



Test Report: LOP-600-54

600W 5"×3" Low Profile Open Frame Power Supply

■ 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	OUTPUT VOLTAGE ADJUST RANGE	CH1: 52V~58V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	49.75V~59.35V/230VAC 49.75V~59.35V/115VAC
2	OUTPUT VOLTAGE TOLERANCE	V1: -1% ~ +1%	I/P: 80VAC~ 264VAC O/P:FULL~ MIN. LOAD Ta:25°C	V1: -0.04% ~0.04%
3	LINE REGULATION	V1: -0.5% ~ +0.5%	I/P: 80VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: 0% ~0%
4	LOAD REGULATION	V1: -1% ~ +1%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.04% ~0.04%
5	OVER/UNDERSHOOT TEST	<±5%	I/P: 230VAC O/P:FULL LOAD / NO LOAD Ta:25°C	0.74%
6	RIPPLE & NOISE (Max)	V1: 250mVp-p	I/P:230VAC O/P: FULL LOAD Ta:25°C	V1: 89mVp-p / high frequency 130mVp-p / low frequency
high frequency :				
low frequency :				
7	SET UP TIME(Max)	230VAC/1000ms 115VAC/1500ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 706ms 115VAC/ 558ms
INPUT=230VAC/50HZ @ FULL LOAD CH1: Output Voltage CH2: AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1: Output Voltage CH2: AC Input Voltage		

8	RISE TIME (Max)	230VAC/30ms 115VAC/30ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C
	<p>INPUT=230VAC/50HZ @ FULL LOAD CH1: Output Voltage</p>		<p>INPUT=115VAC/60HZ @ FULL LOAD CH1: Output Voltage</p>
9	HOLD UP TIME (Typ.)	8ms /600W load 12ms /400W load	I/P : 230 VAC O/P : TESTING Ta : 25°C
	<p>INPUT=230VAC/50HZ @ 600W load CH1: Output Voltage CH2: AC Input Voltage</p>		<p>INPUT=230VAC/50HZ @ 400W load CH1: Output Voltage CH2: AC Input Voltage</p>
10	DYNAMIC LOAD	V1: 5400mVp-p	I/P: 230VAC O/P: (1) FULL/0% LOAD 50%DUTY / 120HZ (2) FULL/0% LOAD 50%DUTY / 1KHZ Ta:25°C
	FULL /0% LOAD 50%DUTY / 120HZ		FULL /0% LOAD 50%DUTY / 1KHZ

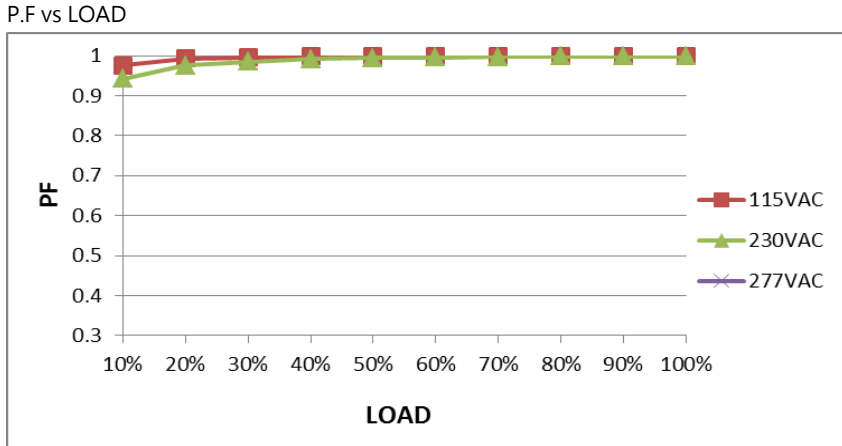
<p>11 TRANSIENT RECOVERY TIME</p>	<p>V1: 540mVp-p < 500us</p>	<p>I/P: 230VAC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us</p>	<p>362mVp-p 0us</p>
<p>12 PEAK LOAD</p>	<p>150% PEAK LOAD@3S</p>	<p>I/P: 264VAC I/P: 115VAC O/P: PEAK LOAD</p>	<p>TEST : OK</p>

