



Test Certificate No.: **9612311210**  
In accordance with Clause 12 of the Standards Law – 1953

**Details of order:**

Name of customer	: Bureau Veritas Consumer Product Services GmbH
Address	: Businesspark A96, 86842 Türkheim, Germany
Date of order	: 12/04/2016

**Description of sample:**

Solar Inverter Models	: REFUsol 40K (840P040) REFUsol 46K (840P046)
Manufacturer	: REFU Elektronik GmbH
Country of origin	: Germany
(see additional product information on pages 2-10)	

**Sampling details:**

No sample required.

**Nature of test:**

Review of test reports Ref. No.: 14TH0128-IEC62109-1\_0, dated 02/03/2016, 14TH0128-IEC62109-2\_0, dated 02/03/2016, and 14TH0128-AS/NZS4777\_1, dated 08/04/2016, issued by Bureau Veritas Consumer Products Services, Germany GmbH for the above-specified solar inverter models according to the following standards:

IEC 62109-1: 2010 / EN 62109-1: 2011  
Safety of power converters for use in photovoltaic power system – Part 1: General requirements

IEC 62109-2: 2011 / EN 62109-2: 2011  
Safety of power converters for use in photovoltaic power system – Part 2: Particular requirements for inverters

AS/NZS 4777.2: 2005 - Grid connection of energy systems via inverters: Inverter requirements

AS/NZS 4777.3: 2005 - Grid connection of energy systems via inverters: Grid protection requirements, with Deviations for Israel according to SI 4777 parts 2, 3: 2008 according to the Guidelines for Importers, Installers and Owners of Electricity Generating Systems Using Photo-Voltaic Technology, regarding Adjustment of Photo-Voltaic Inverters: 2013


This document contains 10 pages and may be used only in full.


**The test results in this report refer only to the item tested.**

This document alone is not sufficient for the release of goods from customs.

**Test Conclusions:**

Based on the information provided in the above mentioned test reports, the above-specified solar inverter models **comply** with the Israeli requirements for grid-tied photovoltaic inverters.

Anatoly Oimatov   
Testing Engineer, Electrical Safety Branch

Irina Antonov   
Head of Medical Devices, Laser and Electrical Safety Branch  
Electronics and Telematics Laboratory  
The Standards Institution of Israel  
Date: 05/05/2016

Electronics and Telematics Laboratory  
The Standards Institution of Israel  
Date: 05/05/2016



Test Certificate No.: 9612311210  
In accordance with Clause 12 of the Standards Law – 1953

**ADDITIONAL PRODUCT INFORMATION**

**Electrical Ratings**

Test item description.....: Grid-tied photovoltaic inverter		
Trademark .....: <b>REFU</b> <b>Elektronik</b>		
Model / Type .....: REFUsol 40K (840P040), REFUsol 46K (840P046)		
<b>Ratings..... :</b>	<b>REFUsol 40K (840P040)</b>	<b>REFUsol 46K (840P046)</b>
MPP DC voltage range [V].....:	490-850	575-850
Input DC voltage range [V].....:	350-1000	350-1000
Input DC current [A].....:	84	82
Output AC voltage [V].....:	3 x 400/50Hz	3 x 460/50Hz
Output AC current [A].....:	59	59
Output power [kVA].....:	40	46



Test Certificate No.: 9612311210  
In accordance with Clause 12 of the Standards Law – 1953

Page 3 of 10pages

**APPENDIX**  
**List of Critical Components**

**Test Certificate No.: 9612311210**

In accordance with Clause 12 of the Standards Law – 1953

Page 4 of 10pages

14	TABLE: List of critical components					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of con- formity <sup>1)</sup>	
<b>Unit from outside</b>						
Enclosure	+CoolCase GmbH	0034823 MZ04 De- ckel mit BF AE 840	Plated sheet Metal, overall approx. Structure, 760x740x260mm, thickness components plate min. 3,0mm thickness	--	Evaluated as part of the product	
heatsink	+Constellium Singen GmbH	0034492 Kühlkörper REFU sol 840	675mmx420mmx105mm Aluminium, eloxed	--	Evaluated as part of the product	
Sealing	+Rampf	PU fo- aming RAKU- PUR 32- 3250-11	(-40°C to 100 °C); 750mmx70mmx4mm UL50 listed, hydrophobic, good compression set	UL50E	MH17507	
AC Connection box	+CoolCase GmbH	0034496 MZ01 Tül- lengehäu- se AC- An- schluss 840	overall approx. Structure, 104x80x260mm, components plate min. 3,0mm thickness	--	Evaluated as part of the product	
Strain relief	+Lapp	Kabel- verschraub ung ST- M40x1,5 lichtgrau (53111450 )	IP68; 100°C; Polyamide V2; M40by1,5	QCRV2	cULus E79903	
DC connector (male)	+Phönix contact	Photovolta- ik- Steckver- binder - PV-FT- C2F-HSG - 1704926	1000V, 40A	EN 50521:200 8	VDE	
DC connector (female)	+Phönix contact	Photovolta- ik- Steckver- binder - PV-FT- C2M-HSG - 1704925	1000V, 40A	EN 50521:200 8	VDE	
AC connector	+Weidmüller	WGK25	600V, 100A	IEC60947- 1-1	cULus E60693	

