TEST REPORT: RPS-400-15

400W Reliable Green Medical 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

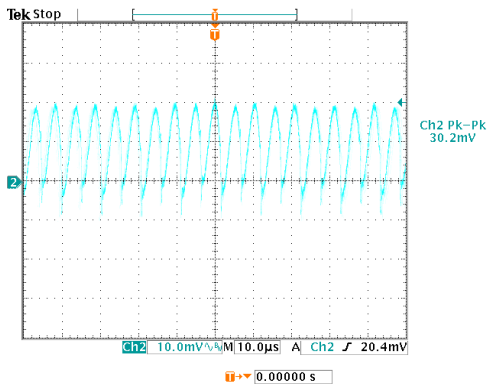
- ENVIRONMENT TEST

■ DESIGN VERIFY TEST

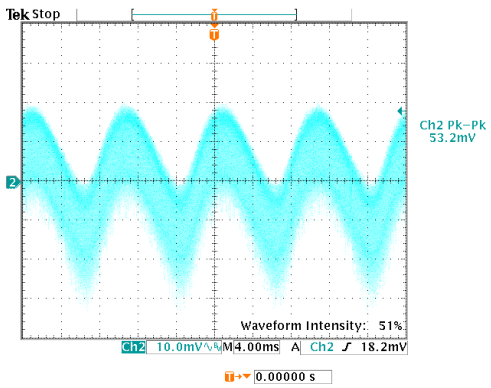
OUTPUT FUNCTION

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 14.30V ~ 15.80V	I/P : 230VAC O/P: MIN LOAD TA : 25℃	CH1: 13.81V ~ 16.41V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 3.0% ~ -3.0%	I/P : 115VAC / 264VAC O/P: FULL / MINLOAD TA= 25℃	V1: 0.73% ~ 0.33%
3	LINE REGULATION (MAX.)	V1 : 0.5% ~ -0.5%	I/P : 115VAC / 264VAC O/P: FULL LOAD TA : 25℃	V1: 0.00% ~ -0.07%
4	LOAD REGULATION (MAX.)	V1 : 1.0% ~ -1.0%	I/P : 230VAC O/P: MIN LOAD ~ FULL LOAD TA : 25℃	V1: 0.20% ~ -0.13%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230VAC O/P: FULL LOAD TA : 25℃	TEST< 2.0 %
6	RIPPLE & NOISE(Max)	V1 : 120 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25℃	V1 : 53.2 mVp-p

high frequency:



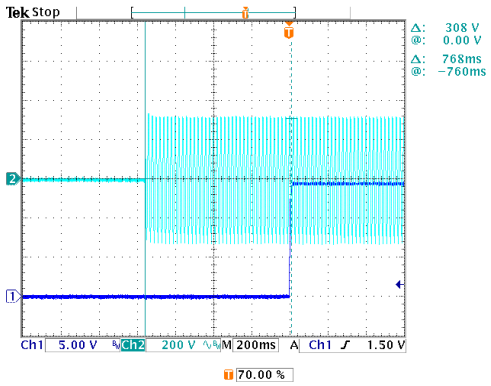
low frequency:



NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
7	SET UP TIME (MAX.)	230VAC : 1000ms 115VAC : 1500ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 768ms 115VAC : 300ms