INPUT FUNCTION TEST

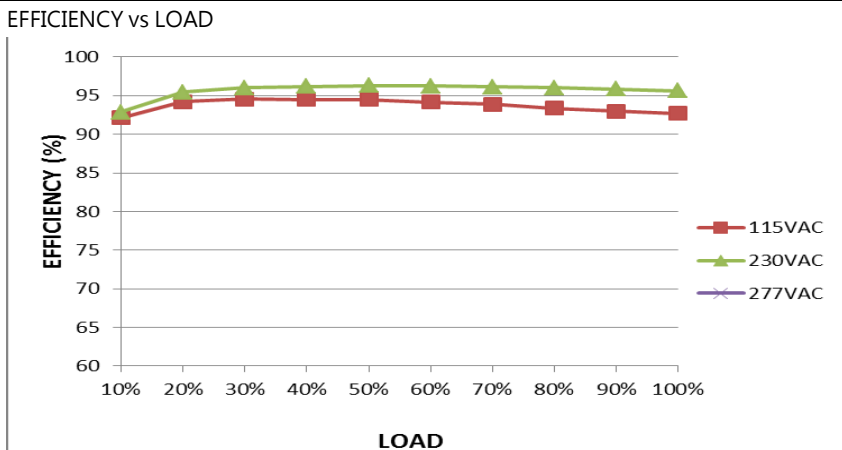
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC~264VAC 113VDC~ 370VDC 	(1) I/P: TESTING O/P: FULL / 70% LOAD (2) I/P: DC TESTING (L: + N: -) O/P: FULL / 70% LOAD (3) I/P: DC TESTING (L: - N: +) O/P: FULL / 70% LOAD Ta:25°C I/P: HIGH-LINE+15%=300V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	(1) 70V~264V/ FULL LOAD 70V~264V/ 70% LOAD (2) 96.8Vdc~370Vdc/FULL LOAD 96.8Vdc~370Vdc/70% LOAD (3) 96.8Vdc~370Vdc/FULL LOAD 96.8Vdc~370Vdc/70% LOAD TEST : OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:80 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST : OK
3	INPUT CURRENT (Typ.)	230V/ 3.2A 115V/ 6.4A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =2.7932A/ 230VAC I =5.8324A/ 115VAC
4	LEAKAGE CURRENT	Earth leakage current <500uA(rms) @ 264VAC touch current <70uA(rms) @ 264VAC	I/P : 264 VAC/60HZ O/P : Min LOAD Ta : 25°C	256.3 uA / 264 VAC@ For Earth 33.7uA / 264 VAC@For Touch
5	NO LOAD CONSUMPTION	<0.5W	I/P : 240VAC O/P : NO LOAD Ta : 25°C	0.38W



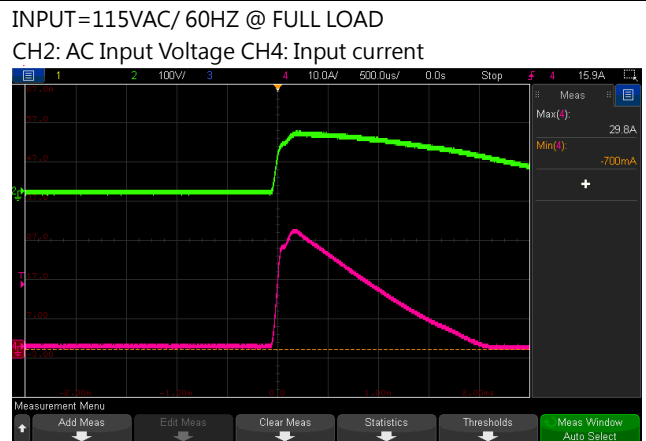
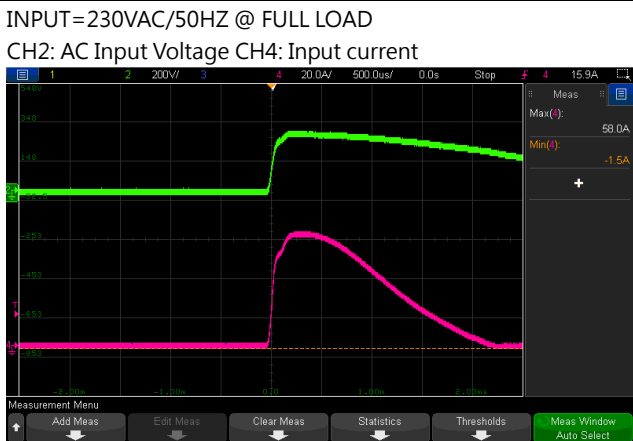
6	POWER FACTOR (Typ.)	0.94/ 230VAC 0.98/115VAC	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF=0.9977/230VAC PF=0.9986/115VAC
---	---------------------	-----------------------------	--	--------------------------------------



