

# CERTIFICATES

# SOLAR MODULES

# Certificate

Registration No.: PV 60025844

Page 1

Report No.: 15031989.001

**License Holder:**

**Novergy Energy Solutions Pvt, Ltd.**

I Navlok Navratna Complex  
Bedla Road  
Udaipur-313001  
India

**Product:**

PV Module

**Type:**

MCA205, MCA210, MCA215, MCA220,  
MCA225, MCA230, MCA235, MCA240,  
MCA245, MCA250.  
MCA160, MCA165, MCA170, MCA175,  
MCA180, MCA185, MCA190.

**Manufacturing plant:**

**Novergy Energy Solutions Pvt, Ltd.**

I Navlok Navratna Complex  
Bedla Road  
Udaipur-313001  
India

**Basis:**

- IEC 61730-1:2004  
IEC 61730-2:2004  
EN 61730-1:2007  
EN 61730-2:2007  
"Photovoltaic (PV) module safety qualification"

- Factory Inspection**  
To document the consistent quality of the product factory inspections are performed periodically.



- Qualified, IEC 61215
- Safety tested, IEC 61730
- Periodic Inspection

**Remarks:**

- IEC EN 61730 consists of part 1 ( Requirements for construction) and part 2 (Requirements for testing).
- The above listed PV modules fulfil the requirements of Application Class A (Safety Class II ). They may be used in PV plants at a maximum system voltage (Voc at STC) of up to **1000 VDC**.
- The fire test (IEC 61730-2 / MST 23) was not performed.

**Conditions:**

The product test is voluntarily according to technical regulations. Any change of the design, materials, components or processing may require the repetition of some of the qualification tests in order to retain type approval.

**The certificate is valid until 23 May 2014.**

Cologne, 2 July 2009



Dipl.-Ing. M. Adrian

# BATTERIES



## Letter of Attestation

205867-1446744

*CSA International has completed an evaluation on TGE 420 Batteries for Cyclic Endurance test as per CL.15 of IEC 61427 comprising of shallow cycling at low state of charge and high state of charge at 40 Deg C for 14 units each comprising of 150 cycles*

*Manufactured by:*

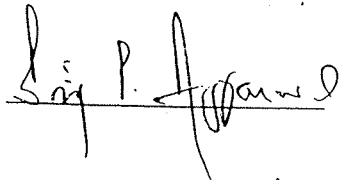
*HBL NIFE Power Systems Ltd.  
8-2-601, Road No. 10, Banjara Hills  
Hyderabad – 500 034, India*

*Based on the evaluation CSA hereby attests that the above subject model complies with the following standards/requirements, to the extent applicable*

*IEC 61427 : 1999 : Secondary cells and batteries for solar photovoltaic energy  
Clause 15 systems – General requirements and methods of test*

Issued by: Brij Aggarwal, P. Eng.

Date Issued: March 28, 2005

Signature: 

This Letter of Attestation is not an authorization to use any of CSA's registered Marks. The results obtained are contingent upon the characteristics of the actual samples used in the evaluation. In the absence of a continuing Inspection Service, CSA International provides no assurance, expressed or implied, that the results are applicable to reproductions of these samples. This letter can only be reproduced as a complete entity and abstracts and abbreviations are not permitted.

# Certificate of Compliance

Certificate: 1391882

Master Contract: 205867

Project: 1391882

Date Issued: October 28, 2003

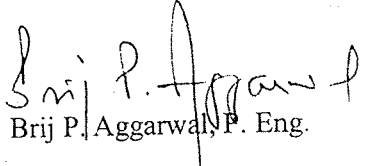
Issued to: HBL NIFE Power Systems Ltd.  
8-2-601 Road No 10  
Banjara Hills  
Hyderabad, 560034  
INDIA

*The products listed below are eligible to bear the CSA Mark shown*



IEC/EN 60896-2

Issued by:

  
Brij P. Aggarwal, P. Eng.

Authorized by: Terry Nagy  
Operations Manager

## PRODUCTS

CLASS 9091 01 - MISCELLANEOUS.

PART A: TGE Series (OPzV type)

Tubular VRLA (Gelled electrolyte) batteries, TGE series, Models 4 OPzV 200 (TGE 200) to 12 OPzV 1200 (TGE 1200), rating 200 Ah to 1200 Ah (single cells); 200 Ah to 3000 Ah (multiple single cells connected in parallel), at 10 hr discharge rate to end voltage of 1.80 V at 20°C, nominal voltage 2V per cell; 2.27± 0.02 V float operation at 20°C.

Certificate: 1391882

Master Contract: 205867

Project: 1391882

Date: October 28, 2003

The details for the range covered are as follows:

| Cell type     | Model    | Nominal Capacity (Amp-hr) |
|---------------|----------|---------------------------|
| 4 OPz V 200   | TGE 200  | 200                       |
| 5 OPz V 250   | TGE 250  | 250                       |
| 6 OPz V 300   | TGE 300  | 300                       |
| 5 OPz V 350   | TGE 350  | 350                       |
| 6 OPz V 420   | TGE 420  | 420                       |
| 7 OPz V 490   | TGE 490  | 490                       |
| 6 OPz V 600   | TGE 600  | 600                       |
| 8 OPz V 800   | TGE 800  | 800                       |
| 10 OPz V 1000 | TGE 1000 | 1000                      |
| 12 OPz V 1200 | TGE 1200 | 1200                      |

**PART B: TGI Series**

Tubular VRLA (Gelled electrolyte) batteries, TGI Series, Models TGI 80 to TGI 500, rating 80 Ah to 500 Ah (single cells); 80 Ah to 3000 Ah (multiple single cells connected in parallel), 10 hr discharge rate to end voltage of 1.80 V at 20°C, nominal voltage 2 V per cell; 2.27 ± 0.02 V float operation at 20°C.

The details for the range covered are as follows:

| Model   | Nominal Capacity (Amp-hr) |
|---------|---------------------------|
| TGI 80  | 80                        |
| TGI 120 | 120                       |
| TGI 200 | 200                       |
| TGI 250 | 250                       |
| TGI 300 | 300                       |
| TGI 350 | 350                       |
| TGI 400 | 400                       |
| TGI 500 | 500                       |

\* Nominal capacity is at 10 hr rate of discharge to an End Cell Voltage of 1.80 V at 20°C.

**APPLICABLE REQUIREMENTS**

- IEC 60896-2:1995 - Stationary lead-acid batteries - General requirements and methods of test Part 2: Valve regulated types.
- EN 60896-2:1996 - Stationary lead-acid batteries - General requirements and methods of test Part 2: Valve regulated types.



CSA INTERNATIONAL

## *Supplement to Certificate of Compliance*

Certificate: 1391882

Master Contract: 205867

*The products listed, including the latest revision described below,  
are eligible to be marked in accordance with the referenced Certificate.*

### **Product Certification History**

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| <b>Project</b> | <b>Date</b> | <b>Description</b>      |
|----------------|-------------|-------------------------|
| 1391882        | 2003/10/28  | Original Certification. |



सी.एस.आर. कॉम्प्लेक्स, चेन्नै - 600 113 इंडिया

दूरभाष 2254 2068, 2254 2818

फैक्स कॉन्सर्च

दूरभाष 044-22542456/22541973/22541508



CSIR Complex, Chennai - 600 113, INDIA

Phone : 2254 2068, 2254 2818

Grams : CONSEARCH

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## केन्द्रीय विद्युतरसायन अनुसंधान संस्थान - मद्रास यूनिट

CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE - MADRAS UNIT

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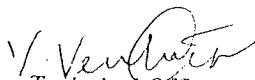
### TEST REPORT

No: EC/M/B/TR-15/HBL12V80GVRLAB/2004

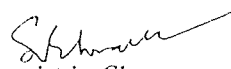
DATE: 06-12-2004

1. *Name and address of the firm whose Product is evaluated.* : M/s. HBL NIFE POWER SYSTEMS LTD.,  
Regd. Office: 8-2-601, Road No.10,  
Banjara Hills,  
Hyderabad - 500 034.
2. *Sponsoring Authority* : Nil
3. *Letter references* : (1) TSW/CECRI/03/2003-04 dt.29.12.2003  
(2) HNPS/18.0/CBO dt. 19.06.2004
4. *Nature of product* : 12V 80Ah Tubular Gel Valve Regulated Lead Acid  
Secondary Batteries
5. *Description with trade mark* : "HBL NIFE 12V - 80Ah @ 10Hr. Model 12TGI 80  
Tubular Gel Valve Regulated Lead Acid Secondary  
Batteries assembled in plastic containers
6. *Total numbers submitted for evaluation with serial numbers* : Three numbers
7. *Test procedure* : Capacity tests @ C<sub>10</sub>, C<sub>5</sub>, C<sub>20</sub>, C<sub>48</sub>, C<sub>72</sub>, C<sub>120</sub>, & C<sub>240</sub>  
and Charge Efficiency tests @ 90%, 75%, & 40% State  
of Charge as per Specification No. IEC 61427

Total Pages: Twelve

  
Technical Officer  
(Testing)



  
Scientist-in-Charge  
CECRI Madras Unit

ए.एस.आई.आर. कॉम्प्लेक्स, चेन्नै - 600 113 इंडिया

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फ़ैक्स : कॉन्सर्च

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### TEST REPORT

No: EC/M/B/TR-15/HBL12V80GVRLAB/2004

DATE: 06-12-2004

Issued to : M/s. HBL NIFE POWER SYSTEMS LTD.,  
Regd. Office: 8-2-601, Road No.10, Banjara Hills, Hyderabad - 500 034.

Sponsoring Authority : Nil

Product Tested : 12V 80Ah Tubular Gel Valve Regulated Lead Acid Secondary Batteries

### RESULTS:

#### (a) Construction:

The batteries are assembled in plastic containers and sealed with plastic lids. The battery lid has six vent holes fitted with valves. The positive and negative terminals are clearly identifiable.