**Test Certificate No.: 9612311210**

In accordance with Clause 12 of the Standards Law – 1953

Page 5 of 10pages

Inside the Unit non PCB					
Internal wiring (DC Side input to boards)	+Huber+Suhner	RADOX125	AWM AWG 10 150°C, 1000V	UL 758	URus E63322
Internal wiring (DC PCB to AC PCB)	+Huber+Suhner	RADOX125	AWM AWG 18 150°C, 1000V	UL 758	URus E63322
Internal wiring (DC PCB to Boost choke)	+Huber+Suhner	RADOX UL 3289	AWM AWG 10 150°C, 750Vdc	UL 758	URus E63322
DC Boost choke Inductor	Schwa-medico GmbH	0035018 BV01 Speicher- drossel 3E70 0,825 30A DC	Open type construction with overall approx. dimension: 65by65by95mm  DC2500V, 30A; 0,825mH; max op. Temperature 80°C; Flame Class: bobbin 94V-0, varnish MW 30-C	--	Evaluated as part of the product
Shrink tube (DC PCB to Booster chokes)	+Heinrich Thulesius	HTS-B55	22 kV/mm; 135°C; 0,48mm thickness	--	Evaluated as part of the product
Shrink tube (XA223 AC to DC board)	+Hilpress	HIL-SHRI NK® HQ 2:1 (30135)	125°C; 0,51mm thickness	UL224	cULus E346028
Flat cable (AC to DC board)	+Klasing	Microflex pitch1,27	35 kV/mm, Flame Class UL VW-1, rated 105 °C, thickness 1,4mm	UL2651	cULus E111235
Internal wiring (AC PCB to Grid chokes)	+Huber+Suhner	RADOX UL 3289	AWM AWG 6 150°C,600Vac	UL 758	URus E63322
AC Grid choke Inductor	Schwa-medico GmbH	0034981 BV 00 Speicher- drossel 0,85mH 58A AMCC320	Open type construction with overall approx. dimension: 110by130by105mm  DC2500V, 58A; 0,85mH; max op. Temperature80°C; Flame Class: bobbin 94V-0, varnish MW 30-C	--	Evaluated as part of the product
Shrink tube (AC PCB to Grid chokes)	+Heinrich Thulesius	HTS-B55	22 kV/mm; 135°C; 0,48mm thickness	--	Evaluated as part of the product
Internal wiring (AC Side output to boards)	+ Huber + Su- hner	Radox 125	AWM AWG 8 150°C, 600Vac	UL 758	URus E63322
FAN	+ebmpapst	3114gm	24V; 117mA	UL 507	cULus E38324