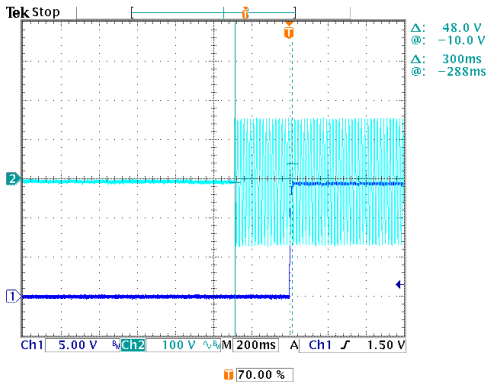
INPUT=230VAC/50HZ @ FULL LOAD

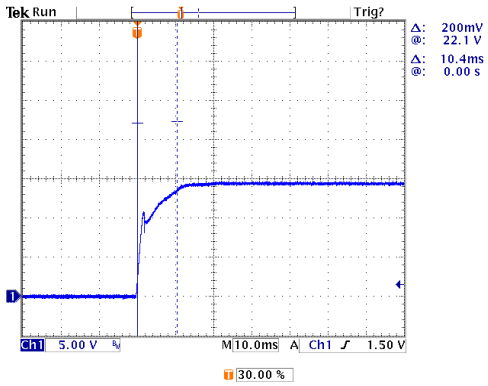
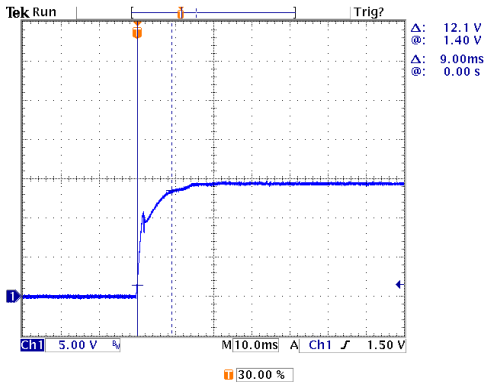
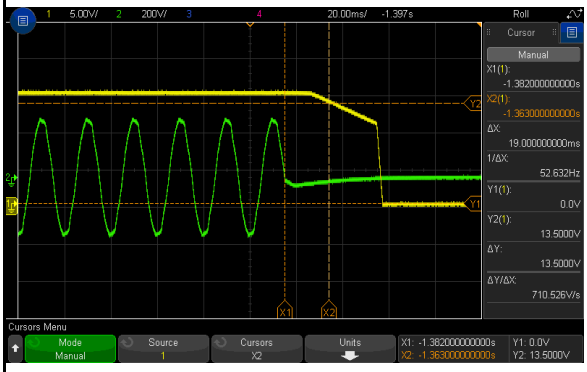
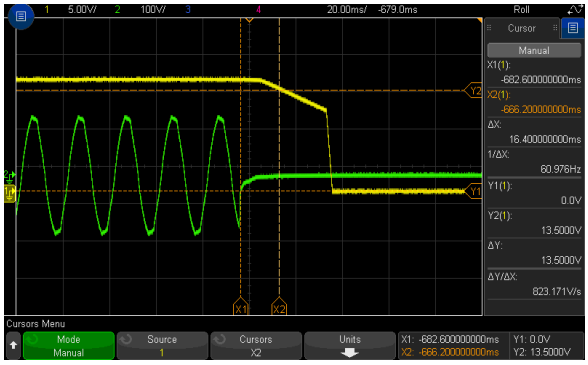
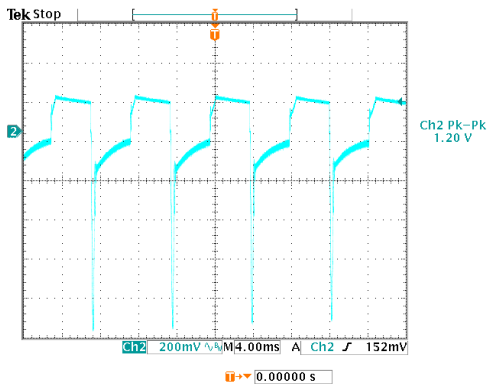
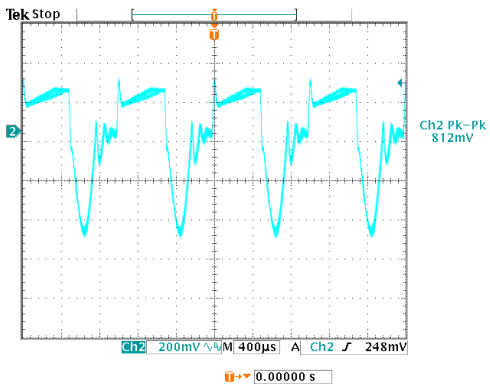
CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=115VAC/60HZ @ FULL LOAD