#### (b) Markings:

**TUBULAR GEL VRLA 12V - 80Ah @ 10 Hr.**

MODEL : 12 TGI 80

Constant Voltage Charging :

Float Charging Voltage : 13.8V @ 27°C

Boost Charging Voltage : 14.1V @ 27°C

Maximum Current Limit : 0.2C<sub>10</sub>

**HBL NIFE** HBL NIFE Power Systems Limited

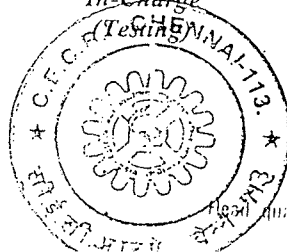
#### (c) Dimensions:

| Over all dimensions | Observed (mm) |
|---------------------|---------------|
| Length              | 525           |
| Width               | 220           |
| Height              | 230           |

V. Venkatesh  
Technical Officer  
(Testing)

M. V. Anandh  
In-Charge  
(Testing)

S. S. Srinivasan  
Scientist-in-Charge  
CECRI Madras Unit



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फैक्स : 044-22542456/22541973/22541508



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TEST REPORT

No: EC/M/B/TR-15/HBL12V80GVRLAB/2004

DATE: 06-12-2004

Issued to : M/s. HBL NIFE POWER SYSTEMS LTD.,  
Regd. Office: 8-2-601, Road No.10, Banjara Hills, Hyderabad - 500 034.  
Sponsoring Authority : Nil  
Product Tested : 12V 80Ah Tubular Gel Valve Regulated Lead Acid Secondary Batteries

RESULTS:

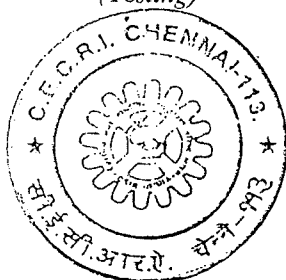
(d) Test for Capacity @ C<sub>10</sub> Rate :

|                        |  |      |      |
|------------------------|--|------|------|
| Rated Capacity (Ah)    | 80Ah at C <sub>10</sub> rate discharge @ 20°C  |      |      |
| Requirement            | Capacity should not be less than 80Ah at C <sub>10</sub> rate @ 20°C to an end voltage of 10.8 V |      |      |
| Battery No.            | 1  | 2    | 3    |
| Observed Capacity (Ah) | 90.7   | 86.1 | 88.3 |

V. Venkatesh  
Technical Officer  
(Testing)

M. V. Anand  
In-Charge  
(Testing)

S. S. Mani  
Scientist-in-Charge  
CECRI Madras Unit



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DATE: 06-12-2004

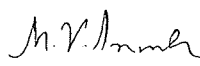
Issued to : M/s. HBL NIFE POWER SYSTEMS LTD.,  
Regd. Office: 8-2-601, Road No.10, Banjara Hills, Hyderabad - 500 034.  
Sponsoring Authority : Nil  
Product Tested : 12V 80Ah Tubular Gel Valve Regulated Lead Acid Secondary Batteries

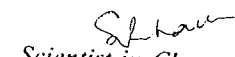
RESULTS:

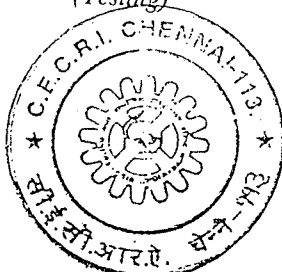
(e) Test for Capacity @ C<sub>5</sub> Rate :

|                        |  |
|------------------------|--|
| Rated Capacity (Ah)    | 83.3% of C <sub>10</sub> (i.e. 66.6Ah) at C <sub>5</sub> rate discharge @ 20°C   |
| Requirement            | Capacity should not be less than 66.6Ah at C <sub>5</sub> rate (discharge current 13.35A) @ 20°C to an end voltage of 10.5 V |
| Battery No.            | 1  |
| Observed Capacity (Ah) | 79.3   |

  
Technical Officer  
(Testing)

  
In-Charge  
(Testing)

  
Scientist-in-Charge  
CECRI Madras Unit



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इन तार कॉन्सार्च

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Regd. Office: 8-2-601, Road No.10, Banjara Hills, Hyderabad - 500 034.

Sponsoring Authority : Nil

Product Tested : 12V 80Ah Tubular Gel Valve Regulated Lead Acid Secondary Batteries

RESULTS:

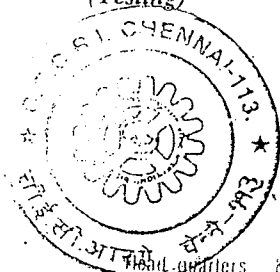
(f) Test for Capacity @ C<sub>20</sub> Rate :

|                        |   |
|------------------------|---|
| Rated Capacity (Ah)    | 110% of C <sub>10</sub> (i.e. 88Ah) at C <sub>20</sub> rate discharge @ 20°C  |
| Requirement            | Capacity should not be less than 88Ah at C <sub>20</sub> rate (discharge current 4.4A) @ 20°C to an end voltage of 10.8 V |
| Battery No.            | 1   |
| Observed Capacity (Ah) | 107.6   |

*V. Venkatesh*  
Technical Officer  
(Testing)

*A. V. Annamalai*  
In-Charge  
(Testing)

*S. Srinivasan*  
Scientist-in-Charge  
CECRI Madras Unit



पूरा आर्ड.आर. कॉम्प्लेक्स, चेन्नै - 600 113 इंडिया

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Issued to

: M/s. HBL NIFE POWER SYSTEMS LTD.,

Regd. Office: 8-2-601, Road No.10, Banjara Hills, Hyderabad - 500 034.

Sponsoring Authority

: Nil

Product Tested

: 12V 80Ah Tubular Gel Valve Regulated Lead Acid Secondary Batteries

### RESULTS:

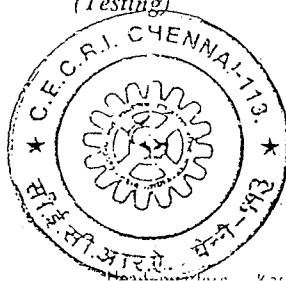
#### (g) Test for Capacity @ C<sub>48</sub> Rate :

|                        |   |
|------------------------|---|
| Rated Capacity (Ah)    | 124% of C <sub>10</sub> (i.e. 99.2Ah) at C <sub>48</sub> rate discharge @ 20 <sup>0</sup> C   |
| Requirement            | Capacity should not be less than 99.2Ah at C <sub>48</sub> rate (discharge current 2.07A) @ 20 <sup>0</sup> C to an end voltage of 10.8 V |
| Battery No.            | 1   |
| Observed Capacity (Ah) | 126.4   |

*V. Venkatesh*  
Technical Officer  
(Testing)

*M.V. Anur*  
In-Charge  
(Testing)

*S. Khan*  
Scientist-in-Charge  
CECRI Madras Unit



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रभाग 2254 2068, 2254 2818

इन तार कॉन्सर्च

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Issued to

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Regd. Office: 8-2-601, Road No.10, Banjara Hills, Hyderabad - 500 034.

Sponsoring Authority

: Nil

Product Tested

: 12V 80Ah Tubular Gel Valve Regulated Lead Acid Secondary Batteries

### RESULTS:

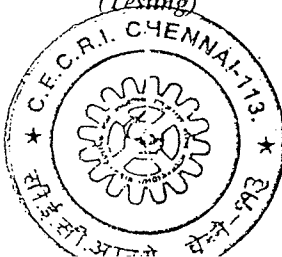
(i) Test for Capacity @ C<sub>120</sub> Rate :

|                        |   |
|------------------------|---|
| Rated Capacity (Ah)    | 150% of C <sub>10</sub> (i.e. 120Ah) at C <sub>120</sub> rate discharge @ 20°C  |
| Requirement            | Capacity should not be less than 120Ah at C <sub>120</sub> rate (discharge current 1A) @ 20°C to an end voltage of 11.1 V |
| Battery No.            | 1   |
| Observed Capacity (Ah) | 125.6   |

V. Venkatesh  
Technical Officer  
(Testing)

M.V. Inam  
In-Charge  
(Testing)

S. Subramanian  
Scientist-in-Charge  
CECRI Madras Unit



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दूरभाष : 2254 2068, 2254 2818

फोन तार : कॉन्सर्च

फैक्स : 044- 22542456 / 22541973 / 22541508



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Phone : 2254 2068, 2254 2818

Grams : CONSEARCH

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E.mail : bnl@vsnl.com

## केन्द्रीय विद्युतरसायन अनुसंधान संस्थान - मद्रास यूनिट

## CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE - MADRAS UNIT

### TEST REPORT

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No: EC/M/B/TR-15/HBL12V80GVRLAB/2004

DATE: 06-12-2004

Issued to

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Regd. Office: 8-2-601, Road No.10, Banjara Hills, Hyderabad - 500 034.

Sponsoring Authority

: Nil

Product Tested

: 12V 80Ah Tubular Gel Valve Regulated Lead Acid Secondary Batteries

### RESULTS:

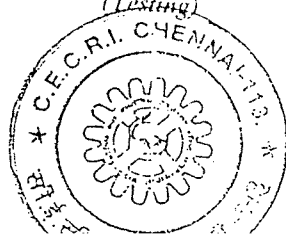
#### (j) Test for Capacity @ C<sub>240</sub> Rate :

|                        |   |
|------------------------|---|
| Rated Capacity (Ah)    | 150% of C <sub>10</sub> (i.e. 120Ah) at C <sub>240</sub> rate discharge @ 20°C  |
| Requirement            | Capacity should not be less than 120Ah at C <sub>240</sub> rate (discharge current 0.5A) @ 20°C to an end voltage of 11.4 V |
| Battery No.            | 1   |
| Observed Capacity (Ah) | 125.4   |

V. Venkatesh  
Technical Officer  
(Testing)

M. V. Anand  
In-Charge  
(Testing)

S. S. Srinivasan  
Scientist-in-Charge  
CECRI Madras Unit





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केन्द्रीय विद्युतरसायन अनुसंधान संस्थान - मद्रास यूनिट  
CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE - MADRAS UNIT

TEST REPORT

Page 10 of 12

No: EC/M/B/TR-15/HBL12V80GVRLAB/2004

DATE: 06-12-2004

Issued to : M/s. HBL NIFE POWER SYSTEMS LTD.,  
Regd. Office: 8-2-601, Road No.10, Banjara Hills, Hyderabad - 500 034.  
Sponsoring Authority : Nil  
Product Tested : 12V 80Ah Tubular Gel Valve Regulated Lead Acid Secondary Batteries

RESULTS:

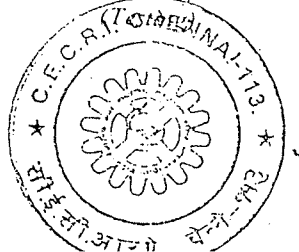
(k) Test for Charge Efficiency @ 90% State of Charge :

|                                |  |       |
|--------------------------------|--|-------|
| Rated Capacity (Ah)            | 80Ah at C <sub>10</sub> rate discharge @ 20°C                        |       |
| Requirement                    | Charge Efficiency should not be less than 85% at 90% State of Charge |       |
| Battery No.                    | 2  | 3     |
| Charge Efficiency Observed (%) | 96.1%  | 96.8% |

V. Venkatesh  
Technical Officer  
(Testing)

M. V. ...  
In-Charge

Scientist-in-Charge  
CECRI Madras Unit



सी.एस.आई.आर. कॉम्प्लेक्स, चेन्नै - 600 113 इंडिया  
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Page 11 of 12

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Sponsoring Authority : Nil  
Product Tested : 12V 80Ah Tubular Gel Valve Regulated Lead Acid Secondary Batteries

RESULTS:

