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شركة خلووف لطاقة المستقبل ش.م.م.
صناعة أنظمة الطاقة الشمسية المتطورة

KHALLOUF FUTURE POWER.L.L.C

شهادة اختبار

مشروع سكن الطالبان + المبنى الرياضي

جامعة البتراء - عمان - الأردن

بالتعاون مع شركة المسار الهندسية



TEST REPORT NO. : 333/10/204

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Our Ref. : (3)148/55/1/2056	Date: . 9 . 2010	Designation No. : 3/10/10682
Object : Solar Collector		Date of Receipt : 26.09.2010
Designation : AL MASAR		Date of Test : 26.09 ... 29.09.2010
Method of Sampling: Sample was brought by your representative.		

3. Internal thermal shock test for liquid heating collectors



Test conditions

Test performed	: Outdoors
Collector tilt angle (degree from horizontal)	: 45 °
Average irradiance during test	: 1105 W/m ²
Minimum irradiance during test	: 1066 W/m ²
Average surrounding air temperature during test	: 31.1 °C
Minimum surrounding air temperature	: 30.6 °C
Flow rate of heat transfer fluid (approximation)	: 150 kg/h
Temperature of heat transfer fluid	: 8 °C
Duration of heat transfer fluid flow	: 5 min
Surface temperature of tube immediately prior to heat transfer fluid flow	: 41 °C
Period during which steady-state conditions were maintained prior to internal thermal shock	: 1 hr

Test results

By visual inspection, the solar collector was not affected after the internal thermal shock test

Record of test sequence and summary of main results

Test	Date		Summary of main test results
	Start	End	
High-temperature resistance	26.09.2010	26.09.2010	Not affected
External thermal shock (First)	27.09.2010	27.09.2010	Not affected
External thermal shock (Second)	28.09.2010	28.09.2010	Not affected
Internal thermal shock	29.09.2010	29.09.2010	Not affected

Royal Scientific Society
RSS Testing

Lab. Supervisor: Samer Al-Kharouf

Division Head: Eng. Saed Barakat

Date: 30/9/2010

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- The results apply only to the tested sample / samples.



TEST REPORT NO. : 333/10/204

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Our Ref. :	(3)148/55/1/21056	Date:	. 9 . 2010	Designation No. :	3/10/10582
Object :	Solar Collector	Date of Receipt :	26.09.2010		
Designation :	AL MASAR	Date of Test :	26.09 ... 29.09.2010		
Method of Sampling: Sample was brought by your representative.					

I. High temperature resistance test



Method used to heat collector : Outdoor testing

Conditions for testing outdoors

Average irradiance during test	: 1050 - 1200 W/m ²
Average surrounding air temperature	: 30 - 40 °C
Average surrounding air speed	: < 1 m/s
Duration of test (after steady state conditions)	: 60 min

The values under available climate conditions

Collector tilt angle (degree from horizontal)	: 45°
Average irradiance during test	: 1115 W/m ²
Average surrounding air temperature	: 33.8 °C
Average surrounding air speed	: 0.0 m/s
Average temperature of surface tube	: 42 °C
Duration of test	: 60 min

Test result

By visual inspection, the solar collector was not affected after the high temperature resistance test.

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ROYAL SCIENTIFIC SOCIETY
RSS TESTING
NON-DESTRUCTIVE LABORATORIES DIVISION
Thermal Testing Lab.
P. O. Box 1438, Al-jubaiha 11941 - Jordan
Fax. (962)6-5344806, Phone: (962)6-5344701-9, Telex: 21276

TEST REPORT NO. : 333/10/204

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Our Ref. :	{ 3 } 148/55/1/ 21056	Date: . 9 . 2010	Designation No. :	3/10/10682
Object :	Solar Collector		Date of Receipt :	26.09.2010
Designation :	AL MASAR		Date of Test :	26.09 ... 29.09.2010
Method of Sampling: Sample was brought by your representative.				

إشارة إلى كتاب مؤسسة المعايير والمقاييس رقم (ج م ع / ٣٥٩ /) بتاريخ ٢٠١٠/٩/٢٦ رقم المعاملة وتاريخها :
٢٠١٠/٩/٢٢ ، (٢٠١٠/٤/٦٧٩٥٤)

Client Name & Address

مؤسسة المعايير والمقاييس / شركة الزول والنقم
هاتف : ٩٦٢ ٦٥٢-١٢٢٥ + ، صرب ٩٤١٢٨٧ - عمان ١١١٩٤ الأردن

Type of test :

1. High temperature resistance test.
2. External thermal shock test.
3. Internal thermal shock test.

According to : JS 435-2:1999



Collector description *

Type :	Evacuated tube
Collector Dimensions* (Length x Width):	1.70 m X 1.80 m
Tube outer Diameter:	58 mm
Tube inner Diameter:	44 mm
Number of Vacuum Tubes:	20
Gross area :	3.0 m ²
Aperture area :	1.8 m ²
Tube description:	Glass-Glass-Water flow path

* The dimensions without cylinder.

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RSS TESTING
NON-DESTRUCTIVE LABORATORIES DIVISION

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Fax: (962)6-5344806, Phone: (962)6-5344701-9, Telex: 21276

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Our Ref. :	(3)148/55/1/210 56	Date: . 9 . 2010	Designation No. : 3/10/10682
Object :	Solar Collector	Date of Receipt :	26.09.2010
Designation :	AL MASAR	Date of Test :	26.09 ... 29.09.2010
Method of Sampling: Sample was brought by your representative.			

2.1 External thermal shock test : First shock

Test conditions

Test performed	: Outdoors
Test combined with short-term exposure test	: No
Collector tilt angle (degree from horizontal)	: 45°
Average irradiance during test	: 1098 W/m ²
Minimum irradiance during test	: 1059 W/m ²
Average surrounding air temperature	: 34.7 °C
Minimum surrounding air temperature	: 33.2 °C
Flowrate of water spray (approximation)	: 300 kg/h
Temperature of water spray	: 8 °C
Duration of water spray	: 15 min
Surface temperature of tube immediately prior to water spray	: 41 °C
Period during which steady-state conditions were maintained prior to external thermal shock : 1 hr	



Test results

By visual inspection, the solar collector was not affected after the first external thermal shock test

2.2 External thermal shock test : Second shock

Test conditions

Test performed	: Outdoors
Test combined with short-term exposure test	: No
Collector tilt angle (degree from horizontal)	: 45°
Average irradiance during test	: 1122 W/m ²
Minimum irradiance during test	: 1112 W/m ²
Average surrounding air temperature	: 34.8 °C
Minimum surrounding air temperature	: 33.2 °C
Flowrate of water spray (approximation)	: 300 kg/h
Temperature of water spray	: 8 °C
Duration of water spray	: 15 min
Surface temperature of tube immediately prior to water spray	: 42 °C
Period during which steady-state conditions were maintained prior to external thermal shock : 1 hr	

Test results

By visual inspection, the solar collector was not affected after the second external thermal shock test.

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