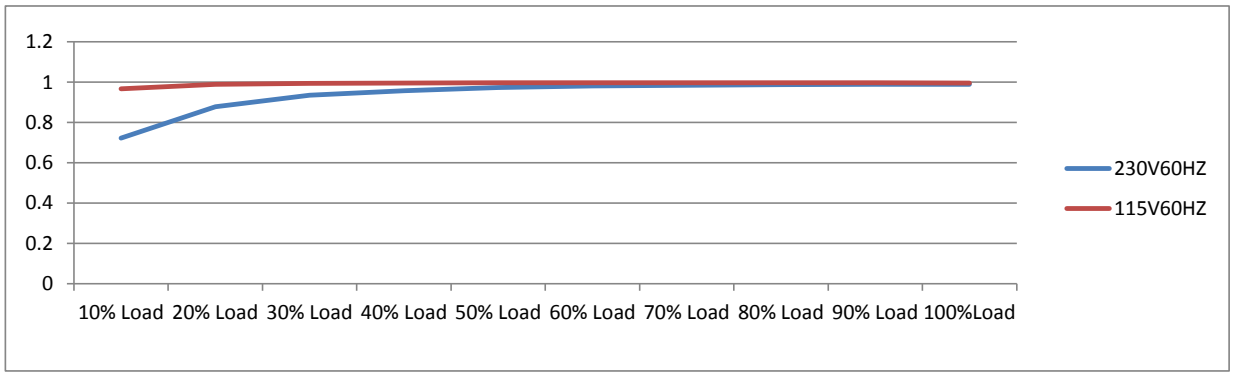
CH1 : Output Voltage CH2 : AC Input Voltage



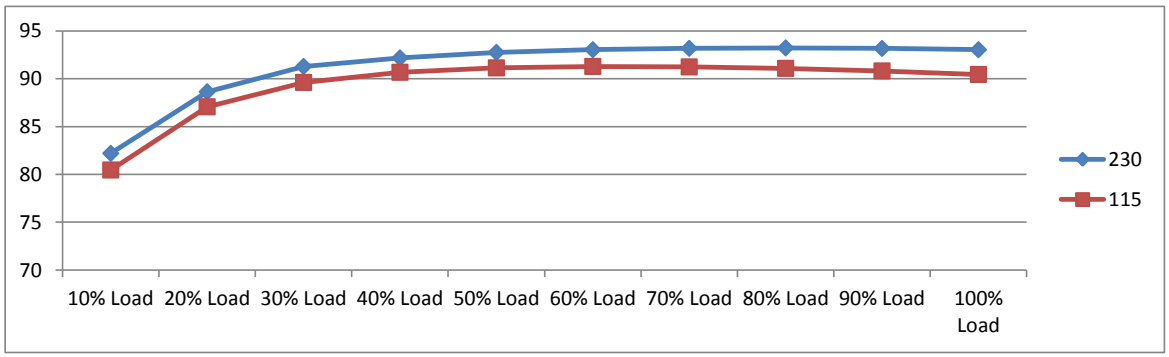
8	RISE TIME (MAX.)	230VAC : 30ms 115VAC : 30ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 10.4ms 115VAC : 9.0ms	
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage		
					
9	HOLD UP TIME (TYP.)	230VAC : 16ms 115VAC : 16ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 19.0ms 115VAC : 16.4ms	
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		
					
10	DYNAMIC LOAD	V1 : 1500 mVp-p	I/P : 230VAC O/P: (1)Full/Min load 50%duty/120HZ (2)Full/Min load 50%duty/1KHZ TA : 25℃	(1). (2). unit:mVp-p V1: 1200mv 812mv	
	FULL /MIN LOAD 50%DUTY / 120HZ		FULL /MIN% LOAD 50%DUTY / 1KHZ		
					