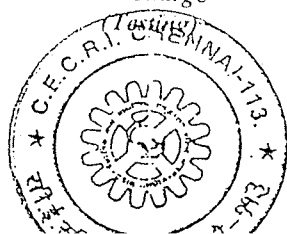
(I) Test for Charge Efficiency @ 75% State of Charge :

|                                |  |       |
|--------------------------------|--|-------|
| Rated Capacity (Ah)            | 80Ah at C <sub>10</sub> rate discharge @ 20 <sup>0</sup> C           |       |
| Requirement                    | Charge Efficiency should not be less than 90% at 75% State of Charge |       |
| Battery No.                    | 2  | 3     |
| Charge Efficiency Observed (%) | 98.3%  | 97.0% |

V. Venkatesh  
Technical Officer  
(Testing)

M.V. Anand  
In-Charge  
(Testing)

S. S. Srinivasan  
Scientist-in-Charge  
CECRI Madras Unit



# INVERTERS – TRUE POWER

**ation Sheet**

| Product Description                             | Brand         | Model No.   | Manufacturer's Name & Address  | Standard Reference                | Country of Origin | Revalidation Date |
|---|---------------|---|--|-----------------------------------|-------------------|-------------------|
| II-136 - POWER SUPPLY, BATTERY CHARGERS AND UPS | TP TRUE POWER | SAPHIRE PURE SINE WAVE INVERTERS (650VA-850VA )               | TRUE POWER INTERNATIONAL LTD. BG-135, SANJAY GANDHI TRANSPORT NAGAR, DELHI-42, INDIA | IEC 62040-1-1: 2002 (1ST EDITION) | INDIA             | 26 NOVEMBER 2009  |
| II-136 - POWER SUPPLY, BATTERY CHARGERS AND UPS | TP TRUE POWER | PLUTO PURE SINE WAVE INVERTERS (1450VA)                       | TRUE POWER INTERNATIONAL LTD. BG-135, SANJAY GANDHI TRANSPORT NAGAR, DELHI-42, INDIA | IEC 62040-1-1: 2002 (1ST EDITION) | INDIA             | 06 NOVEMBER 2009  |
| II-136 - POWER SUPPLY, BATTERY CHARGERS AND UPS | TP TRUE POWER | HULK PURE SINE WAVE INVERTERS (2.0KVA)                        | TRUE POWER INTERNATIONAL LTD. BG-135, SANJAY GANDHI TRANSPORT NAGAR, DELHI-42, INDIA | IEC 62040-1-1: 2002 (1ST EDITION) | INDIA             | 06 NOVEMBER 2009  |
| II-136 - POWER SUPPLY, BATTERY CHARGERS AND UPS | TP TRUE POWER | HULK PURE SINE WAVE HIGH CAPACITY INVERTERS (2.5KVA-15.0 KVA) | TRUE POWER INTERNATIONAL LTD. BG-135, SANJAY GANDHI TRANSPORT NAGAR, DELHI-42, INDIA | IEC 62040-1-1: 2002 (1ST EDITION) | INDIA             | 06 NOVEMBER 2009  |

Product Certificate No.: COINM015122



Signed:





## Product Certificate

### STANDARDS ORGANISATION OF NIGERIA CONFORMITY ASSESSMENT PROGRAMME

Product Certificate No.: COINM015122

Issued to: TRUE POWER INTERNATIONAL LTD.

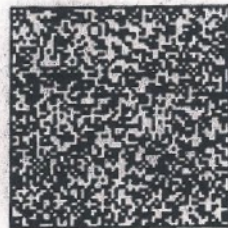
Issue Date: 27 NOVEMBER 2008

Remarks: ADDRESS: BG-135, SANJAY GANDHI TRANSPORT NAGAR, DELHI-42, INDIA

Issued by: Ramakrishna Poluri

SONCO, INM - ITS INDIA PRIVATE LTD.

SONCO manager (Intertek)



This Product Certificate is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this Product Certificate. Only the Client is authorized to permit copying or distribution of this Product Certificate and then only in its entirety. Any use of the Intertek name for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek.

# INVERTERS – NOVERGY

## EC Declaration of Conformity

### Manufacturer

Novergy Energy Solutions Pvt. Ltd., 1 Navlok Navratna Complex, Bedla Road, Udaipur-313001, India

### The Directives covered by this Declaration

2004/108/EC Electromagnetic Compatibility directive, as amended  
2006/95/EEC Low Voltage Equipment directive.

### The Products Covered by this Declaration

IPC-E10 series of solar inverters.

### The Basis on which Conformity is being Declared

The manufacturer hereby declares under his sole responsibility that the products identified above comply with the protection requirements of the EMC directive and with the principal elements of the safety objectives of the Low Voltage Equipment directive, and that the following standards have been applied:

#### EMC Testing:

Emissions testing to BS EN 61000-6-4: 2001

EN 55022:2007 Class A, Conducted Emissions

EN 55022:2007 Class A, Radiated Emissions.

Immunity testing to BS EN 61000-6-2:2005

EN 61000-4-2:1995 Electrostatic discharge immunity test1: Severity level  $\pm 8\text{kV}$  air discharge and  $\pm 4\text{kV}$  contact discharge.

EN 61000-4-4:204 Electrical fast transient/burst immunity test1, for 1 minute each polarity, on the following:

rectifier AC input port, severity level  $\pm 2.0\text{kV}$  on each line to ground.

rectifier DC output port, severity level  $\pm 2.0\text{kV}$  with capacitive clamp. Functional earth ports, severity level  $\pm 0.5\text{kV}$

EN 61000-4-5:1995 Surge immunity test1 on the following: rectifier a.c. input port, severity levels;  $\pm 2\text{kV}$  line-to-earth.

EN 61000-4-6:2007 Immunity to conducted disturbances, induced by radio-frequency fields, 150kHz to 80MHz at a CW level of 10V with 1kHz, 80% a.m. on the following:

DC output port.

AC input ports.

#### Low Voltage Directive:

EN 60950-1: 2006 EN 50178: 1997 The technical documentation required to demonstrate that the products meet the requirements of the Low Voltage Equipment directive has been compiled and is available for inspection by the relevant enforcement authorities. The CE mark was first applied in 2009.

Issued by: C N Navalekar

Authority: R&D Incharge

Date: 21-Apr-2010



# CHARGE CONTROLLERS



Manufacturer

Phocos AG, Magirus-Deutz Strasse 12, D-89077 Ulm

hereby certifies on it's sole responsibility that the following products:

|                     |   |
|---------------------|---|
| <b>CML05-2</b>      | <b>CML Charge Regulator 12/24 V 5/5 A, V2</b>                     |
| <b>CML05-2.1</b>    | <b>CML Charge Regulator 12/24 V 5/5 A, V2, ROHS</b>               |
| <b>CML05-2.1-NL</b> | <b>CML Charge Regulator 12/24 V 5/5 A, V2, Nightlight, ROHS</b>   |
| <b>CML08-2</b>      | <b>CML Charge Regulator 12/24 V 8/8 A, V2</b>                     |
| <b>CML08-2.1</b>    | <b>CML Charge Regulator 12/24 V 8/8 A, V2, ROHS</b>               |
| <b>CML10-2</b>      | <b>CML Charge Regulator 12/24 V 10/10 A, V2</b>                   |
| <b>CML10-2.1</b>    | <b>CML Charge Regulator 12/24 V 10/10 A, V2, ROHS</b>             |
| <b>CML10-2.1-NL</b> | <b>CML Charge Regulator 12/24 V 10/10 A, V2, Nightlight, ROHS</b> |
| <b>CML15-2</b>      | <b>CML Charge Regulator 12/24 V 15/15 A, V2</b>                   |
| <b>CML15-2.1</b>    | <b>CML Charge Regulator 12/24 V 15/15 A, V2, ROHS</b>             |
| <b>CML15-2.1-NL</b> | <b>CML Charge Regulator 12/24 V 15/15 A, V2, Nightlight, ROHS</b> |
| <b>CML20-2</b>      | <b>CML Charge Regulator 12/24 V 20/20 A, V2</b>                   |
| <b>CML20-2.1</b>    | <b>CML Charge Regulator 12/24 V 20/20 A, V2, ROHS</b>             |
| <b>CML20-2.1-NL</b> | <b>CML Charge Regulator 12/24 V 20/20 A, V2, Nightlight, ROHS</b> |

Which are explicitly referred to by this Declaration meet the following directives and standards:

**Directive 73/23/EEC, Electrical Apparatus Low Voltage Directive**

**Directive 89/336/EEC, Electromagnetic compatibility**

**Directive 93/68/EEC, CE Marking**

**EN60730-1, EN60730-2-1 I**

Documentation evidencing conformity with the requirements of the Directives is kept available for inspection at the company's address.



Anton Zimmermann  
CTO

01.01.2008



# Test and Measurement Protocol

## - Charge Controllers -



|            |
|------------|
| Model/Type |
| CML 10     |

|            |
|------------|
| Date       |
| 19.01.2004 |

| DuT | Serial Number    | Reference number |
|-----|------------------|------------------|
| 1   | 0332-k           | 001-PHC-1103     |
| 2   | 031130001 V. 4.0 | 002-PHC-1103     |



**Table of contents**

|  |      |    |
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| Evaluation                             | page | 3  |
| Detailed overview                      | page | 4  |
| Pretest                                | page | 6  |
| Functiontests                          | page | 9  |
| Detailtests                            | page | 11 |
| O.N.E statement                        | page | 23 |
| O.N.E charge controller specifications | page | 24 |
| Normative references                   | page | 25 |
| Overview of measurement equipment      | page | 26 |
| DIN / ISO 9001:2000 Zertifikat         | page | 27 |

## **1. Evaluation / Summary**

### **Description**

- The charge controller CML 10 from phocos is a professional manufactured charge controller for lead acid batteries.
- Case workmanship is very good, the controller has an industrial manufactured printed circuit board. The charge controller is able for wall mounting.
- The wire connection is made via screw terminal. The terminal wire cross section is sufficiently high.
- The labeling and pictograms of the wire interface are complete and unmistakable.
- The charge controller has 5 LEDs to display different states of charging, state of battery, load-disconnection warning and disconnected load. Additional the charge controller has a built in beeper for warning purposes.
- The labeling and pictograms of the LED display are complete and unmistakable.
- The documentation of the charge regulator is short but complete and clear.
- The charge controller is protected against: overload, short circuit load, short circuit and reverse polarity PV and reversed battery and transient voltages at PV terminals via varistors. Transient voltages at load terminal The controller has a night discharge protection implemented.

### **Evaluation of the test results:**

Most of ISE requirements could be passed. Some tests could not be passed due to the special versions of the charge controllers we had under test. These versions are intended for use in systems with direct battery operation of the load (inverter). Therefore the LVD threshold of the charge controller was very low (11,12 V measured) and there was no current compensation built in. The standard version of CML 10 has a current compensation built in (LVD 11,5 V @ Iloadmax, 11,9 V @ Iloadmin according to manufacturer information).

