



# Test Report: HEP-600C-12

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600W Single Output Battery Charger

## ■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Control Function Test

Component Stress Test

## ■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

## ■ RELIABILITY TEST

ENVIRONMENT TEST

## DESIGN VERIFY TEST

### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	BOOST CHARGE VOLTAGE	14.4V	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	14.39V	P
2	FLOAT CHARGE VOLTAGE	13.6V	I/P: 230 VAC O/P: MIN LOAD Ta: 25°C	13.589V	P
3	VOLTAGE ADJ RANGE	11.5~15.1V	I/P: 230VAC O/P: 0 % LOAD Ta: 25°C	10.942V~15.75V	P
4	CURRENT ADJ. RANGE	17.5~35A	I/P: 230VAC O/P: TESTING Ta: 25°C	12.037A~38.25A	P
5	OUTPUT CURRENT	35A	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	35.36A	P

### INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	90VAC~305 VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C  I/P : LOW-LINE-3V= 87 V (PLEASE CHECK DERATING CURVE) HIGH-LINE+10V=315 V O/P : FULL/MIN LOAD ON : 30 Sec . OFF : 30 Sec 10MIN ( POWER ON/OFF NO DAMAGE )	73 V~305V  TEST : OK	P
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P : 90 VAC ~ 305 VAC O/P : FULL~MIN LOAD Ta : 25°C	TEST : OK	P
3	POWER FACTOR	0.93 / 277 VAC(TYP) 0.95 / 230 VAC(TYP) 0.98 / 115 VAC(TYP)	I/P : 277 VAC I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF= 0.956 / 277 VAC PF= 0.978 / 230 VAC PF= 0.992 / 115 VAC	P
4	EFFICIENCY	93.5% / 230VAC (TYP) 93.5% / 277VAC (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	94.25 % / 230V  94.44 % / 277V	P
5	INPUT CURRENT	277V/ 2.9 A (TYP) 230V/ 3.3 A (TYP) 115V/ 7 A (TYP)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I = 2.04 A / 277 VAC I = 2.4 A / 230 VAC I = 4.77 A / 115 VAC	P
6	INRUSH CURRENT	230V/ 70 A (TYP)  (twidh=1010us measured at 50% Ipeak) COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I = 48.2 A / 230 VAC  T50= 944 us	P

7	LEAKAGE CURRENT	< 0.75 mA / 277 VAC	I/P : 277 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.36 mA N-FG : 0.36 mA	P
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### PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER VOLTAGE PROTECTION	CH1 : 16.5 V ~ 20.5 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	17.5 V / 230 VAC 17.5 V / 115 VAC Shut down o/p voltage, re-power on to recover	P
2	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P : 230 VAC O/P : FULL LOAD	O.T.P. Active Shut down o/p voltage, re-power on to recover	P
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P : 305 VAC O/P : FULL LOAD Ta : 25°C	NO DAMAGE Constant Current Limiting	P

### CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	CUREMOTE ON/OFFON/OFF CONTROL	Power on : "Hi" (Open circuit) or ">2 ~ 5V" Power off : "Low" (Short circuit) or "<0 ~ 0.5V"	I/P:230 VAC O/P:FULL LOAD Ta:25°C	POWER ON : > 2~5V OR OPEN POWER OFF : < 0~0.5V OR SHORT	P
2	5 V STANDBY	5V@0.5A ; tolerance ±5%, ripple : 100mVp-p(max.)	I/P:230VAC O/P : FULL LOAD Ta:25°C	4.92 V 56 mVp-p	P
3	NO LOAD POWER CONSUMPTION	<0.5W at remote off	I/P:240V O/P: NO LOAD Ta:25°C	0.292 W	P

### COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q 13 Rated : 20A/600V	I/P : High-Line +3V = 308V O/P : (1)Full Load Turn on (2) Output Short Ta : 25°C	(1) 488 V (2) 479 V	P
2	Diode Peak Voltage	Q 100 Rated 100A/ 60 V  Q 101 Rated 100A/ 60 V	I/P : High-Line +3V = 308 V O/P : (1)Full Load Turn on (2)Output Short Ta : 25°C	(1) 34.4 V (2) 22.4 V (1) 32.1 V (2) 8.8 V	P
3	Input Capacitor Voltage	C5 Rated: 150u/450V Surge Voltage:495V	I/P : High-Line +3V = 308 V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C	(1) 437 V (2) 440 V (3) 440 V	P

4	Control IC Voltage Test	U2 Rated 8.85~16V	I/P : High-Line +3V = 308 V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C	(1) 13.87 V (2) 13.8 V (3) 13.87 V	P
5	Power Transistor ( D to S) or (C to E) Peak Voltage	Q3 Rated 20.2A/ 600V	I/P : High-Line +3V = 308 V O/P : (1)Full Load Turn on (2) Output Short  Ta : 25°C	(1) 520 V (2) 488 V	P

## SAFETY & E.M.C. TEST

### SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P : 3.75 KVAC/min I/P-FG : 2 KVAC/min O/P-FG : 1.5 KVAC/min	I/P-O/P : 4 KVAC/min I/P-FG : 2.4 KVAC/min O/P-FG : 1.8 KVAC/min Ta : 25°C	I/P-O/P : 4.13 mA I/P-FG : 3.2 mA O/P-FG : 7.56 mA NO DAMAGE	P
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC>100MΩ I/P-FG : 500VDC>100MΩ O/P-FG : 500VDC>100MΩ	I/P-O/P : 500 VDC I/P-FG : 500 VDC O/P-FG : 500 VDC Ta : 25°C/70%RH	I/P-O/P : 23.2 GΩ I/P-FG : 22.6 GΩ O/P-FG : 22.9 GΩ NO DAMAGE	P
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta : 25°C / 70%RH	26 mΩ	P

