Test Report: DBR -3200-24

3200W Rack Mountable Front End 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

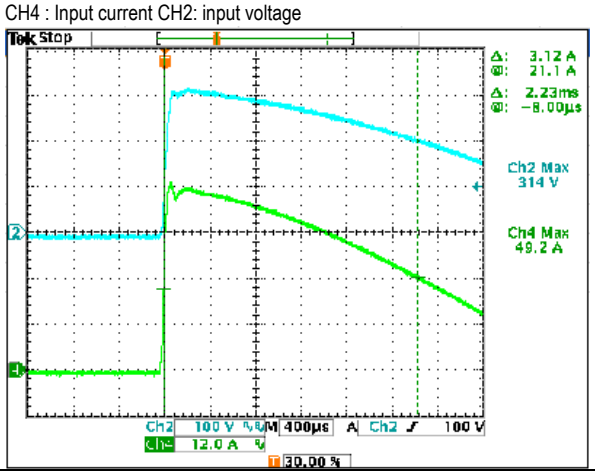
■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BOOST CHARGE VOLTAGE	Default, programmable 28.8V±0.24V	I/P: 230 VAC O/P: CV MODE Ta:25℃	28.788 V
2	FLOAT CHARGE VOLTAGE	Default, programmable 27.6V±0.24V	I/P: 230 VAC O/P: CV MODE Ta:25℃	27.58V
3	OUTPUT CURRENT	110A±3%	I/P: 230 VAC O/P:CV MODE-2V Ta:25℃	109A
4	VOLTAGE ADJ. RANGE	23.5V~30V	I/P: 230 VAC O/P:NO LOAD Ta:25℃	23V~31.23 V/230VAC 23.1V~ 31.23V/115VAC
5	LEAKAGE CURRENT FROM BATTERY (Typ.)	<1.5mA	I/P: AC OFF O/P:BATTERY 24V Ta:25℃	1.17mA

INPUT FUNCTION TEST

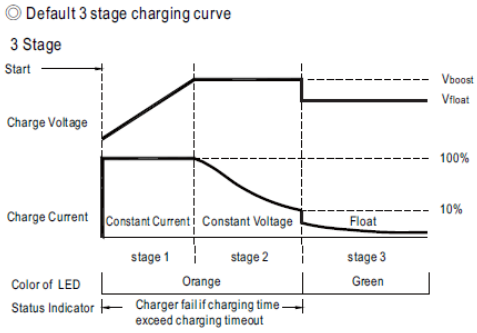
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~264VAC	I/P:TESTING O/P:FULL LOAD Ta:25℃	180V~264V/ FULL LOAD 76V~264V /HALF LOAD
			I/P: (1)LOW-LINE-3V=87 V HIGH-LINE+15%=300V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (2)230Vac ON: 0.5 Sec OFF: 0.5 Sec 20MIN (3)230Vac ON:3Sec OFF:3Sec 12HOURS (POWER ON/OFF NO DAMAGE)	TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:180 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 17A	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	I = 15.73A/ 230VAC
4	LEAKAGE CURRENT	<1.5 mA / 230 VAC	I/P： 230 VAC O/P：Min LOAD Ta：25℃	L-FG：0.63 mA N-FG：0.63 mA
5	POWER FACTOR (Typ.)	0.97 / 230VAC	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	PF= 0.997 /230VAC
6	EFFICIENCY(Typ.)	93.5%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	93.53%

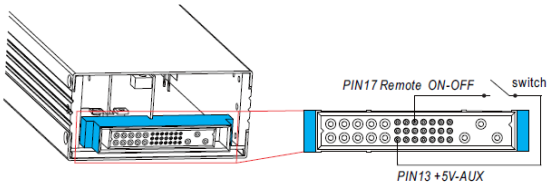
7	INRUSH CURRENT(Typ.)	230V/55 A COLD START	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	I =49.2A/ 230VAC T50=2230 us/230V
	INPUT=230VAC/50HZ @ FULL LOAD CH4 : Input current CH2: input voltage 			