The first tests showed that DuT 1 was defective. Therefore some tests were repeated with a second device.

Some recommendations:

- for signalling of battery charging and charged battery a green LED should be used. (Remark: according to manufacturer information, the colours of the LEDs can be customized.)
- the charge controller should be improved to withstand shorted battery terminals. (Remark: according to manufacturer information, the problem with shorted battery terminals is solved meanwhile.)

## 2. Detailed Overview

| <b>Basic tests and features</b>     |   |         | passed                              | failed                              | not available            |
|-------------------------------------|---|---------|-------------------------------------|-------------------------------------|--------------------------|
| ordered                             |   |         |                                     |                                     |                          |
| <input checked="" type="checkbox"/> | Visual Inspection                         | page 8  | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | end of charge voltage                     | page 9  | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | reconnect PV                              | page 9  | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | load disconnect warning on                | page 9  | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | load disconnect                           | page 9  | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | reconnect load                            | page 9  | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | Stresstest at max. current for 1 hour     | page 10 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | self consumption                          | page 11 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | charge efficiency                         | page 13 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | discharge efficiency                      | page 13 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | Display                                   | page 14 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <b>Fail-Save behaviour:</b>         |   |         |                                     |                                     |                          |
| <input checked="" type="checkbox"/> | Operating with disconnected battery       | page 15 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | Removing battery during normal operat.    | page 15 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | Operating with extreme discharged bat.    | page 15 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <b>Protection feactures:</b>        |   |         |                                     |                                     |                          |
| <input checked="" type="checkbox"/> | Protection against reversed polarity bat. | page 16 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | Protection against reversed polarity PV   | page 16 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | Protection against overloading            | page 16 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | Protection against overcurrent PV         | page 16 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | Protection against overvoltage PV         | page 16 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | Protection against transient overvoltage  | page 16 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | Protection against short circuited load   | page 16 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |

|                                     |  |         |                                     |                                     |                          |
|-------------------------------------|--|---------|-------------------------------------|-------------------------------------|--------------------------|
| <input checked="" type="checkbox"/> | Protection against short circuited PV      | page 16 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | Protection against short circuited battery | page 16 | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

**Recommended features**

| ordered                             |  |         | passed                              | failed                   | not available                       |
|-------------------------------------|--|---------|-------------------------------------|--------------------------|-------------------------------------|
| <input checked="" type="checkbox"/> | Adjustment range of the thresholds       | page 17 | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> | gassing function                         | page 9  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| <input checked="" type="checkbox"/> | Saving the state of gassing function     | page 9  | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> | Protection against current flow into PV  | page 18 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| <input checked="" type="checkbox"/> | Protection against overcurrent and -load | page 16 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |

**Additional tests**

|                                     |   |         |                          |                          |                                     |
|-------------------------------------|---|---------|--------------------------|--------------------------|-------------------------------------|
| <input type="checkbox"/>            | long run test for 48 hour                     | page 19 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| <input checked="" type="checkbox"/> | current compensation                          | page 20 | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/>            | temperature compensation                      | page 21 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| <input type="checkbox"/>            | DC/DC-converter                               | page 22 | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/>            | Operating with disconnected temp. Sens.       | page 16 | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/>            | Operating with short circuited temp.sens.     | page 16 | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/>            | Operating with disconnected bat.volt.sens.    | page 16 | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/>            | Operating with short circuited bat.volt.sens. | page 16 | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

### 3. Pretest

#### 3.1. Information given by the manufacturer

|                    |             |                  |  |
|--------------------|-------------|------------------|--|
| Manufacturer       | phocos      |                  |  |
| Country/Origin     | Deutschland |                  |  |
| Model/Type         | CML 10      |                  |  |
| Serial / Batch Nr. | 1.          | 0332-k           |  |
|                    | 2.          | 031130001 V. 4.0 |  |

#### Mechanical data

|                                   |                |
|-----------------------------------|----------------|
| Dimensions (l * w * h) [mm]       | 100x80x32      |
| Weight [g]                        | 180            |
| Case material                     | plastic        |
| Protection class (IP)             | 20             |
| Case mounting                     | screws         |
| Connection type                   | screw terminal |
| Cable stress relief               | no             |
| Cable diameter [mm <sup>2</sup> ] | max. 16        |
| Label                             | yes            |

#### Electrical data

|   |   |  |  |  |
|---|---|--|--|--|
| At ambient temperature of [°C]                      | 25 °C                                   |  |  |  |
| Rated voltage                                       | <input type="checkbox"/> 12V            | <input type="checkbox"/> 24V               | <input checked="" type="checkbox"/> 12 & 24V |  |
| Automatic adjustment 12/24V                         | <input checked="" type="checkbox"/> yes |  | <input type="checkbox"/> no                  |  |
| Max. module power [W]                               | ---                                     |  |  |  |
| Max. charge current [A]                             | 10,00                                   |  |  |  |
| Max. discharge current [A]                          | 10,00                                   |  |  |  |
| Type of controller                                  | <input type="checkbox"/> shunt          | <input checked="" type="checkbox"/> serial | <input type="checkbox"/> other:              |  |
| Technique of regulation                             | <input type="checkbox"/> two point      | <input checked="" type="checkbox"/> PWM    | <input type="checkbox"/> other:              |  |
| Self consumption [mA]                               | 4                                       |  |  |  |
| End of charge voltage [V]                           | 13,7 (float voltage)                    |  |  |  |
| return switch-on voltage (two point regulation) [V] | ---                                     |  |  |  |
| load disconnect warning on [V]                      | 11,0 < V <sub>batt</sub> < 11,5         |  |  |  |
| load disconnect voltage [V]                         | 11                                      |  |  |  |
| time delay at load shedding [s]                     | 2 ... 120 sec. current depending        |  |  |  |
| Reconnection voltage load [V]                       | 12,8                                    |  |  |  |
| time delay at reconnection [s]                      | no information                          |  |  |  |
| load reconnection manually [V]                      | no                                      |  |  |  |
| operation temperature range [°C]                    | -20 up to +50                           |  |  |  |
| display   | <input checked="" type="checkbox"/> LED | <input type="checkbox"/> LCD               | <input type="checkbox"/> LED & LCD           |  |

**additional functions**

|  |                                     |      |                                     |      |
|--|-------------------------------------|------|-------------------------------------|------|
| gassing function                             | <input checked="" type="checkbox"/> | yes  | <input type="checkbox"/>            | no   |
| gassing activation voltage (equal) [V]       | 12,3                                |      |                                     |      |
| final gassing voltage (equalisation) [V]     | 14,5                                |      |                                     |      |
| gassing activation voltage (boost) [V]       | 12,1                                |      |                                     |      |
| final gassing voltage (boost) [V]            | 14,8                                |      |                                     |      |
| Temperature compensation                     | <input checked="" type="checkbox"/> | yes  | <input type="checkbox"/>            | no   |
| temperature compensation [mV/K*cell]         | -3                                  |      |                                     |      |
| Battery voltage sensor                       | <input type="checkbox"/>            | yes  | <input checked="" type="checkbox"/> | no   |
| DC/DC-Converter                              | <input type="checkbox"/>            | yes  | <input checked="" type="checkbox"/> | no   |
| MPPT   | <input type="checkbox"/>            | yes  | <input checked="" type="checkbox"/> | no   |
| adjustable for different battery types       | <input type="checkbox"/>            | yes  | <input checked="" type="checkbox"/> | no   |
| adjustable thresholds                        | <input type="checkbox"/>            | yes  | <input checked="" type="checkbox"/> | no   |
| end of charge [V]                            | <input type="checkbox"/>            | min. | <input type="checkbox"/>            | max. |
| load disconnect [V]                          | <input type="checkbox"/>            | min. | <input type="checkbox"/>            | max. |
| selectable priority at load disconnection    | <input type="checkbox"/>            | yes  | <input checked="" type="checkbox"/> | no   |
| Protection against reversed battery polarity | <input checked="" type="checkbox"/> | yes  | <input type="checkbox"/>            | no   |
| Protection against reversed PV polarity      | <input checked="" type="checkbox"/> | yes  | <input type="checkbox"/>            | no   |
| Others                                       |                                     |      |                                     |      |

listed values rated for

12V

24V

**Other**

|            |                           |
|------------|---------------------------|
| Interfaces | no                        |
| Price      | not available             |
| Service    | only manufacturer website |
| Warranty   | no information            |



### 3.2. Visual Inspection

|  |                                     |           |                                     |          |                                     |                                     |      |
|--|-------------------------------------|-----------|-------------------------------------|----------|-------------------------------------|-------------------------------------|------|
| Connection type                            | <input type="checkbox"/>            | plug      | <input checked="" type="checkbox"/> | screw    | <input type="checkbox"/>            | other:                              |      |
| Cable stress relief                        | <input type="checkbox"/>            | o.k.      | <input type="checkbox"/>            | not o.k. | <input checked="" type="checkbox"/> | not available                       |      |
| Cable diameter stranded [mm <sup>2</sup> ] | <input type="checkbox"/>            | 2,5       | <input type="checkbox"/>            | 4        | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | 10   |
| Cable diameter solid [mm <sup>2</sup> ]    | <input type="checkbox"/>            | 2,5       | <input type="checkbox"/>            | 4        | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | 10   |
| Case quality                               | <input type="checkbox"/>            | very good | <input checked="" type="checkbox"/> | good     | <input type="checkbox"/>            | bad                                 |      |
| Connector quality                          | <input checked="" type="checkbox"/> | very good | <input type="checkbox"/>            | good     | <input type="checkbox"/>            | bad                                 |      |
| Electronic quality                         | <input checked="" type="checkbox"/> | very good | <input type="checkbox"/>            | good     | <input type="checkbox"/>            | bad                                 |      |
| Packing of charge contr.                   | <input type="checkbox"/>            | very good | <input checked="" type="checkbox"/> | good     | <input type="checkbox"/>            | bad                                 |      |
| Lettering of packing                       | <input type="checkbox"/>            | very good | <input checked="" type="checkbox"/> | good     | <input type="checkbox"/>            | bad                                 |      |
| Usability                                  | <input type="checkbox"/>            | very good | <input checked="" type="checkbox"/> | good     | <input type="checkbox"/>            | bad                                 |      |
| Fuse changing                              | <input type="checkbox"/>            | very good | <input type="checkbox"/>            | good     | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | n.a. |
| Mounting of charge contr.                  | <input type="checkbox"/>            | very good | <input checked="" type="checkbox"/> | good     | <input type="checkbox"/>            | bad                                 |      |
| Others:                                    |                                     |           |                                     |          |                                     |                                     |      |
| Comment quality                            | very good quality                   |           |                                     |          |                                     |                                     |      |
| Damages                                    | <input type="checkbox"/>            | yes       | <input type="checkbox"/>            | no       | <input checked="" type="checkbox"/> | no                                  |      |

