a_{1a}$	4.083	W/(m <sup>2</sup> K)
	$a_{2a}$	0.012	W/(m <sup>2</sup> K <sup>2</sup> )

<b>Stagnation temperature - Weather conditions see note 2</b>	tstg	194	°C
---	------	-----	----

<b>Effective thermal capacity</b>	Ceff = C/Aa	4.1	kJ/(m <sup>2</sup> K)
-----------------------------------	-------------	-----	-----------------------

<b>Max. operation pressure - see note 3</b>	pmax	600	kPa
---	------	-----	-----

Incidence angle modifiers $K_{\theta}(\theta)$	$G_{DIF}/G_{TOT}$		$\theta_T / \theta_L$	50°	10°	20°	30°	40°	60°	70°
	min	max								
		0.16	0.29	$K_{\theta}(\theta_L)$	0.94	1.00	0.99	0.98	0.97	0.89

$G_{DIF}/G_{TOT}$ : min&max - while measuring

*Optional values*

<b>Testing Laboratory</b>	TÜV Energie und Umwelt GmbH
<b>Website</b>	www.eco-tuv.de
<b>Test report id. number</b>	21218975_EN2_Bosch
<b>Date of test report</b>	01-08-2012
<b>Perf. test method</b>	EN 12975-2 6.3 (outdoor)

**Comments of testing laboratory :**

Note 1	Fluid	Water	Flow rate	0.019 kg/s per m <sup>2</sup>	<p>TÜV Rheinland Energie und Umwelt GmbH Am Gräfen Stein D - 51105 Köln</p>
Note 2	Irradiance, $G_s=1000$ W/m <sup>2</sup>				
Note 3	Ambient temperature, $T_a=30$ °C				
Note 3	Given by manufacturer				

<b>Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate</b>	<b>Certificate No.</b>	<b>011-7S2181 F</b>
	Issued	01-08-2012

Annual collector output kWh													
Collector name	Location and collector temperature (T <sub>m</sub> )												
	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	
Bosch FCC220-2V	2 338	1 600	992	1 864	1 224	717	1 285	802	459	1 399	865	487	

<b>Collector mounting: Fixed or tracking</b>	<b>Fixed; slope = latitude - 15° (rounded to nearest 5°)</b>
--	--

Overview of locations				
Location	Latitude °	Gtot kWh/m <sup>2</sup>	T <sub>a</sub> °C	Collector orientation or tracking mode
Athens	38	1 765	18.5	South, 25°
Davos	47	1 714	3.2	South, 30°
Stockholm	59	1 166	7.5	South, 45°
Würzburg	50	1 244	9.0	South, 35°

Gtot	Annual total irradiation on collector plane	kWh/m <sup>2</sup>
T <sub>a</sub>	Mean annual ambient air temperature	°C
T <sub>m</sub>	Constant collector operating temperature (mean of in- and outlet temperatures)	°C

Calculation of the annual collector performance is done by the official Solar Keymark spreadsheet tool. Hour by hour the collector output is calculated according to the efficiency parameters from the Keymark test using constant collector operating temperature (T<sub>m</sub>). Detailed description with all equations used is available from the Solar Keymark web site (direct link:<http://www.estif.org/solarkeymark/annexb1.php>)

<b>DIN CERTCO • Alboinstraße 56 • 12103 Berlin</b>	Datasheet version:
Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: info@dincertco.de • www.dincertco.de	VERSION 3.5, 2012.01.13
	Calculation program version:
	3.07, October 2011 (SP)