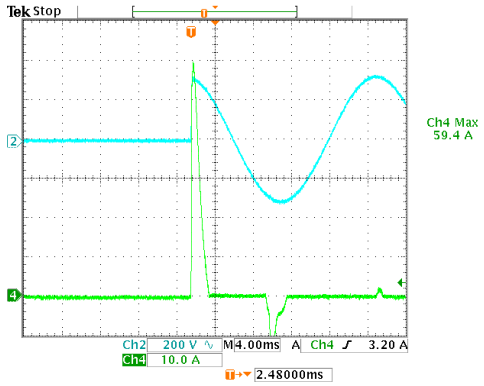
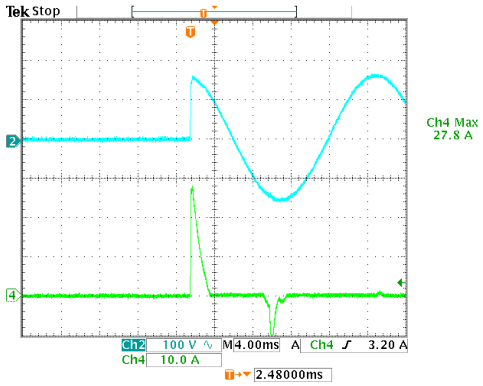
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC ~ 264VAC	I/P : TESTING O/P : FULL LOAD Ta : 25℃	68.0VAC ~ 264VAC
			I/P : LOW-LINE = 112VAC HIGH-LINE = 300VAC O/P : FULL/MIN LOAD ON:30 Sec ; OFF:30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST : OK
2	INPUT FREQUENCY RANGE	47HZ ~ 63HZ NO DAMAGE	I/P : 115VAC ~ 264VAC O/P : FULL~MIN LOAD Ta : 25℃	TEST : OK
3	INPUT CURRENT (TYP.)	2.1A / 230VAC 4.2A / 115VAC	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	I= 1.917A / 230VAC I= 3.97A / 115VAC
4	LEAKAGE CURRENT	< 200uA Earth leakage current	I/P : 264VAC O/P: MIN LOAD TA : 25℃	L-FG 132 uA N-FG 135 uA
		< 70uA Touch leakage current	I/P : 264VAC O/P: MIN LOAD TA : 25℃	L-V-: 26 uA N-V- 24 uA
5	NO LOAD POWER CONSUMPTION	< 0.50W	I/P : 230VAC O/P: MIN LOAD TA : 25℃	< 0.417 W
6	POWER FACTOR (TYP.)	0.94 / 230VAC 0.98 / 115VAC	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	PF= 0.994 / 230VAC PF= 0.998 / 115VAC



7	EFFICIENCY (TYP.)	92.0%	I/P : 230VAC O/P: FULL LOAD TA : 25℃	92.3 %



8	INRUSH CURRENT (TYP.)	70A / 230VAC 35A / 115VAC COLD START		I/P : 230VAC I/P : 115VAC TA : 25℃		I= 59.4A / 230VAC I= 27.8A / 115VAC	
	INPUT=230VAC/50HZ @ FULL LOAD			INPUT=115VAC/50HZ @ FULL LOAD			
	CH2 : AC Input Voltage CH4 : Input current (1V=1A)			CH2 : AC Input Voltage CH4 : Input current (1V=1A)			
						

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105% ~ 135%	I/P: 264VAC I/P: 230VAC I/P: 115VAC O/P: TESTING TA : 25℃	121.53% 264VAC 121.53% 230VAC 121.19% 115VAC Hiccup Mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	16.50V ~ 19.50V	I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P: MIN LOAD TA : 25℃	17.40V 264VAC 17.40V 230VAC 17.40V 80VAC Shut down Re- power ON
3	OVER TEMPERATURE PROTECTION	Shut down Re- power ON	I/P: 264VAC I/P: 80VAC O/P: FULL LOAD	O.T.P. Active Shut down o/p voltage, recovers automatically after temperature goes down
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 80VAC O/P: FULL LOAD Ta: 25℃	NO DAMAGE Hiccup Mode, recovers automatically after fault condition is removed