#### Lettering of the charge controller

|                       |                                     |     |                          |    |                                     |      |
|-----------------------|-------------------------------------|-----|--------------------------|----|-------------------------------------|------|
| Manufacturer          | <input checked="" type="checkbox"/> | yes | <input type="checkbox"/> | no |                                     |      |
| Model / type          | <input checked="" type="checkbox"/> | yes | <input type="checkbox"/> | no |                                     |      |
| Serial / batch number | <input checked="" type="checkbox"/> | yes | <input type="checkbox"/> | no |                                     |      |
| Nominal voltage       | <input checked="" type="checkbox"/> | yes | <input type="checkbox"/> | no |                                     |      |
| Connectors            | <input checked="" type="checkbox"/> | yes | <input type="checkbox"/> | no |                                     |      |
| Fuse                  | <input type="checkbox"/>            | yes | <input type="checkbox"/> | no | <input checked="" type="checkbox"/> | n.a. |
| LED, displays         | <input checked="" type="checkbox"/> | yes | <input type="checkbox"/> | no |                                     |      |
| Comment label:        | o.k.                                |     |                          |    |                                     |      |

#### Documentation

|                           |                                     |      |                          |          |                                     |               |
|---------------------------|-------------------------------------|------|--------------------------|----------|-------------------------------------|---------------|
| Data sheet                | <input checked="" type="checkbox"/> | o.k. | <input type="checkbox"/> | not o.k. | <input type="checkbox"/>            | not available |
| User manual               | <input checked="" type="checkbox"/> | o.k. | <input type="checkbox"/> | not o.k. | <input type="checkbox"/>            | not available |
| Installation instructions | <input checked="" type="checkbox"/> | o.k. | <input type="checkbox"/> | not o.k. | <input type="checkbox"/>            | not available |
| Operating instructions    | <input checked="" type="checkbox"/> | o.k. | <input type="checkbox"/> | not o.k. | <input type="checkbox"/>            | not available |
| Troubleshooting guide     | <input checked="" type="checkbox"/> | o.k. | <input type="checkbox"/> | not o.k. | <input type="checkbox"/>            | not available |
| Calibration instructions  | <input type="checkbox"/>            | o.k. | <input type="checkbox"/> | not o.k. | <input checked="" type="checkbox"/> | not available |
| Safety instructions       | <input checked="" type="checkbox"/> | o.k. | <input type="checkbox"/> | not o.k. | <input type="checkbox"/>            | not available |
| Others                    | no                                  |      |                          |          |                                     |               |
| Comment documentation     |                                     |      |                          |          |                                     |               |

#### Spare parts

|                     |                          |           |                          |               |                                     |               |
|---------------------|--------------------------|-----------|--------------------------|---------------|-------------------------------------|---------------|
| Fuse                | <input type="checkbox"/> | available | <input type="checkbox"/> | not available | <input checked="" type="checkbox"/> | not available |
| Mounting parts      | <input type="checkbox"/> | available | <input type="checkbox"/> | not available | <input checked="" type="checkbox"/> | not available |
| Connectors          | <input type="checkbox"/> | available | <input type="checkbox"/> | not available | <input checked="" type="checkbox"/> | not available |
| Others              | no                       |           |                          |               |                                     |               |
| Comment spare parts |                          |           |                          |               |                                     |               |

#### Support

|                          |                                       |           |                          |               |                                     |               |
|--------------------------|---------------------------------------|-----------|--------------------------|---------------|-------------------------------------|---------------|
| Repair / Service address | <input type="checkbox"/>              | available | <input type="checkbox"/> | not available | <input checked="" type="checkbox"/> | not available |
| Warranty                 | <input type="checkbox"/>              | available | <input type="checkbox"/> | not available | <input checked="" type="checkbox"/> | not available |
| Others                   | website of manufacturer               |           |                          |               |                                     |               |
| Comment support          | A support address should be delivered |           |                          |               |                                     |               |

Is it possible to test the charge controller?

yes  no

passed  failed

### 4. Functiontest

#### 4.1. Voltage thresholds

|                      |         |
|----------------------|---------|
| Ambient temperature: | 21,3 °C |
| Rated voltage:       | 12,0 V  |

|            |              |              |
|------------|--------------|--------------|
| DuT        | 1            | 2            |
| Reference  | 001-PHC-1103 | 002-phc-1103 |
| Date:      | 17.11.03     | 10.12.2003   |
| Inspector: | NP           | NP           |

| Voltage thresholds                              | Specification (manufacturer) [V] | Measured [V] <sup>1)</sup> |       |       |     | p / f | Remarks                                       |
|---|----------------------------------|----------------------------|-------|-------|-----|-------|---|
|   |                                  | 1.                         | 2.    | 3.    | 4.  |       |   |
| End of charge voltage                           | 13,7                             |                            | 13,58 | 13,69 |     | p     | 13,58 V PWM start, 13,69 V PV current cut off |
| Gassing final voltage (equalisation)            | 14,5                             |                            | 14,42 | 14,48 |     | p     | 14,42 V PWM start, 14,48 V PV current cut off |
| Gassing final voltage (boost)                   | 14,8                             |                            | 14,73 | 14,80 |     | p     | 14,73 V PWM start, 14,80 V PV current cut off |
| Return switch-on voltage (two point regulation) | ---                              | ---                        | ---   | ---   | --- | ---   |   |
| Load disconnect warning on                      | 11,5 > V <sub>batt</sub> > 11,0  |                            | 11,20 |       |     | p     |   |
| Deep discharging cut-off voltage                | 11,0                             |                            | 11,12 |       |     | f     | LVD threshold too low                         |
| Reconnect voltage load                          | 12,8                             |                            | 12,86 |       |     | p     |   |
| Load reconnect manually                         | ---                              | ---                        | ---   | ---   | --- | ---   |   |

1) Measured in 10 mV-steps

|                                 |                                       |  |
|---------------------------------|---------------------------------------|--|
| Time delay load disconnect [s]: | > 60 s                                |  |
| Time delay load reconnect [s]:  | not measured                          |  |
| Type of controller              | serial controller                     |  |
| equal to manufacturer data:     | <input checked="" type="checkbox"/> x | <input type="checkbox"/> yes <input type="checkbox"/> no |

|  |                         |
|--|-------------------------|
| Remarks: LVD voltage threshold is too low, recommended is > 11,4 V |                         |
| Used measurement equipment   | Vbat: Agilent HP 34401A |
|  |                         |
|  | Ta: Tinsley 5885A       |
|  |                         |

reason of failing?  passed  x failed  
 see remarks

**4.2. Stresstest at max. currents for 1 hour**

|                               |         |
|-------------------------------|---------|
| Ambient temperature:          | 23,1 °C |
| Rated voltage:                | 12,0 V  |
| Rated max. charge current:    | 10,0 A  |
| Rated max. discharge current: | 10,0 A  |

|            |              |   |
|------------|--------------|---|
| DuT        | 1            | 2 |
| Reference  | 001-phc-1103 |   |
| Date:      | 19.11.03     |   |
| Inspector: | np           |   |

| time<br>[min] | PV-module |       | Battery |      | load  |       | Theats<br>°C | DuT |
|---------------|-----------|-------|---------|------|-------|-------|--------------|-----|
|               | [V]       | [A]   | [V]     | [A]  | [V]   | [A]   |              |     |
| 0             | 13,20     | 10,01 | 13,00   | 0,00 | 12,89 | 10,03 | 21,8         | 1   |
|               |           |       |         |      |       |       |              | 2   |
| 15            | 13,22     | 9,99  | 13,00   | 0,00 | 12,88 | 10,05 | 40,7         | 1   |
|               |           |       |         |      |       |       |              | 2   |
| 30            | 13,22     | 9,99  | 13,00   | 0,11 | 12,87 | 10,09 | 41,9         | 1   |
|               |           |       |         |      |       |       |              | 2   |
| 45            | 13,22     | 9,98  | 12,99   | 0,13 | 12,87 | 10,10 | 44,1         | 1   |
|               |           |       |         |      |       |       |              | 2   |
| 60            | 13,22     | 9,98  | 12,99   | 0,13 | 12,87 | 10,11 | 44,5         | 1   |
|               |           |       |         |      |       |       |              | 2   |
|               |           |       |         |      |       |       |              | 1   |
|               |           |       |         |      |       |       |              | 2   |

|                             |                     |
|-----------------------------|---------------------|
| Remarks:                    |                     |
| Used measurement equipment: | Vbat: Zimmer LMG95  |
|                             | Ibat: Zimmer LMG95  |
|                             | Vpv: Zimmer LMG95   |
|                             | Ipv: Zimmer LMG95   |
|                             | Vload: Zimmer LMG95 |
|                             | Iload: Zimmer LMG95 |
|                             | Ta: Tinsley 5885A   |
| Tc: Tinsley 5885A           |                     |

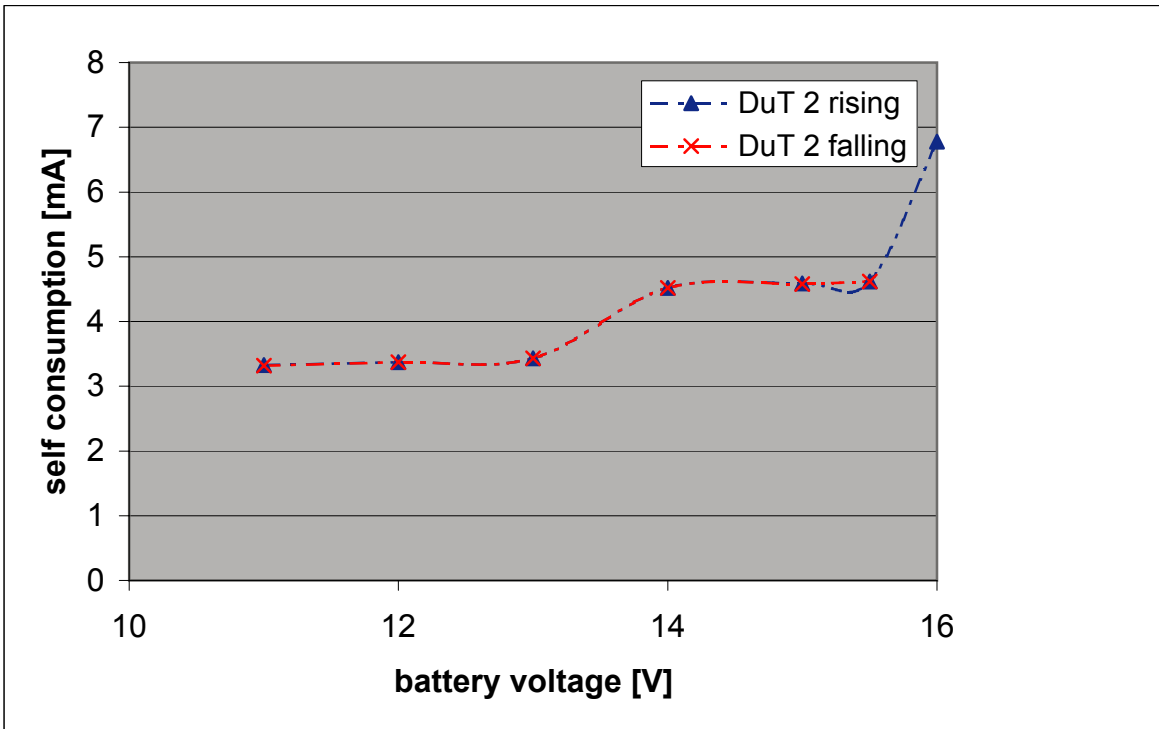
passed       failed

### 5. Detailtest

#### 5.1 Self consumption

|                      |         |
|----------------------|---------|
| Ambient temperature: | 22,4 °C |
| Rated voltage:       | 12,0 V  |