### E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2 CLASS A	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	PASS	P
2	CONDUCTION	EN55022 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab	P
3	RADIATION	EN55022 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab	P
4	E.S.D	EN61000-4-2 INDUSTRY AIR : 8KV / Contact : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A	P
5	E.F.T	EN61000-4-4 INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A	P
6	SURGE	IEC61000-4-5 INDUSTRY L-N : 2KV L,N-PE : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A	P
7	Test by certified Lab & Test Report Prepare				

## RELIABILITY TEST

### ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT																																																																												
1	TEMPERATURE RISE TEST	MODEL : HEP-600C-24 1. ROOM AMBIENT BURN-IN : 17 HRS I/P : 230VAC O/P : FULL LOAD Ta= 30.7 °C 2. HIGH AMBIENT BURN-IN : 8HRS I/P : 230VAC O/P : FULL LOAD Ta= 59 °C	<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta=30.7 °C</th> <th>HIGH AMBIENT Ta= 59 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>71.3°C</td><td>96.5°C</td></tr> <tr><td>2</td><td>C10</td><td>67.2°C</td><td>93.2°C</td></tr> <tr><td>3</td><td>C2</td><td>63.5°C</td><td>89.2°C</td></tr> <tr><td>4</td><td>LF3</td><td>64.6°C</td><td>90.4°C</td></tr> <tr><td>5</td><td>Q1</td><td>67.0°C</td><td>92.8°C</td></tr> <tr><td>6</td><td>L3</td><td>69.9°C</td><td>97.2°C</td></tr> <tr><td>7</td><td>T1</td><td>78.6°C</td><td>106.2°C</td></tr> <tr><td>8</td><td>T2</td><td>73.2°C</td><td>99.9°C</td></tr> <tr><td>9</td><td>C5</td><td>65.3°C</td><td>91.6°C</td></tr> <tr><td>10</td><td>RTH2</td><td>67.4°C</td><td>94.7°C</td></tr> <tr><td>11</td><td>Q13</td><td>70.7°C</td><td>98.7°C</td></tr> <tr><td>12</td><td>C115</td><td>64.7°C</td><td>91.0°C</td></tr> <tr><td>13</td><td>C124</td><td>65.2°C</td><td>91.8°C</td></tr> <tr><td>14</td><td>U1</td><td>62.6°C</td><td>87.8°C</td></tr> <tr><td>15</td><td>C560</td><td>65.5°C</td><td>91.2°C</td></tr> <tr><td>16</td><td>C562</td><td>65.7°C</td><td>91.8°C</td></tr> <tr><td>17</td><td>C510</td><td>65.4°C</td><td>91.1°C</td></tr> <tr><td>18</td><td>C523</td><td>65.4°C</td><td>91.1°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=30.7 °C	HIGH AMBIENT Ta= 59 °C	1	BD1	71.3°C	96.5°C	2	C10	67.2°C	93.2°C	3	C2	63.5°C	89.2°C	4	LF3	64.6°C	90.4°C	5	Q1	67.0°C	92.8°C	6	L3	69.9°C	97.2°C	7	T1	78.6°C	106.2°C	8	T2	73.2°C	99.9°C	9	C5	65.3°C	91.6°C	10	RTH2	67.4°C	94.7°C	11	Q13	70.7°C	98.7°C	12	C115	64.7°C	91.0°C	13	C124	65.2°C	91.8°C	14	U1	62.6°C	87.8°C	15	C560	65.5°C	91.2°C	16	C562	65.7°C	91.8°C	17	C510	65.4°C	91.1°C	18	C523	65.4°C	91.1°C		
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2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/115VAC O/P : 100 % LOAD Ta= -45 °C	TEST : OK	P																																																																												
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 55 °C NO DAMAGE	I/P : 305 VAC O/P : FULL LOAD Ta= 55°C HUMIDITY= 95 %R.H	TEST : OK	P																																																																												
4	TEMPERATURE COEFFICIENT	± 0.03 %/°C (0~55°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.00125 %/°C (0~55°C)	P																																																																												
5	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -45°C~ +90°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 5 CYCLE 5. Input/Output condition : STATIC		OK	P																																																																												
6	THERMAL SHOCK TEST	1. Thermal shock Temperature : -45°C~ +60°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : 230VAC/Full Load AC ON/OFF TEST turn on 58sec ; turn off 2sec		OK	P																																																																												



7	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 20~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 10G (5) Test Time : 72min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK	P
8	CAPACITOR LIFE CYCLE	SUPPOSE C 115 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 55 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 55 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 55 °C LIFE TIME	(1) 297547HRS (2) 42699HRS (3) 80245HRS (4) 122577HRS	P
9	MTBF	MIL-HDBK-217F TOTAL FAILURE RATE : 73.1 KHRS		P
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 55,000 hours @ TA 55°C		P

SAMPLE	TESTER	REVIEW	APPROVAL
PRODUCT SAMPLE	DANIEL GAO	SANFORD SU	Vincent Zeng

12.10.30 A50-F031