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PS-ON INPUT SIGNAL	Power on: PS-ON = "Hi" or " > 2 ~ 5V" ; Power off: PS-ON = "Low" or " < 0 ~ 0.5V"	I/P: 230VAC O/P: FULL LOAD TA : 25℃	OK
2	5V STANDBY	5V / 1.0A ripple & noise: 120 mv Tolerance: ±2%	I/P: 230VAC O/P: FULL LOAD TA : 25℃	4.97 V/ 0.9938 A ripple & noise: 66 mv Tolerance: ±0.6 %
3	FAN SUPPLY	12V / 0.5A Tolerance: ±10%	I/P: 230VAC O/P: FULL LOAD TA : 25℃	11.88 V/ 0.4935 A Tolerance: ±1 %
4	POWER GOOD/ POWER FAIL	> 1ms 10ms< PG < 500ms	I/P: 230VAC I/P: 115VAC O/P: FULL LOAD TA : 25℃	88.8ms 8.0ms /230VAC 90.0ms 7.6ms /115VAC

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Power Transistor	Q5 Rated： 600V 30.0A	I/P： 267VAC VDS： O/P： (1)Full Load Turn on (2) Output Short (3)Fulll load continue Ta： 25℃	VIN: 267VAC VDS: (1). 404.00V (2). 444.00V (3). 396.00V
2	PWM Power Transistor	Q6 Rated： 600V 30.0A	I/P： 267VAC VDS： O/P： (1)Full Load Turn on (2) Output Short (3)Fulll load continue Ta： 25℃	VIN: 267VAC VDS: (1). 400.00V (2). 440.00V (3). 398.00V
3	PWM Power Transistor	U900 Rated： 725V 0.7A	I/P： 267VAC VDS： O/P： (1)Full Load Turn on (2) Output Short (3)Fulll load continue Ta： 25℃	VIN: 267VAC VDS: (1). 486.00V (2). 506.00V (3). 484.00V
4	O/P MOSFET	Q101 Rated： 60V 200.0A Q102 Rated： 60V 200.0A	I/P： 267VAC VDS： O/P： (1)Full Load Turn on (2) Output Short (3)Fulll load continue Ta： 25℃	Q101 Q102 VDS： VDS： (1). 44.20V 43.00V (2). 11.90V 11.60V (3). 44.00V 43.00V
5	Input Capacitor	C5 Rated： 270uf 400V	I/P： 267VAC O/P： (1)Full Load Turn on /Off (2)Min load Turn on /Off (3)Full Load /Min load Change Ta： 25℃	(1). 386.00V (2). 388.00V (3). 398.00V
6	Control IC	U2 Rated： 26V (max) -0.3V (min) U1 Rated： 16V (max) -0.3V (min)	I/P： 267VAC O/P： (1)Full Load (2)Output Short (3)O.L.P (4)O.V.P (5)Low Line No Load Vo(min) Ta： 25℃	U2 U1 (1). 15.60V 14.00V (2). 15.90V 13.80V (3). 15.50V 14.10V (4). 15.50V 13.80V (5). 16.50V 13.80V
7	Control IC	U101 Rated： 24V (max) -0.3V (min)	I/P： 267VAC O/P： (1)Full Load (2)Output Short (3)O.L.P (4)O.V.P (5)Low Line No Load Vo(min) Ta： 25℃	U101 (1). 11.60V (2). 5.50V (3). 11.50V (4). 11.40V (5). 11.30V
8	PFC Power Transistor	Q1 Rated： 600V 35.0A	I/P： 267VAC VDS： O/P： (1)Full Load Turn on (2) Output Short (3)Fulll load continu PASS Ta： 25℃	VIN: 267VAC VDS: (1). 476.00V (2). 526.00V (3). 464.00V
9	PFC Diode	D10 Rated： 600V 6.0A	I/P： 267VAC O/P： (1)Full Load Turn on (2) Output Short (3)Dynamic Load Full/Min Load 90%Duty/5KHz (4)Dynamic Load Full/Min Load 50%Duty/120Hz Ta： 25℃	267VAC (1). 400.00V (2). 402.00V (3). 402.00V (4). 396.00V