|            |              |              |
|------------|--------------|--------------|
| DuT        | 1.           | 2.           |
| Reference  | 001-PHC-1103 | 002-PHC-1103 |
| Date:      | 18.11.03     | 11.12.2003   |
| Inspector: | NP           | NP           |



|                       |     |      |        |     |
|-----------------------|-----|------|--------|-----|
| max. Selfconsumption: | 6,8 | mA @ | V      | DuT |
|                       |     |      |        | 1   |
|                       |     |      | 16,0 V | 2   |

|                             |   |                   |  |
|-----------------------------|---|-------------------|--|
| Comment:                    | at 16 V the charge controllers recognises "overvoltage" and LEDs load disconnect and battery full lit both. Therefore the selfconsumption raises (information of the manufacturer). |                   |  |
| Used measurement equipment: | Ibat:   | Agilent HP 34401A |  |
|                             | Ubat:   | Zimmer LMG 95     |  |
|                             | Ta:   | Tinsley 5885A     |  |

passed       failed

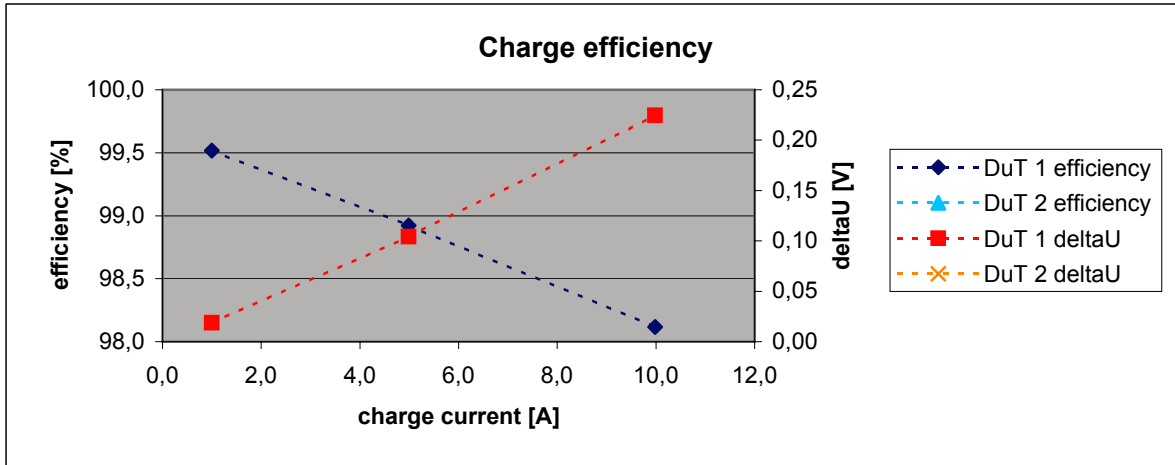
**Measured data:**

| Nr. | Batt. Volt. [V]<br>↑ ↓ | Self consumpt. [mA]<br>↓ | Self consumpt. [mW]<br>↓ | remarks<br>↓  | Self consumpt. [mA]<br>↑ | Self consumpt. [mW]<br>↑ | remarks<br>↑                             | DuT |
|-----|------------------------|--------------------------|--------------------------|---|--------------------------|--------------------------|--|-----|
| 1   |                        |                          |                          |   |                          |                          |  | 1   |
|     | 11,0                   | 3,33                     | 36,63                    | low batt LED (yellow) flashing; 25 beeps                    | 3,32                     | 36,52                    | low batt LED (yellow) flashing; 25 beeps | 2   |
| 2   |                        |                          |                          |   |                          |                          |  | 1   |
|     | 12,0                   | 3,37                     | 40,44                    | low batt LED (yellow) on                                    | 3,37                     | 40,44                    | low batt LED (yellow) on                 | 2   |
| 3   |                        |                          |                          |   |                          |                          |  | 1   |
|     | 13,0                   | 3,43                     | 44,59                    | high batt LED (yellow) on                                   | 3,43                     | 44,59                    | low batt LED (yellow) on                 | 2   |
| 4   |                        |                          |                          |   |                          |                          |  | 1   |
|     | 14,0                   | 4,52                     | 63,28                    | high batt LED (yellow) on                                   | 4,52                     | 63,28                    | high batt LED (yellow) on                | 2   |
| 5   |                        |                          |                          |   |                          |                          |  | 1   |
|     | 15,0                   | 4,59                     | 68,85                    | high batt LED (yellow) on                                   | 4,58                     | 68,70                    | high batt LED (yellow) on                | 2   |
| 6   |                        |                          |                          |   |                          |                          |  | 1   |
|     | 15,5                   | 4,62                     | 71,61                    | high batt LED (yellow) on                                   | 4,62                     | 71,61                    | high batt LED (yellow) on                | 2   |
| 7   |                        |                          |                          |   |                          |                          |  | 1   |
|     | 16,0                   | 6,78                     | 108,48                   | high batt LED (yellow) on plus load disconnect LED (red) on |                          |                          |  | 2   |

### 5.2. Efficiencies

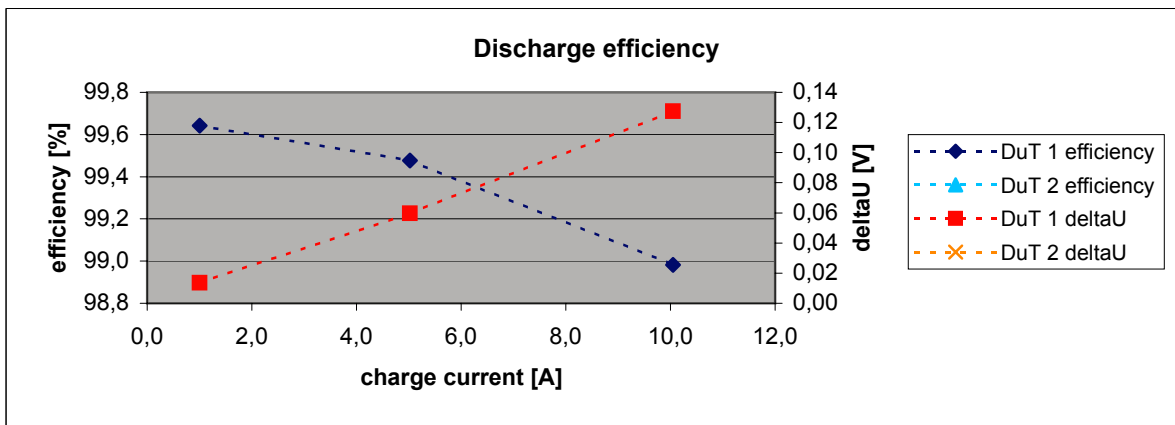
|                               |      |    |
|-------------------------------|------|----|
| Ambient temperature:          | 22,0 | °C |
| Rated voltage:                | 12,0 | V  |
| Rated max. charge current:    | 10,0 | A  |
| Rated max. discharge current: | 10,0 | A  |

|            |              |   |
|------------|--------------|---|
| DuT        | 1            | 2 |
| Reference  | 001-PHC-1103 |   |
| Date:      | 18.11.03     |   |
| Inspector: | NP           |   |



min. charge efficiency [%]: 98,1 +/- 0,4 1.  passed

+/- 0,0 2.



min. discharge efficiency [%]: 99,0 +/- 0,5 1.  passed  failed

+/- 0,0 2.

|                             |                        |               |
|-----------------------------|------------------------|---------------|
| Remarks:                    | very high efficiencies |               |
| Used measurement equipment: | Vbat:                  | Zimmer LMG 95 |
|                             | Ibat:                  | Zimmer LMG 95 |
|                             | Vpv:                   | Zimmer LMG 95 |
|                             | Ipv:                   | Zimmer LMG 95 |
|                             | Vload:                 | Zimmer LMG 95 |
|                             | Iload:                 | Zimmer LMG 95 |
|                             | Ta:                    | Tinsley 5885A |

### 5.3. Display

|                      |         |
|----------------------|---------|
| Ambient temperature: | 20,0 °C |
| Rated voltage:       | 12,0 V  |

|            |              |    |
|------------|--------------|----|
|            | 1.           | 2. |
| Reference  | 001-phc-1103 |    |
| Date:      | 19.11.03     |    |
| Inspector: | np           |    |

|  | p/f | DuT |
|--|-----|-----|
| nominal operation indicated by a green LED           | p   | 1   |
|  |     | 2   |
| load disconnection warning indicated by a yellow LED | p   | 1   |
|  |     | 2   |
| load disconnection indicated by a red LED            | p   | 1   |
|  |     | 2   |

|                             |   |               |
|-----------------------------|---|---------------|
| Remarks:                    | nominal operation is indicated by a yellow LED, recommended is a green LED<br>(According to the manufacturer, the colours of the LEDs can be customized.) |               |
| Used measurement equipment: | Vbat:   | Zimmer LMG95  |
|                             | Ibat:   | Zimmer LMG95  |
|                             | Vpv:  | Zimmer LMG95  |
|                             | Ipv:  | Zimmer LMG95  |
|                             | Vload:  | Zimmer LMG95  |
|                             | Iload:  | Zimmer LMG95  |
|                             | Ta:   | Tinsley 5885A |

passed       failed

### 5.4 Fail-safe behaviour

|                      |         |
|----------------------|---------|
| Ambient temperature: | 21,4 °C |
| Rated voltage:       | 12,0 V  |

|            |              |   |
|------------|--------------|---|
| DuT        | 1            | 2 |
| Reference  | 001-phc-1103 |   |
| Date:      | 19.11.03     |   |
| Inspector: | np           |   |

