



<b>Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate</b>	<b>Certificate No.</b>	<b>011-7S735 F</b>
	Date of issue	29-11-2012

<b>Company</b>	Ferroli SpA	<b>Country</b>	Italy
<b>Brand (optional)</b>	Ferroli	<b>Website</b>	www.ferroli.it
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<b>Collector Type</b> (flat plate / evacuate tubular / un-glazed)	Flat plate collector
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<b>Integration in the roof possible ?</b>	No
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Collector name	Aperture area (A <sub>a</sub> ) [m <sup>2</sup> ]	Gross length [mm]	Gross width [mm]	Gross height [mm]	Gross area (A <sub>g</sub> ) [m <sup>2</sup> ]	Power output per collector unit G = 1000 W/m <sup>2</sup> T <sub>m</sub> -T <sub>a</sub> :				
						0 K	10 K	30 K	50 K	70 K
						[W]	[W]	[W]	[W]	[W]
VMF 2.0	1,89	1.700	1.160	80	1,97	1.452	1.381	1.222	1.039	831
VMF 2.3	2,23	2.000	1.160	80	2,32	1.713	1.629	1.442	1.225	981
VMF 2.8	2,69	2.400	1.160	80	2,78	2.066	1.966	1.739	1.478	1.183
VRF 2.0	1,89	1.700	1.160	80	1,97	1.452	1.381	1.222	1.039	831
VRF 2.3	2,23	2.000	1.160	80	2,32	1.713	1.629	1.442	1.225	981
VRF 2.8	2,69	2.400	1.160	80	2,78	2.066	1.966	1.739	1.478	1.183

<b>Collector efficiency parameters related to aperture area (A<sub>a</sub>)</b> Type of fluid and flow rate see note 1	η <sub>0a</sub>	0,768	-
	a <sub>1a</sub>	3,570	W/(m <sup>2</sup> K)
	a <sub>2a</sub>	0,016	W/(m <sup>2</sup> K <sup>2</sup> )

<b>Stagnation temperature</b> - Weather conditions see note 2	t <sub>stg</sub>	214,5 °C
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<b>Effective thermal capacity</b>	C <sub>eff</sub> = C/A <sub>a</sub>	5,75 kJ/(m <sup>2</sup> K)
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<b>Max. operation pressure</b> - see note 3	p <sub>max</sub>	1000 kPa
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Incidence angle modifiers K <sub>θ</sub> (θ)	G <sub>DIF</sub> /G <sub>TOT</sub>		θ <sub>T</sub> / θ <sub>L</sub>	50°	10°	20°	30°	40°	60°	70°
	min	max	K <sub>θ</sub> (θ <sub>T</sub> )	0,90	1,00	0,99	0,97	0,94	0,81	0,64
			K <sub>θ</sub> (θ <sub>L</sub> )	0,90	1,00	0,99	0,97	0,94	0,81	0,64
G <sub>DIF</sub> /G <sub>TOT</sub> : min&max - while measuring					<i>Optional values</i>					

<b>Testing Laboratory</b>	TÜV Energie und Umwelt GmbH
<b>Website</b>	www.eco-tuv.de
<b>Test report id. number</b>	21211664a_VF2.8; 21211664a_VF2.0; 21220219_EN_R; 21220219_EN_P
<b>Date of test report</b>	22.12.2009; 22.12.2009; 09.11.2012; 09.11.2012
<b>Perf. test method</b>	EN 12975-2 6.3 (outdoor)

<b>Comments of testing laboratory :</b>	
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Note 1	<b>Fluid</b>	Water	<b>Flow rate</b>	0,022 kg/s per m <sup>2</sup>	
Note 2	<b>Irradiance, G<sub>s</sub>=1000 W/m<sup>2</sup></b>		<b>Ambient temperature, T<sub>a</sub>=30 °C</b>		
Note 3	<b>Given by manufacturer</b>				



**Annual collector output based on EN 12975 Test Results,  
annex to Solar KEYMARK Certificate**

**Certificate No.**

**011-7S735 F**

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**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
VMF 2.0	2.224	1.562	989	1.803	1.214	726	1.237	798	468	1.343	856	493
VMF 2.3	2.624	1.844	1.167	2.127	1.432	857	1.460	942	552	1.585	1.010	582
VMF 2.8	3.165	2.224	1.408	2.566	1.727	1.034	1.761	1.136	666	1.912	1.219	702
VRF 2.0	2.224	1.562	989	1.803	1.214	726	1.237	798	468	1.343	856	493
VRF 2.3	2.624	1.844	1.167	2.127	1.432	857	1.460	942	552	1.585	1.010	582
VRF 2.8	3.165	2.224	1.408	2.566	1.727	1.034	1.761	1.136	666	1.912	1.219	702

**Collector mounting: Fixed or tracking**

Fixed; slope = latitude - 15° (rounded to nearest 5°)

**Overview of locations**

Location	Latitude °	G <sub>tot</sub> 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°

G <sub>tot</sub>	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>)

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Datasheet version:

VERSION 3.5, 2012.01.13

Calculation program version:

3.07, October 2011 (SP)