SAFETY & E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P : 4.000KVAC /min I/P-FG : 2.000KVAC /min O/P-FG : 1.500KVAC /min	I/P-O/P: 4.400KVAC /min I/P-FG: 2.400KVAC /min O/P-FG: 1.800KVAC /min Ta : 25℃	I/P-O/P: 1.49mA I/P-FG: 2.00mA O/P-FG: 0.55mA 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: 500VDC I/P-FG: 500VDC O/P-FG: 500VDC Ta : 25℃/70%RH	I/P-O/P: 9999.0MΩ I/P-FG: 9999.0MΩ O/P-FG: 9999.0MΩ NO DAMAGE

E.M.C. TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A Shut down Re- power ON	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25℃	PASS
2	CONDUCTION	EN55022 CLASS B	I/P : 230VAC /50HZ O/P : FULL LOAD / 50% LOAD Ta : 25℃	PASS Test by certified Lab
3	RADIATION	EN55022 CLASS B	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25℃	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 AIR：15KV / Contact：8KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT： 2KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N：2KV;L/N-PE：4KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A

RELIABILITY TEST

NO	TEST ITEM	SPECIFICATION
1	TEMPERATURE RISE TEST	MODEL : EPP-400-12 1. ROOM AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 250W TA= 25.5℃ 2. HIGH AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 250W TA= 44.9℃

NO.	Position	ROOM AMBIENT 25.5℃	HIGH AMBIENT Ta: 44.9℃
1	BD1	62.5℃	78.2℃
2	LF3	40.6℃	57.3℃
3	C1	42.0℃	58.7℃
4	LF1	42.9℃	59.7℃
5	LF2	49.8℃	65.7℃
6	C2	47.4℃	62.3℃
7	Q5	80.8℃	95.6℃
8	Q6	74.3℃	89.6℃
9	L1	79.4℃	95.0℃
10	D10	71.0℃	86.2℃
11	Q1	72.1℃	87.3℃
12	T1COIL	83.5℃	97.3℃
13	T1COIL	74.2℃	89.1℃
14	C5	69.4℃	82.5℃
15	L2	84.1℃	96.9℃
16	Q101	79.3℃	94.9℃
17	Q102	67.8℃	83.4℃
18	TSW1	65.7℃	80.8℃
19	C105	73.3℃	89.0℃
20	U900	73.5℃	88.5℃
21	U2	68.9℃	84.3℃
22	U1	68.5℃	82.7℃
23	D911	72.7℃	87.1℃
24	T900	64.5℃	80.0℃

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230VAC O/P : 121.00% LOAD Ta : 25℃	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 264VAC / 115VAC O/P : FULL LOAD Ta : -30.0℃	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 45℃ NO DAMAGE	I/P : 272VAC O/P : FULL LOAD Ta : 45℃ HUMIDITY= 95.0% RH	TEST : OK
5	TEMPERATURE COEFFICIENT	±0.03% /(0℃~50℃)	I/P : 230VAC O/P : FULL LOAD	±0.0043% /(0℃~50℃)
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -40℃ ~ +85℃ 2. Temperature change rate : 25℃ / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 5 CYCLE 5. Input/Output condition : STATIC		TEST : OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -35℃ ~ +50℃ 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 : 230VAC Full Load AC ON/OFF test turn on 58sec ; turn off 2sec		TEST : OK
8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (4) Acceleration : 2G (5) Test Time : 60 min in each axis (X.Y.Z) (6) Ta : 25℃		TEST : OK
9	CAPACITOR LIFE CYCLE	:SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25.0℃ LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 45.0℃ LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 45.0℃ LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 45.0℃ LIFE TIME		(1). 75771.6 HRS (2). 31213.5 HRS (3). 71286 HRS (4). 174348 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 194.1K hrs min. MIL-HDBK-217F (25℃)		
11	DMTBF /Accelerated Life test	Demonstration Mean Time Between Failure (Expected Life): Above 30000HRS @ TA 45℃ O/P : FULL LOAD		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	frank	GESG	WANGDZ

12.10.30 A50-F031