**Test Certificate No.: 9612311210**

In accordance with Clause 12 of the Standards Law – 1953

Page 6 of 10pages

DC PCB – DS34400B					
PCB	+ Leiterplatten Pfullingen	Basismaterial: Panasonic R1755M	94V0; 300x190x2,5mm; T=130°C;	ANSI/UL 746	URus E81336
DC Connector terminals (XA1, XB1, XA2, XB2, XA3, XB3, XA4, XB4, XB214, XB215, XB216, XB217)	+PHOENIX CONTACT	Printklemme 1polig 6qmm SPT5/1-V-7,5(UL)	Max. Voltage 1000 V Max. current: 41A UL94V-0	ANSI/UL 486	cURus E60425
Terminals for varistor (XA230, XA231, XA232, XA233, XA234, XA235, XA236, XA237, XA238, XA239, XA240, XA241)	+WAGO Kontakttechnik GmbH & Co. K	Klemmleiste mit Fingerdrücken 2polig 255-602	Max. Voltage 1000 V Max. current: 24A UL94-V0	ANSI/UL 486	cULus E45172
Varistor (R1, R2, R3, R4, R5, R6, R7, R8, R68, R69, R70, R71)	+ Epcos	Varistor SIOV-S20K1000 B72220-S102-K101	1100V; Diameter 19mm; Clamping voltage min. 1500V	ANSI/UL14 49	cULus E321126
Inductance (L1, L3, L5, L6)	Schaffner	RB8522-25-2M0	1000V; 25A 2mH; UL94V-0	--	Evaluated as part of the product
Current Sensor (U13, U15, U16, U21)	+ LEM	CKSR 25	Material: UL94-V0 Max Temperature 110°C	ANSI/UL 508	cURus E189713
IGBT High side (V1, V121) (Insulation foil)	HALA Dichtungen u. Isolierteile	Nomex410	Breakdown Voltage 55kV/mm Material UL94-V0	--	Evaluated as part of the product
IGBT low side (V12, V212) (Insulation foil)	HALA Dichtungen u. Isolierteile	Nomex410	Breakdown Voltage 55kV/mm Material UL94-V0	--	Evaluated as part of the product
Bulk capacitor (C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C43, C44, C45, C46, C205, C206)	+ Nippon-Chemi-con	ECST451V NN102MA 60M	450Vdc, 1000µF; 105°C	-	Evaluated as part of the product
Current Sensor (U1, U2, U3, U22, U23)	+ LEM	CKSR 50	Material: UL94-V0 Max Temperature 110°C	ANSI/UL 508	cURus E189713

Test Certificate No.: 9612311210  
 In accordance with Clause 12 of the Standards Law – 1953

Page 7 of 10pages

Transformator (T10)	Voltis	E-3139Ka	<p>Closed type construction with overall dimensions 39x23x11mm</p> <p><b>Rating:</b>          Input: 50V; 210mA          Output: 50V; 210mA          Switching frequency: 140kHz</p> <p><b>Core:</b>          Ferrit E22PLT22 N87 or equivalent</p> <p><b>Insulation bobbin:</b>          Laminate: R-1566 / R-1566W <b>UL</b> R-1566          Prepreg: R-1551 / R-1551W <b>UL</b> R- 1551 <b>UL</b> E 143060</p> <p><b>Pin Headers:</b>          Thermoplastic, rated UL94 V-0 <b>UL</b> E 419 38</p> <p><b>Strip:</b>          Neoprene Temp.Class B</p>	--	Evaluated as part of the product
Transformator (T1, T2, T7, T8, T9)	Voltis	E-909KA	<p>Closed type construction with overall dimensions: 21,5x28,0x11,4mm</p> <p><b>Rating:</b>          Input: 50V; 30mA          Output: 50V; 10mA          Switching frequency: 140kHz</p> <p><b>Core:</b>          EFD 20/10/7; N87</p> <p><b>Insulation:</b>          Triple insulated wire class F according to EN 61558-1. EN/UL 60950, EN 60601</p> <p><b>Cover Insulation:</b>          Kaptonklebeband Trägerstärke 14x0,025mm Isolierstoffklasse F</p>	--	Evaluated as part of the product

**Test Certificate No.: 9612311210**

In accordance with Clause 12 of the Standards Law – 1953

Page 8 of 10pages

Optical Isolator (U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11, U12, U13, U14, U15)	+ Fairchild	FOD8320	Rated Insulation 5000Vac	UL 1577 IEC 60747- 5-2	cULus E90700 VDE
Optical Isolator (U17, U18, U19, U20)	+ Avago	HCNR201- 300E	Rated Insulation 5000Vac;	UL 1577 VDE 0884	cULus E55361 VDE
<b>AC PCB – AV34402B</b>					
PCB	+ Leiterplatten Pfullingen	Basismate- rial: Pana- sonic R1755M	UL94V-0; 300x190x2,5mm; T=130°C;	ANSI/UL 746	URus E81336
Contactory Relay (K1, K2, K3, K4)	+ Finder	67.23.9.02 4.4300	Coil voltage 24 Vdc, Contact: 400V 50A	UL 508 VDE 0126- 1-1	cURus E106390 VDE
Contactory Relay (K6, K7)	+ Finder	45.31.7.02 4.0310	Coil voltage 24 Vdc, Contact: 250V 16A	UL 508 VDE 0126- 1-1	cURus E81856 VDE
Inductor (L1)	Schaffner	RU32970- 65-99	Open type construction with overall approx. dimensions: 72by72by40mm  Rating: 0,42mH; 65A  Core: Nanocrystalline  Coil: Enamelled copper magnet wire wound on Core  Bobbin: Flame Class 94V-0 min. 0,35mm thickness  Temperature class: 130°C	--	Evaluated as part of the product
AC/DC Con- nector terminals (XA211, XA212, XA213, XB211, XB212, XB213, X1, X2, X3)	+ PHOENIX CONTACT	SPT16/ 1- V-10,0	Max. Voltage 1000 V Max. current: 76A UL94-V0	ANSI/UL 486	cURus E60425
Capacitor L to N (C31, C32, C33, C34, C35, C37, C36, C38, C39)	+ Vishay	F339M X2	305Vac; 5,6µF; X2	UL60384- 14	cURus E354331 ENEC