PROTECTION FUNCTION TEST

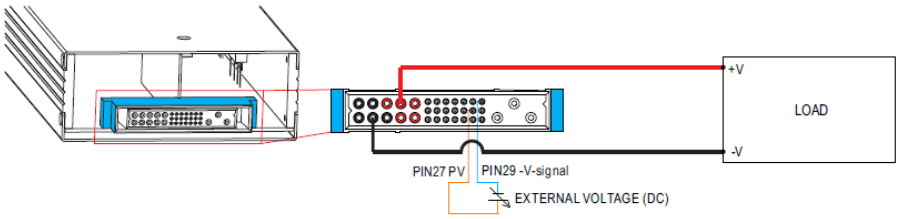
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER VOLTAGE PROTECTION	31.5 V~ 37.5 V PROTECTION TYPE： Shut down o/p voltage, re-power on to recover	I/P: 264VAC I/P: 230VAC I/P: 90VAC O/P:MIN LOAD Ta:25℃	33.35V/ 264VAC 33.33V/ 230VAC 33.35V/ 90VAC PROTECTION TYPE ： Shut down o/p voltage, re-power on to recover
2	OVER TEMPERATURE PROTECTION	NO DAMAGE PROTECTION TYPE： Shut down o/p voltage, recovers automatically after temperature goes down	I/P: 264VAC I/P: 90VAC O/P:FULL LOAD	O.T.P. Active PROTECTION TYPE： Shut down o/p voltage, recovers automatically after temperature goes down

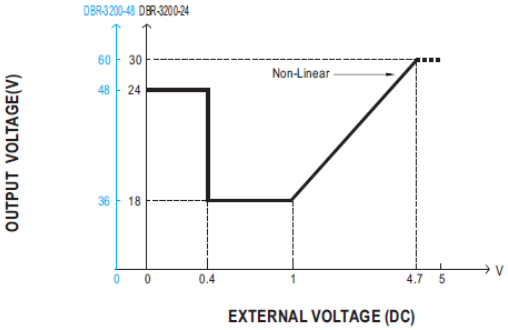
CONTROL FUNCTION TEST

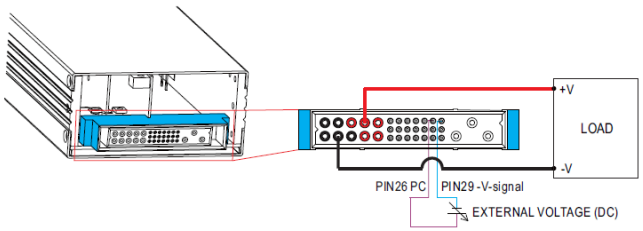
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PMBus Communication Interface	※DBR-3200 supports PMBus Rev. 1.1 with maximum 100KHz bus speed, allowing information reading, status monitoring, output trimming, etc. For details, please refer to the Installation Manual. Test Result：OK		
2	Charging Curve	※ By factory default, this charger performs the default curve which can be programmed via PMBus. ※ To disable / enable the charging curve, change to a 2 stage curve, a different curve frequently used for certain types of batteries in the industry, and so on, please refer to the Installation Manual. ◎ Default 3 stage charging curve  ◎ Suitable for lead-acid batteries (flooded, Gel and AGM) and Li-ion batteries (lithium iron and lithium manganese). I/P: 230 VAC		◎ Embedded 3 stage charging curve MODEL / Description / Vboost / Vfloat / CC(default) 24V: Default, programmable 28.8 27.6; Pre-defined, gel battery 28 27.2; Pre-defined, flooded battery 28.4 26.8; Pre-defined, AGM battery 29 27 — 110A 48V: Default, programmable 57.6 55.2; Pre-defined, gel battery 56 54.4; Pre-defined, flooded battery 56.8 53.6; Pre-defined, AGM battery 58 54 — 55A Note: When using this charger unit, please configured the system with recommended battery capacity by specification defined. Should battery capacity in use be much smaller so that user needs to set a low current for charging, under such condition it might cause higher current ripple.

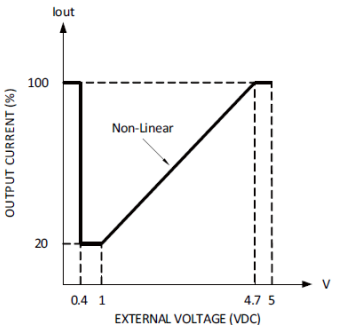
<table>
<tr><td></td><td></td><td>O/P:TESTING
Ta:25℃
TEST RESULT：OK</td></tr>
<tr><td>3</td><td>REMOTE ON/OFF CONTROL</td><td>The power supply can be turned ON/OFF individually or along with other units by using the "Remote ON-OFF" function.
 