7	EFFICIENCY(Typ.)	95%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	95.18%
---	------------------	-----	---	--------



8	INRUSH CURRENT(Typ.)	230V/80A 115V/40A COLD START	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =58.0A/ 230VAC I =29.8A/ 115VAC T50= 1214us/230V
---	----------------------	------------------------------------	--	--



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~ 150%PROTECTION TYPE : Hiccup after 3 sec, recovers automatically after fault condition is removed	I/P: 264VAC I/P: 230VAC I/P: 115VAC O/P:TESTING Ta:25°C	140.17%/ 264VAC 140.17%/ 230VAC 140.17%/ 115VAC PROTECTION TYPE : Hiccup after 3 sec, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	59.4V~67.5V Protection type: Shut down o/p voltage, re-power on to recover	I/P: 264VAC I/P: 80VAC O/P:MIN LOAD Ta:25°C	62.1V/ 264VAC 62.1V/ 80VAC Protection type: Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	Protection type: Shut down o/p voltage, recovers automatically after temperature goes down (Vin=115Vac); Shut down o/p voltage, re-power on to recover (Vin=230Vac or FAN LOCK)	I/P: 264VAC I/P: 80VAC O/P:FULL LOAD	O.T.P Active OK Protection type : Shut down o/p voltage, recovers automatically after temperature goes down (Vin=115Vac); Shut down o/p voltage, re-power on to recover (Vin=230Vac or FAN LOCK)
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE Protection type: Hiccup mode, recovers automatically after fault condition is removed	I/P: 264VAC I/P: 80VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE OK PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	EXTERNAL FAN SUPPLY	12V@0.5A for driving a fan ; tolerance -15% ~ +15% at main output 20% rated current (23CFM)	I/P: 230 VAC O/P: TESTING Ta:25°C	TEST : <u>-0.46% ~0.24%</u>
2	REMOTE SENSE	S+ / S- The remote sensing compensates voltage drop on the load wiring up to 0.5V	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	TEST : <u>OK</u>

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q2/ Q3 Rated: 26A/600V	AC ON/OFF I/P: High-Line +3V =267V VDS: O/P: (1)Full Load (2)Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4) Dynamic Load Full Load/	Q2: Q3: VDS: VDS: (1) 433V (1) 413V (2) 433V (2) 425V (3) 429V (3) 417V (4) 425V (4) 413V (5) 421V (5) 413V (6) 433V (6) 417V



			<p>Min. Load 90%Duty/3KHz (5) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load (8) Peak Load Ta:25°C</p>	<p>(7) 433V (8) 429V</p>	<p>(7) 417V (8) 417V</p>
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated: 52A/600V	<p>AC ON/OFF I/P: High-Line +3V =267V VDS: O/P: (1)Full Load (2)Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4) Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load (8) Peak Load Ta:25°C</p>	<p>VDS: (1) 437V (2) 425V (3) 429V (4) 437V (5) 437V (6) 429V (7) 457V (8) 453V</p>	
3	P.F.C DIODE	D2 Rated: 6A/ 650V	<p>I/P: High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (4) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (5) Peak Load Ta:25°C</p>	<p>(1) 399V (2) 399V (3) 395V (4) 395V (5) 416V</p>	
4	Diode Peak Voltage	Q101/Q103 Rated: 19A/ 200V	<p>AC ON/OFF I/P: High-Line +3V =267 V <u>Vo=Vmax</u> O/P: (1)Full Load (2)Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4) Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. (8).NO LOAD</p>	<p>Q101: <u>Vo=Vmax</u> VDS: (1) 142V (2) 140V (3) 142V (4) 142V (5) 143V (6) 148V (7) 146V (8) 146V (9) 136V (10) 145V <u>Vo=Vnormal</u> (1) 140V</p>	<p>Q103: <u>Vo=Vmax</u> VDS: (1) 151V (2) 151V (3) 157V (4) 150V (5) 150V (6) 157V (7) 159V (8) 140V (9) 162V (10) 158V <u>Vo=Vnormal</u> (1) 143V</p>