| Test  | Behaviour / results                     |     |               | DuT |
|---|---|-----|---------------|-----|
| operating with disconnected battery:                          | no damages could be observable          |     |               | 1   |
|   | V load = 0,04 V                         | p   | Passed/failed |     |
|   |   |     |               | 2   |
| removing battery during normal operation:                     | No observable damages                   |     |               | 1   |
|   | V load = 12,01 V                        | p   | Passed/failed |     |
|   |   |     |               | 2   |
| Operating with extreme discharged battery (e.g. VBatt. = 6 V) | charging current possible down to 6,3 V | p   | Passed/failed | 1   |
|   |   |     | Passed/failed | 2   |
| Operating with disconnected temperature sensor                | no temp. sens. available                | --- | Passed/failed | 1   |
|   |   |     | Passed/failed | 2   |
| Operating with short circuited temperature sensor             | no temp. sens. available                | --- | Passed/failed | 1   |
|   |   |     | Passed/failed | 2   |
| Operating with disconnected battery voltage sensor            | no battery sens. available              | --- | Passed/failed | 1   |
|   |   |     | Passed/failed | 2   |
| Operating with short circuited battery voltage sensor         | no battery sens. available              | --- | Passed/failed | 1   |
|   |   |     | Passed/failed | 2   |

|                             |        |               |
|-----------------------------|--------|---------------|
| Remarks:                    |        |               |
| Used measurement equipment: | Vbat:  | Zimmer LMG95  |
|                             | Ibat:  | Zimmer LMG95  |
|                             | Vpv:   | Zimmer LMG95  |
|                             | Ipv:   | Zimmer LMG95  |
|                             | Vload: | Zimmer LMG95  |
|                             | Iload: | Zimmer LMG95  |
|                             | Ta:    | Tinsley 5885A |

passed       failed



### 5.5 Protection Features

|                      |         |
|----------------------|---------|
| Ambient temperature: | 22,6 °C |
| Rated voltage:       | 12,0 V  |

|            |              |              |
|------------|--------------|--------------|
| DuT        | 1            | 2            |
| Reference  | 001-phc-1103 | 002-phc-1103 |
| Date:      | 19.11.03     | 11.12.2003   |
| Inspector: | np           | np           |

| Test   | Behaviour / results |  |     |  |     |
|--|---------------------|--|-----|--|-----|
|  | DuT                 | 1  | p/f | 2  | p/f |
| Protection against short circuited PV                        |                     |  |     | no damages observable                        | p   |
| Protection against reversed polarity PV Module               |                     | No damages observable, but the heatsink is running very hot. There were a power dissipation of 12 W at the end of the test. Test aborted.  | f   | test repeated: no problems observable        | p   |
| Protection against overcurrent at PV side                    |                     | No damages observable  | p   |  |     |
| Protection against overvoltage at PV side over one hour      |                     | no damages could be observed   | p   |  |     |
| Protection against transient overvoltage (diodes, varistors) |                     | Load side: according to information of the manufacturer, the load side is protected against transient voltages using the internal load switch (MosFET).<br>PV side: varistor available | p   |  |     |
| Protection against short circuited load                      |                     | No damages observable. Red LED was flashing during short circuit.  | p   |  |     |
| Protection against overload                                  |                     | No damages observable  | p   |  |     |
| Operation with reversed polarity battery                     |                     | No damages observable. Beeper was ringing. Test canceled because of too high battery current. The heatsink is running very hot (heatsink temperature over 90 °C).                      | f   | test repeated: no problems observable        | p   |
| Protection against short circuited battery                   |                     |  |     | Heatsink is running very hot, test cancelled | f   |

|                             |   |                            |
|-----------------------------|---|----------------------------|
| Remarks:                    | DuT 1 was defective. Therefore test were repeated.<br>According to manufacturer information, the problem with the test "short circuit battery" is solved meanwhile. |                            |
| Used measurement equipment: | Vbat:   | no battery sens. available |
|                             | Ibat:   | Zimmer LMG95               |
|                             | Vpv:  | no battery sens. Available |
|                             | Ipv:  | Zimmer LMG95               |
|                             | Vload:  | Zimmer LMG95               |
|                             | Iload:  | Zimmer LMG95               |
|                             | Ta:   | Tinsley 5885A              |

passed       failed

### 5.6 Adjustment range of thresholds

|                      |    |
|----------------------|----|
| Ambient temperature: | °C |
| Rated voltage:       | V  |

|            |    |    |
|------------|----|----|
|            | 1. | 2. |
| Reference  |    |    |
| Date:      |    |    |
| Inspector: |    |    |

Minimum value:

| Voltage thresholds    | manuf. value [V] | Measured [V] |    | p/f | Remarks |
|-----------------------|------------------|--------------|----|-----|---------|
|                       |                  | 1.           | 2. |     |         |
| End of charge voltage |                  |              |    |     |         |
| load disconnect       |                  |              |    |     |         |

Maximum value:

| Voltage thresholds    | manuf. value [V] | Measured [V]      |    | p/f | Remarks |
|-----------------------|------------------|-------------------|----|-----|---------|
|                       |                  | 1.                | 2. |     |         |
| End of charge voltage |                  | battery sens. ava |    | --- |         |
| load disconnect       |                  |                   |    |     |         |

|                             |                                |               |
|-----------------------------|--------------------------------|---------------|
| Remarks:                    | threshold only factory setable |               |
| Used measurement equipment: | Vbat:                          | Zimmer LMG 95 |
|                             | Ibat:                          | Zimmer LMG 95 |
|                             | Vpv:                           | Zimmer LMG 95 |
|                             | Ipv:                           | Zimmer LMG 95 |
|                             | Vload:                         | Zimmer LMG 95 |
|                             | Iload:                         | Zimmer LMG 95 |
|                             | Ta:                            | Tinsley 5885A |
|                             |                                |               |

passed       failed

### 5.7 Options

|                      |         |
|----------------------|---------|
| Ambient temperature: | 20,9 °C |
| Rated voltage:       | 12,0 V  |

|            |              |              |
|------------|--------------|--------------|
| DuT        | 1            | 2            |
| Reference  | 001-phc-1103 | 002-phc-1103 |
| Date:      | 26.11.2003   |              |
| Inspector: | np           |              |

| Test  | Behaviour / results<br>Ref.1        | p/f | Behaviour / results<br>Ref. 2 | p/f |
|---|-------------------------------------|-----|-------------------------------|-----|
| Protection against current flow into the PV | reverse current is<br>0,1 mA @ 14 V | p   |                               |     |
|   |                                     |     |                               |     |
|   |                                     |     |                               |     |
|   |                                     |     |                               |     |
|   |                                     |     |                               |     |
|   |                                     |     |                               |     |
|   |                                     |     |                               |     |
|   |                                     |     |                               |     |

|                             |                     |
|-----------------------------|---------------------|
| Remarks:                    |                     |
| Used measurement equipment: | Vbat: Zimmer LMG95  |
|                             | Ibat: Zimmer LMG95  |
|                             | Vpv: Zimmer LMG95   |
|                             | Ipv: Zimmer LMG95   |
|                             | Vload: Zimmer LMG95 |
|                             | Iload: Zimmer LMG95 |
|                             | Ta: Tinsley 5885A   |
|                             |                     |

passed

failed

### 5.8 Long run test (48h)

--> Tests were not ordered

|                               |    |
|-------------------------------|----|
| Ambient temperature:          | °C |
| Rated voltage:                | V  |
| Rated max. charge current:    | A  |
| Rated max. discharge current: | A  |

|            |    |    |
|------------|----|----|
|            | 1. | 2. |
| Reference  |    |    |
| Date:      |    |    |
| Inspector: |    |    |

| time | PV-module |     | Battery |     | load |     | Tcase | Ref. |
|------|-----------|-----|---------|-----|------|-----|-------|------|
|      | [h]       | [V] | [A]     | [V] | [A]  | [V] |       |      |
| 0    |           |     |         |     |      |     |       | 1.   |
|      |           |     |         |     |      |     |       | 2.   |
| 12   |           |     |         |     |      |     |       | 1.   |
|      |           |     |         |     |      |     |       | 2.   |
| 24   |           |     |         |     |      |     |       | 1.   |
|      |           |     |         |     |      |     |       | 2.   |
| 36   |           |     |         |     |      |     |       | 1.   |
|      |           |     |         |     |      |     |       | 2.   |
| 48   |           |     |         |     |      |     |       | 1.   |
|      |           |     |         |     |      |     |       | 2.   |
|      |           |     |         |     |      |     |       | 1.   |
|      |           |     |         |     |      |     |       | 2.   |

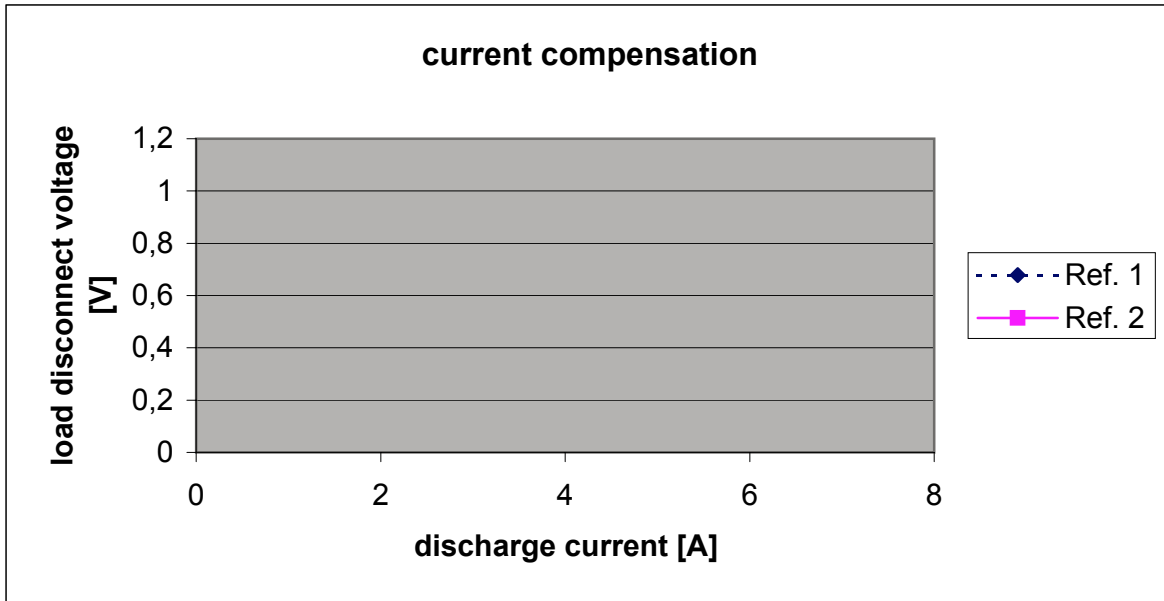
|                             |                     |
|-----------------------------|---------------------|
| Remarks:                    |                     |
| Used measurement equipment: | Vbat: Zimmer LMG95  |
|                             | Ibat: Zimmer LMG95  |
|                             | Vpv: Zimmer LMG95   |
|                             | Ipv: Zimmer LMG95   |
|                             | Vload: Zimmer LMG95 |
|                             | Iload: Zimmer LMG95 |
|                             | Ta: Tinsley 5885A   |
|                             | Tc: Tinsley 5885A   |