<table>
<tr><th>Between Remote ON-OFF and +5V-AUX</th><th>Power Supply Status</th></tr>
<tr><td>Switch Short</td><td>ON</td></tr>
<tr><td>Switch Open</td><td>OFF</td></tr>
</table>
I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
Test Result：
<table>
<tr><th>Between ON/OFF and +5V-AUX</th><th>OUTPUT</th></tr>
<tr><td>SW SHORT</td><td>ON</td></tr>
<tr><td>SW OPEN</td><td>OFF</td></tr>
</table></td></tr>
<tr><td>4</td><td>ALARM SIGNAL</td><td>1. DC OK SIGNAL
High (4.5 ~ 5.5V) : When the Vout≦ 16V±1V.
Low (0 ~ 0.5V) : When Vout≧ 16V±1V.
The maximum sourcing current is 10mA and only for output.
I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
Test Result：
<table>
<tr><th>Vout</th><th>DC OK SIGNAL</th></tr>
<tr><td>Vout≦ 15V</td><td>5.019V</td></tr>
<tr><td>Vout≧ 17V</td><td>-0.045</td></tr>
</table>
2. T-ALARM
<table>
<tr><th>P.SU STATUS</th><th>Vo</th><th>T-ALARM</th></tr>
<tr><td>NORMAL</td><td>100%±2%</td><td>-0.1 ~0.5V</td></tr>
<tr><td>OTP OR FAN LOCK</td><td>0V</td><td>4.5~5.5V</td></tr>
</table>
I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
Test Result：
<table>
<tr><th>P.SU STATUS</th><th>T-ALARM</th></tr>
<tr><td>NORMAL</td><td>-0.044</td></tr>
<tr><td>OTP OR FAN LOCK</td><td>5.019V</td></tr>
</table>
3. AC- OK
<table>
<tr><th>AC IN</th><th>Vo</th><th>AC OK</th></tr>
<tr><td>AC I/P≧87Vrms</td><td>100%±2%</td><td>4.5~5.5V</td></tr>
<tr><td>AC I/P≦75Vrms</td><td>0V</td><td>-0.1~0.5V</td></tr>
</table>
I/P: TEST
O/P:50%LOAD
Test Result：
<table>
<tr><th>AC IN</th><th>Vo</th><th>AC OK</th></tr>
<tr><td>AC I/P≧87V</td><td>28.762V</td><td>5.019V</td></tr>
<tr><td>AC I/P≦75V</td><td>0</td><td>-0.0435V</td></tr>
</table></td></tr>
</table>

<table>
<tr>
<td>5</td>
<td>OUTPUT VOLTAGE PROGRAMMABLE(PV)</td>
<td>
※ In addition to the adjustment via the built-in potentiometer, the output voltage can be trimmed to 75~125% of the nominal voltage by applying EXTERNAL VOLTAGE.


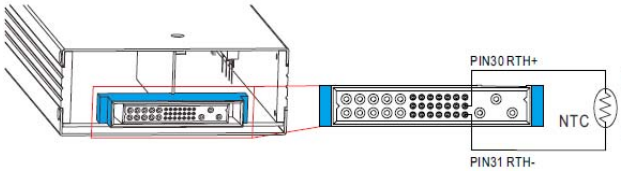


I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
TEST RESULT：
<table>
<tr><td>PV / MODEL</td><td><0.4V</td><td>1V</td><td>4.7V</td><td>5V</td></tr>
<tr><td>SPEC</td><td>24V±5%</td><td>18V±5%</td><td>30V±5%</td><td>30V±5%</td></tr>
<tr><td>Vout</td><td>24.1V</td><td>17.808V</td><td>30.86V</td><td>31.23V</td></tr>
</table>
</td>
</tr>
<tr>
<td>6</td>
<td>OUTPUT CURRENT PROGRAMMABLE (PC)</td>
<td>
※ The output current can be trimmed to 20~100% of the rated current by applying EXTERNAL VOLTAGE.




I/P: 230 VAC
O/P:TESTING
Ta:25℃
<table>
<tr><td>ADJ V</td><td><0.4V</td><td>1V</td><td>4.7V</td><td>5V</td></tr>
<tr><td>SPEC</td><td>100%±10%</td><td>20%±10%</td><td>100%±10%</td><td>100%±10%</td></tr>
<tr><td>Io</td><td>110A</td><td>21.3A</td><td>110A</td><td>110A</td></tr>
</table>
</td>
</tr>
</table>

7 Temperature Compensation



◎ To exploit the temperature compensation function, please attach the temperature sensor, NTC, to the battery or the battery's vicinity.
◎ The charger is able to work normally without the NTC.