			(9) burst Mode (10) Peak Load $V_o = V_{normal}$ O/P: (1) Full Load Ta:25°C	
5	Input Capacitor Voltage	C5 Rated: 330μ / 400V	I/P: High-Line +3V =267V O/P: (1)Full Load input on/off (2) Min load input on /Off (3) Full Load /Min load Change (4) Full load continue Ta:25°C	(1) 393V (2) 389V (3) 393V (4) 393V
6	Control IC Voltage Test	PFC /PWM IC U1: Rated : 10.4V~28.7 V O/P IC U101 Rated : 4.75V~38V	AC ON/OFF I/P: High-Line +3V =267 V O/P: (1) FULL LOAD (2) Output Short (3) O.L.P (4) O.V.P. (5) NO LOAD VRmin (LOW LINE) Ta:25°C	U1 U101 (1) 18.8V (1) 11.29V (2) 18.8V (2) 11.29V (3) 18.8V (3) 11.29V (4) 18.8V (4) 11.37V (5) 12.6V (5) 9.69V

■ SAFETY& E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 4KVAC/min I/P-FG :2KVAC/min O/P-FG:1.5KVAC/min	I/P-O/P: 4.4 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:1.8 KVAC/min Ta:25°C	I/P-O/P: 1.673mA I/P-FG: 2.36mA O/P-FG:0.805mA 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: 600 VDC I/P-FG: 600 VDC O/P-FG: 600 VDC Ta:25°C	I/P-O/P:50GΩ I/P-FG:50GΩ O/P-FG:50GΩ NO DAMAGE

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	BS EN/EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25°C	PASS
2	CONDUCTION	BS EN/EN55032(CISPR32) Class I: Class B , Class II: Class A BS EN/EN55014(CISPR32) Class I: Class B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab

3	RADIATION	BS EN/EN55032(CISPR32) Class I: Class B, Class II: Class A BS EN/EN55014(CISPR32) Class I: Class B	I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	BS EN/EN61000-4-2 ■ MEDICAL AIR : 15KV / Contact : 8KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	■ CRITERIA A
5	E.F.T	BS EN/EN61000-4-4 ■ INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	■ CRITERIA A
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
7	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report			

■ RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION		RESULT	
1	TEMPERATURE RISE TEST	MODEL : LOP-600-54 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD				
			ROOM AMBIENT Ta= 25 °C NO FAN	HIGH AMBIENT Ta= 40 °C NO FAN	ROOM AMBIENT Ta= 25 °C WITH FAN	HIGH AMBIENT Ta= 50 °C WITH FAN
1	ZNR1	56.2°C	70.7°C	29.7°C	55.7°C	
2	LF1	57.1°C	71.1°C	29.7°C	54.9°C	
3	C2	64.9°C	79.7°C	28.7°C	54.5°C	
4	RTH1	70.7°C	85°C	31.8°C	57.7°C	
5	LF2	68.3°C	82.8°C	33.4°C	59.3°C	
6	BD1	77.4°C	92.2°C	46°C	71.9°C	
7	L1	74.4°C	89.3°C	48°C	73.3°C	
8	C8	61.7°C	76.9°C	38.7°C	64.5°C	
9	Q1	77.8°C	93.4°C	48°C	73.8°C	
10	D2	75°C	90.7°C	47.7°C	73.5°C	
11	RY1	74.2°C	87.5°C	35.7°C	60.4°C	
12	RTH3	74.1°C	89.4°C	44.1°C	70.4°C	