**Test Certificate No.: 9612311210**

In accordance with Clause 12 of the Standards Law – 1953

Page 9 of 10pages

Capacitor L to N (C25, C26, C27)	+ Vishay	F1778X2	305Vac; 1 $\mu$ F; X2	UL 60384-14	cURus E354331 ENEC
Capacitor L to N (C28, C29, C30)	+ Vishay	F1778X2	305Vac; 0,047 $\mu$ F; X2	UL 60384-14	cURus E354331 ENEC
Capacitor L to PE (C167)	+ Vishay	MKP338 6 Y2	300V; 33nF; Y2	UL 60384-14	cURus E354331 ENEC
Capacitor L to PE (C168)	+ Epcos	B32024	300Vac; 470nF; X2	UL1414, UL1283	cURus E97863, E301966 ENEC
Gas tube (F1)	+ Epcos	EF800X	680V to 1000V; 5kA, Op. Temp. 90°C	UL 1449 VDE 0845	cURus E319264 VDE
Transformator (T3, T4, T5, T6)	Voltis	E-909KA	Closed type construction with overall dimensions: 21,5x28,0x11,4mm  <b>Rating:</b> Input: 50V; 30mA Output: 50V; 10mA Switching frequency: 140kHz  <b>Core:</b> EFD 20/10/7; N87  <b>Insulation:</b> Triple insulated wire class F according to EN 61558-1. EN/UL 60950, EN 60601  <b>Cover Insulation:</b> Kaptonklebeband Träger- stärke 14x0,025mm Isolier- stoffklasse F	--	Evaluated as part of the product
Current Sensor (U19)	+ LEM	CTSR	<b>Rating:</b> Primary nominal residual current: 300mA  <b>Insulation Voltage:</b> 4250V  <b>Flame Class:</b> 94V-0  <b>Op. Temp.:</b> 105°C	UL 508 IEC 61010-1	cURus E189713 VDE
Optical Isolator (U16, U17)	+ Avago	HCNR201-300E	Rated Insulation 5000Vac	UL 1577 VDE 0884	cULus E55361 VDE

Test Certificate No.: **9612311210**  
 In accordance with Clause 12 of the Standards Law – 1953

Transformator (T2)	Voltis	E-3191K	<p>Closed type construction with overall dimensions of 34x33x27mm</p> <p><b>Rating:</b>                  Input voltage: max.1000V                  F=32kHz                  Output voltage: 24V</p> <p><b>Core:</b>                  ETD 29/N87oder 3F3;                  Mf102; 35G</p> <p><b>Coil:</b>                  Primary: L=3,66mH, N1a 86 turns, N1b 86 turns                  Secondary: N2 21 turns 12W,                  N3 18 turns 30W</p> <p><b>Bobbin:</b>                  Temp. Class: 155°C                  Flame Class: UL 94V-0;                  min. 0,9mm thickness</p> <p><b>Insulation Foil:</b>                  Temp. Class: 155°C                  0,025 mm thickness with adhesive: 0,06 mm</p> <p><b>Insulation Tape:</b>                  Temp. Class: 155°C                  0,025 mm thickness with adhesive: 0,06 mm                  Reinforced copper wire (EN61558-1)</p>	--	Evaluated as part of the product
<b>Communication board</b>					
Transformator (T1)	Würth Elektronik	749014011 0	250Vrms, 8mA, reinforced insulation 4,8kVrms	UL60950-1	cURus E205930
<p>1) an asterisk indicates a mark which assures the agreed level of surveillance</p> <p>2) + means, that components from other vendor and other model number, but with the same rating and equivalent approvals are accepted.</p>					