I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃

Test Result：

TEMP	Voltage compensation	Temperature compensation	
		BEFORE	AFTER
(Ta=0℃)	28.8V = +0.90V ±0.24V	27.593	28.516
(Ta=25℃)	28.8V = 0V ±0.24V	27.593	27.593
(Ta=50℃)	28.8V = -0.90V ±0.24V	27.593	26.695

8 AUXILIARY POWER

a.12V：Auxiliary voltage output, 10.8~13.2V, referenced to GND-AUX (pin 12).
The maximum load current is 0.8A. This output has the built-in "Oring diodes" and is not controlled by the Remote ON/OFF control
b.5V：Auxiliary voltage output, 4.5~5.5V, referenced to GND-AUX (pin 12).
The maximum load current is 0.3A. This output has the built-in "Oring diodes" and is not controlled by the Remote ON/OFF control
I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
Test Result：

AUX	TOLERANCE	RIPPLE	TEST RESULT
12V / 0.8A	10.8~13.2 V	450mVp-p	12.2V/229mv
5V / 0.3A	4.5 ~ 5.5V	150mVp-p	4.9V/16mv

9 LED Status Indicators

※ **LED Status Indicators**

LED	Description
Green	Float (stage 3)
Orange	Charging (stage 1 or stage 2)
Red	The LED will present a constant red light when the abnormal status (OTP, OLP, fan fail and charging timeout) arises.
Red (Flashing)	The LED will flash with the red light when the internal temperature reaches 60℃; under this condition, the unit still operates normally without entering OTP. (In the meantime, an alarm signal will be sent out through the PMBus interface.)

Test Result：OK

10 CURRENT SHARING

< ±5%

I/P： 230 VAC
O/P：396A/160A
Ta：25℃

O/P：396A
PSU1：98.3A
PSU2：98.5 A
PSU3：98.4 A
PSU4：98.6 A

O/P：160A
PSU1：38.9 A
PSU2：40.4 A
PSU3：39.5 A
PSU4：39.2 A

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated 52A/600V Q3 Rated 52A/600V	I/P:High-Line +3V =267V AC ON/OFF VDS: O/P: (1)Full Load Ta:25℃	Q1: VDS: (1)477 V Q3 VDS: (1)493 V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q 900 Rated 52 A/600V Q 902 Rated 52 A/600V	I/P:High-Line +3V =267 V AC ON/OFF VDS: O/P: (1)Full Load Ta:25℃	Q900: VDS: (1)505V Q902: VDS: (1)493V
3	P.F.C DIODE	D8 Rated 16 A/600V	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load Ta:25℃	(1) 441V
4	Diode Peak Voltage	Q101 Rated 100 A/100 V Q104 Rated 100 A/100 V Q107 Rated 100 A/100 V Q110 Rated 100 A/100 V	I/P:High-Line +3V =267 V AC ON/OFF VDS: O/P: (1)Full Load Ta:25℃	Q101: VDS: (1)85.7V Q107: VDS: (1)77.7V Q104: VDS: (1)72.1V Q110: VDS: (1)80.2V
5	Input Capacitor Voltage	C5 Rated: 330μ/ 450V 105℃	I/P:High-Line +3V =267V O/P: (1)Full Load input on/off Ta:25℃	(1)432V
6	Control IC Voltage Test	PWM IC U201 Rated 6.5 V~30V PFC IC U900 Rated 4.5V~20 V	I/P:High-Line +3V =267 V AC ON/OFF O/P(1)FULL LOAD Ta:25℃	U201 (1) 14.9V U900 (1) 13.9V
7	TOP SWITCHING STAND BY POWER	U71 Rate 20 A/ 800V	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load (2)Remote On/Off Ta:25℃	(1) 645V (2) 645V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG :2KVAC/min O/P-FG:1.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:1.8 KVAC/min Ta:25℃	I/P-O/P: 11.68 mA I/P-FG: 13.6 mA O/P-FG: 18.28 mA NO DAMAGE
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℃	I/P-O/P: 13 GΩ I/P-FG: 2.86GΩ O/P-FG: 5 GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	25mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:100% LOAD Ta:25℃	Test by certified Lab
2	CONDUCTION	EN55032 (CISPR32) / EN55011 (CISPR11) CLASS B	I/P： 230 VAC (50HZ) O/P：FULL/50% LOAD Ta：25℃	Test by certified Lab
3	RADIATION	EN55032 (CISPR32) / EN55011 (CISPR11) CLASS A	I/P： 230 VAC (50HZ) O/P：FULL LOAD Ta：25℃	Test by certified Lab
4	E.S.D	EN61000-4-2 INDUSTRY AIR：8KV / Contact：4KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT： 2KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
6	SURGE	IEC61000-6-2 INDUSTRY L-N ： 2KV L,N-PE：4KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
7	Test by certified Lab & Test Report Prepare			

■ RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL： DBR-3200-24 1. ROOM AMBIENT BURN-IN：1 HRS I/P： 230VAC O/P： FULL LOAD 2. HIGH AMBIENT BURN-IN： 1 HRS I/P： 230VAC O/P： FULL LOAD		

NO	Position	ROOM AMBIENT Ta= 25℃	HIGH AMBIENT Ta= 50℃
1	BD1	63.0℃	86.4℃
2	RY1	44.2℃	67.6℃
3	D7	68.4℃	92.1℃
4	D8	62.7℃	86.8℃
5	T3	36.0℃	59.6℃
6	U900	41.9℃	64.6℃
7	Q900	64.2℃	87.7℃
8	Q902	53.9℃	77.9℃
9	C5	31.9℃	53.9℃
10	U902	51.3℃	74.5℃
11	Q1	63.0℃	87.0℃
12	Q3	54.3℃	77.4℃
13	T1-2	68.2℃	90.7℃
14	T1-1	58.4℃	80.8℃
15	T2-2	65.0℃	87.3℃
16	T2-1	58.7℃	80.8℃
17	T301	30.6℃	53.3℃
18	U71	38.6℃	61.4℃
19	U201	45.1℃	67.9℃
20	C111	59.2℃	81.0℃
21	C121	52.4℃	74.9℃
22	C115	55.4℃	78.2℃
23	C116	53.6℃	76.2℃
24	Q401	73.9℃	99.6℃
25	Q411	85.1℃	107.7℃
26	Q101	66.3℃	89.9℃
27	Q108	66.7℃	89.9℃
28	U425	60.0℃	83.0℃
29	RT90	40.0℃	63.4℃
30	U903	31.3℃	54.8℃
31	U501	50.8℃	74.0℃
32	RG76	91.6℃	114.4℃
33	L1	38.4℃	61.1℃
34	L3	56.8℃	78.9℃
35	R900	42.5℃	66.1℃
36	ZR2	39.7℃	63.4℃
37	LF1	51.4℃	75.4℃
38	C2	41.5℃	65.2℃
39	C10	47.0℃	70.6℃
40	ZR1	46.4℃	69.9℃
41	RT1	37.0℃	60.6℃

2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P： 230VAC /180VAC O/P： 100 % LOAD Ta= -30℃/-25℃	TEST：OK
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 ℃ NO DAMAGE	I/P： 272 VAC O/P：FULL LOAD Ta= 50℃ HUMIDITY= 95 %R.H	TEST：OK
4	TEMPERATURE COEFFICIENT	± 0.03 %/℃(0~50℃)	I/P： 230 VAC O/P：FULL LOAD	± 0.0016 %/℃(0~50℃)

5	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature： -45℃~ +90℃ 2. Temperature change rate ：25℃ / MIN 3. Dwell time low and high temperature ： 30 MIN/EACH 4. Total test cycle：10 CYCLE 5. Input/Output condition： STATIC	OK
6	THERMAL SHOCK TEST	1. Thermal shock Temperature： -35℃~ +55℃ 2. Temperature change rate ：25℃ / MIN 3. Dwell time low and high temperature ： 30 MIN/EACH 4. Total test cycle：16 CYCLE 5. Input/Output condition： 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:230V/ FULL LOAD Burn In Test	OK
7	VIBRATION TEST	1 Carton & 1 Set (1) Waveform： Sine Wave (2) Frequency：10~500Hz (3) Sweep Time：12min/sweep cycle (4) Acceleration：2G (5) Test Time：60min in each axis (X.Y.Z) (6) Ta：25℃	TEST：OK
8	CAPACITOR LIFE CYCLE	SUPPOSE C111 IS THE MOST CRITICAL COMPONENT (1) I/P： 230VAC O/P：FULL LOAD Ta= 25 ℃ LIFE TIME (2) I/P： 230VAC O/P：FULL LOAD Ta= 50 ℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta= 50 ℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta= 50 ℃ LIFE TIME	(1) 84676.8HRS (2) 18691HRS (3) 88819HRS (4) 237199HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 160.1K hrs min. Telcordia SR-332 (Bellcore) ; 38.9K hrs min. MIL-HDBK-217F (25℃)	
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 50,000 hours @ TA 50℃	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	DANIEL GAO	SANFORD SU	VINCENT TSENG

2018.4.30 GP-A50-F010