NO	Position	ROOM AMBIENT	HIGH AMBIENT	ROOM AMBIENT	HIGH AMBIENT
		Ta= 25 °C NO FAN	Ta= 40 °C NO FAN	Ta= 25 °C WITH FAN	Ta= 50 °C WITH FAN
13	Q3	73.7°C	88.9°C	47.1°C	73.4°C
14	Q4	74.7°C	90.1°C	46.4°C	72.6°C
15	C5	67.5°C	78.1°C	41.1°C	66°C
16	T1 Coil	93.1°C	107.6°C	66.9°C	93.2°C
17	T1 Core	86.1°C	101.4°C	38.4°C	64.4°C
18	TSW1	64.9°C	80.6°C	34.8°C	61.6°C
19	Q102	72.5°C	87.3°C	43.2°C	70.5°C
20	Q103	75.2°C	90.3°C	44.4°C	72°C
21	C103	63.2°C	77.3°C	31.5°C	58.1°C
22	C104	60.1°C	75.2°C	35.4°C	61.7°C
23	C102	60.8°C	75.2°C	34.1°C	60.5°C
24	C120	64.7°C	79.5°C	36.3°C	62.4°C
25	L100	53.2°C	67.9°C	33.7°C	60°C
26	C125	58°C	73.7°C	36.6°C	63°C
27	D103	66.9°C	82.3°C	37.2°C	63.9°C
28	C37	78.2°C	93.2°C	39.9°C	65.9°C
29	U1	63.4°C	78.5°C	39.7°C	65.2°C
30	Q8	75.6°C	90.4°C	26°C	51.3°C
31	U103	48.2°C	63.2°C	32.6°C	57.9°C
32	RG100	53.5°C	68°C	38.6°C	64.7°C
33	U4	53.1°C	67.9°C	32.6°C	58.6°C
34	R122	58°C	72.7°C	36.6°C	62.2°C
35	D105	58.3°C	73°C	34°C	59.2°C
36	R3	67.8°C	82.8°C	38.6°C	64.3°C
37	D1	62.3°C	77.2°C	32.6°C	57.6°C
38	Q108	69.7°C	84.3°C	31.4°C	57.4°C
39	U101	79°C	93.8°C	31.2°C	56.7°C
40	R101	85.5°C	100.1°C	36.9°C	64.6°C
41	R105	69°C	82.7°C	36.1°C	62.9°C
42	D20	76.8°C	91°C	28.5°C	55°C
43	Q7	71.4°C	85.8°C	28.3°C	53.8°C
44	C60	59°C	74.5°C	26.2°C	51.5°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 129.4%LOAD Ta : 25°C	TEST : OK	
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/115VAC O/P : 100%LOAD Ta= -45°C	TEST : OK	
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C/95 %R.H NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK	



5	TEMPERATURE COEFFICIENT	± 0.03%/°C(0~50°C)	I/P : 230 VAC O/P : FULL LOAD	±0.006%/°C(0~50°C)
6	STORAGE TEMPERATURE TEST	-40~85°C	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 : 10 CYCLE 5. Input/output condition : STATIC	
7	THERMAL SHOCK TEST	-40~50°C	1. Thermal shock Temperature : -45°C~ +55°C 2. Temperature change rate : 25°C / 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	
8	VIBRATION TEST	10 ~ 500Hz, 2G 10min./1cycle, 60min. each along X, Y, Z axes	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 3G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C	
9	CAPACITOR LIFE CYCLE	SUPPOSE C103 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= 40 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 40 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 40 °C LIFE TIME		(1) 225776.9 HRS (NO FAN) (2) 84962.5 HRS (NO FAN) (3) 187900.2 HRS (NO FAN) (4) 300719.7 HRS (NO FAN)
		SUPPOSE C104 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= 50 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 50 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 50 °C LIFE TIME		(5) 1550753.7 HRS (WITH FAN) (6) 250515.1 HRS (WITH FAN) (7) 360491.8 HRS (WITH FAN) (8) 452657.3 HRS (WITH FAN)
10	MTBF	Conducted by Parts Stress Analysis Prediction 1963.2K hrs min. Telcordia SR-332 (Bellcore) ;310.9K hrs min. MIL-HDBK-217F (25°C)		
11	Ongoing Reliability Test	I/P : 230VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 30,000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Yuwei	Liutt	Wangdz

2020.10.1 TAG-QA-009