passed       failed

### 5.9 Current compensation

|                               |    |
|-------------------------------|----|
| Ambient temperature:          | °C |
| Rated voltage:                | V  |
| Rated max. discharge current: | A  |

|            |              |              |
|------------|--------------|--------------|
| DuT        | 1            | 2            |
| Reference  | 001-phc-1103 | 002-phc-1103 |
| Date:      |              |              |
| Inspector: | np           | np           |



|                             |   |               |
|-----------------------------|---|---------------|
| Remarks:                    | The CML 10 charge regulator has normally a current compensation built in. The DuT were special versions without a current compensation. These versions are intended for direct battery operation of the load. The current compensation tests were therefore not |               |
| Used measurement equipment: | Vbat:   | Zimmer LMG95  |
|                             | Ibat:   | Zimmer LMG95  |
|                             | Vpv:  | Zimmer LMG95  |
|                             | Ipv:  | Zimmer LMG95  |
|                             | Vload:  | Zimmer LMG95  |
|                             | Iload:  | Zimmer LMG95  |
|                             | Ta:   | Tinsley 5885A |

passed       failed

### 5.5. Temperatur compensation

--> Tests were not ordered

|                      |    |
|----------------------|----|
| Ambient temperature: | °C |
| Rated voltage:       | V  |

|            |    |    |
|------------|----|----|
|            | 1. | 2. |
| Reference  |    |    |
| Date:      |    |    |
| Inspector: |    |    |

| Voltage thresholds                   | ambient temperature [°C] |    |    |     |    | temp. Comp<br>mV/<br>K*cell | Ref. |
|--------------------------------------|--------------------------|----|----|-----|----|-----------------------------|------|
|                                      | 25                       | 55 | 25 | -10 | 25 |                             |      |
| End of charge voltage [V]            |                          |    |    |     |    |                             | 1.   |
|                                      |                          |    |    |     |    |                             | 2.   |
| Final gassing voltage (equal.) [V]   |                          |    |    |     |    |                             | 1.   |
|                                      |                          |    |    |     |    |                             | 2.   |
| Final gassing voltage (cycle) [V]    |                          |    |    |     |    |                             | 1.   |
|                                      |                          |    |    |     |    |                             | 2.   |
| Reconnect voltage PV [V]             |                          |    |    |     |    |                             | 1.   |
|                                      |                          |    |    |     |    |                             | 2.   |
| Deep discharging cut-off voltage [V] |                          |    |    |     |    |                             | 1.   |
|                                      |                          |    |    |     |    |                             | 2.   |
| Reconnect voltage load [V]           |                          |    |    |     |    |                             | 1.   |
|                                      |                          |    |    |     |    |                             | 2.   |

Operation at case!

|                             |        |               |
|-----------------------------|--------|---------------|
| Remarks:                    |        |               |
| Used measurement equipment: | Vbat:  | Zimmer LMG95  |
|                             | Ibat:  | Zimmer LMG95  |
|                             | Vpv:   | Zimmer LMG95  |
|                             | Ipv:   | Zimmer LMG95  |
|                             | Vload: | Zimmer LMG95  |
|                             | Iload: | Zimmer LMG95  |
|                             | Ta:    | Tinsley 5885A |

passed  failed

### 5.10 DC/DC-Converter

|                      |    |
|----------------------|----|
| Ambient temperature: | °C |
| Rated voltage:       | V  |
| Radio simulated with |    |

|            |    |    |
|------------|----|----|
|            | 1. | 2. |
| Reference  |    |    |
| Date:      |    |    |
| Inspector: |    |    |


| jumper position | battery voltage [V] | battery current [mA] | radio voltage [V] | radio current [mA] | remarks | Ref. |
|-----------------|---------------------|----------------------|-------------------|--------------------|---------|------|
|                 |                     |                      |                   |                    |         | 1.   |
|                 |                     |                      |                   |                    |         | 2.   |
|                 |                     |                      |                   |                    |         | 1.   |
|                 |                     |                      |                   |                    |         | 2.   |
|                 |                     |                      |                   |                    |         | 1.   |
|                 |                     |                      |                   |                    |         | 2.   |
|                 |                     |                      |                   |                    |         | 1.   |
|                 |                     |                      |                   |                    |         | 2.   |
|                 |                     |                      |                   |                    |         | 1.   |
|                 |                     |                      |                   |                    |         | 2.   |
|                 |                     |                      |                   |                    |         | 1.   |
|                 |                     |                      |                   |                    |         | 2.   |
|                 |                     |                      |                   |                    |         | 1.   |
|                 |                     |                      |                   |                    |         | 2.   |

|                             |         |                             |  |
|-----------------------------|---------|-----------------------------|--|
| Remarks:                    |         | no DC/DC-converter built in |  |
| Used measurement equipment: | Vbat:   |                             |  |
|                             | Ibat:   |                             |  |
|                             | Vradio: |                             |  |
|                             | Iradio: |                             |  |
|                             | Ta:     |                             |  |
|                             |         |                             |  |
|                             |         |                             |  |

passed       failed

## O.N.E statement

12:20 24 NOV '03 DER-RE 022754508 P.01


 المكتب الوطني للكهرباء  
 Office National de l'Electricité

**DIRECTION DE L'ELECTRIFICATION RURALE**

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DER/RD/831/2003

## Télécopie

**A :** Monsieur Norbert Pfanner  
ISE- Fraunhofer

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**Objet:** Certification du régulateur de charge

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**Référ. votre fax**    **Télé :** +4976145889217    **Tél :** +4976145885224    **Pages,** copie- **Date**  
 du 12/11/2003    d'incluse : 1    **24 NOV 2003**

---

Monsieur Norbert Pfanner,

En réponse à votre fax cité en référence, nous vous informons que nous acceptons les certificats de test délivrés par votre Institut dans la mesure qu'ils sont accompagnés par le rapport de test.

Nous vous prions d'agréer, Monsieur, l'expression de nos salutations distinguées.

DIRECTION DE L'ELECTRIFICATION RURALE  
 Le Chef de la Division Réseaux Décentralisés  
 et Energies Renouvelables  
  
 Slim Abdou, 4 ESSA-EGH

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 DIRECTION DE L'ELECTRIFICATION RURALE Tél : 022 75 45 01, Fax : 022 75 45 07



## ONE specifications

# ONE SD40727 specification for charge controllers

### Electrical specifications

- Nominal voltage : 12Vdc
- Charge current : min 10A
- Load current : min 15A
- Self consumption (including lights) <10mA
- Charge control mode : PWM
- End of charge and low voltage disconnect functions are compulsory
- End of charge voltage : 14,1V +/- 3%
- Overcharge voltage : 14,5 +/- 3%
- Floating voltage : 13,8V +/- 3%
- Low voltage disconnect : 11,4V +/- 3%
- Hysteresis : 1V to 1,5V
- Temperature range (operating) : -10 Celsius to +50 Celsius
- Efficiency of charge circuit : > 90%
- Efficiency of load circuit : > 90%
- Light indications for the following conditions:
  - battery being charged
  - battery charged
  - battery discharged

### Security

- Controller must be protected against reverse connection of battery and solar panels.
- Controller must be protected against short circuits in the load circuit (fuses must be readily available in the local marketplace and well calibrated).
- Controller must be protected against night discharge of the battery into the solar panels.
- Controller must be protected against transient overvoltage from lightning strikes.

### Mechanical specifications

- Enclosure material : acid, UV and shock proof.
- Labelling and pictograms (inside and outside): must be durable.
- Connections : screw type terminals, minimum section 4 mm<sup>2</sup>.
- Wall mounting.

## **Normative References**

At present, there are no mandatory national or international norms and test procedures for charge regulators available. Therefore FhG-ISE has decided to develop its own "test standard" and procedures.

This ISE "standard" for charge controllers is based on recommendations such as PV-GAP, World Bank or "Universal Technical Standard for Solar Home Systems".

The ISE "standard" is much more comprehensive and in detail stronger than these recommendations. The ISE "standard" therefore "contains" the most important recommendations.

**Overview of measurement equipment used (following DIN ISO 9001:2000)**

| <b>device</b>      | <b>type</b>                                  | <b>measured dimensions</b>   | <b>reference number following DIN EN ISO 9001:2000</b> |
|--------------------|--|--|--|
| Agilent HP 34401A  | System-Multimeter                            | voltages, currents up to 3 A   | 421-DC-10<br>421-DC- 11                                |
| Zimmer LMG 95      | Precision-wattmeter                          | voltages, currents up to 20 A, power   | 421-DC-16<br>421-DC-25<br>421-LI-5                     |
| Tinsley 5885A      | multi channel temperature measurement device | temperatures   | 421-DC-24  |
| Temperature sensor | Pt 100                                       | temperatures in conjunction with Tinsley 5885A   | 421-DC-24.1<br>421-DC-24.2                             |
| Tektronix TM502A   | external current probe amplifier             | currents in conjunction with A6302   | 421-DC-15.1<br>421-DC-15.2                             |
| Tektronix TDS 3014 | 4-channel-digital oszilloscope               | voltages (rms-, mean-, peak-values), currents (rms-, mean-, peak-values), power, frequency, fourier-analyses | 421-DC-22  |
| Tektronix P5205    | High voltage differential probe              | potential free measurement of high voltages with high frequencies  | 421-DC-23  |



**SGS-ICS Gesellschaft für Zertifizierungen m.b.H. und Umweltgutachter**

# Zertifikat

Zertifikats - Nr.: **D 01/1520/1899**

Die SGS-ICS Gesellschaft für Zertifizierungen m.b.H. und Umweltgutachter bescheinigt hiermit, dass das

***Fraunhofer-Institut für Solare Energiesysteme ISE  
Heidenhofstrasse 2  
D-79110 Freiburg i.Br.***

***Forschung, Entwicklung und Dienstleistungen auf den  
Gebieten thermische und elektrische Solarenergienutzung,  
Gebäudetechnik und Wasserstofftechnologie***

ein Qualitätsmanagementsystem nach der folgenden Norm

## DIN EN ISO 9001 : 2000

eingeführt hat und anwendet. Durch ein Qualitätsaudit der SGS-ICS wurde der Nachweis erbracht, dass dieses Qualitätsmanagementsystem die Forderungen der Norm erfüllt.

Das Zertifikat ist gültig bis: **29. März 2004**

Hamburg, **30. März 2001**



*Schulze-Bargmann*  
Geschäftsführung

*DiP*  
Zertifizierungsstelle



**SGS-ICS  
Gesellschaft für Zertifizierungen m.b.H.  
und Umweltgutachter  
Raboisen 28  
D-20095 Hamburg**



Dieses Zertifikat entbindet die Vertragspartei nicht davon, alle ihre Rechte auszuüben und allen ihren Verpflichtungen aus dem Vertrag nachzukommen. Dieses Zertifikat beweist nicht die Qualität der hergestellten Produkte.

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Member of the SGS Group (Société Générale de Surveillance)