



TEST REPORT: RPS-400-36

400W Reliable Green Medical Power Supply

■ DESIGN VERIFY TEST

- Output Function Test
- Input Function Test
- Protection Function Test
- Control Function Test
- Component Stress Test

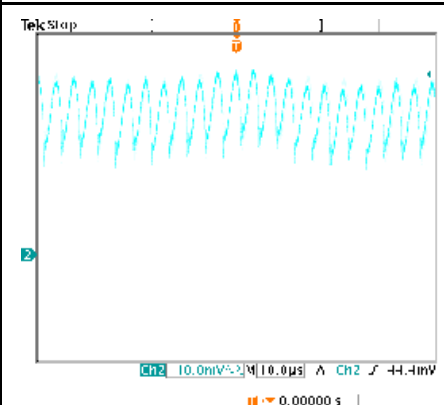
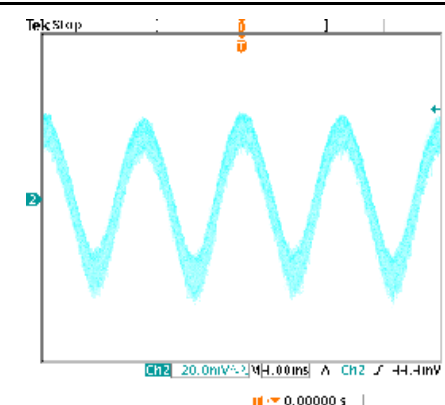
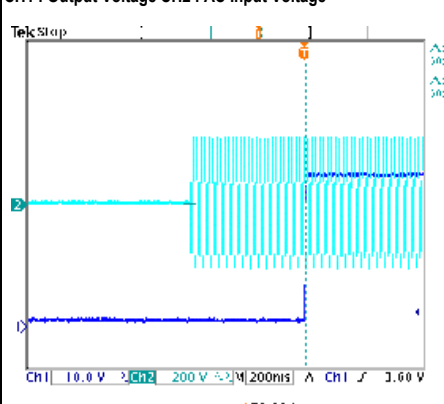
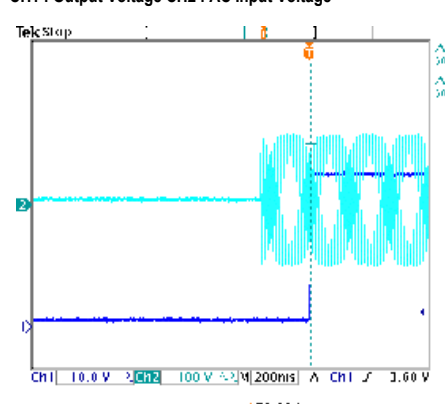
■ SAFETY & E.M.C. TEST

- Safety Test
- E.M.C. Test

■ RELIABILITY TEST

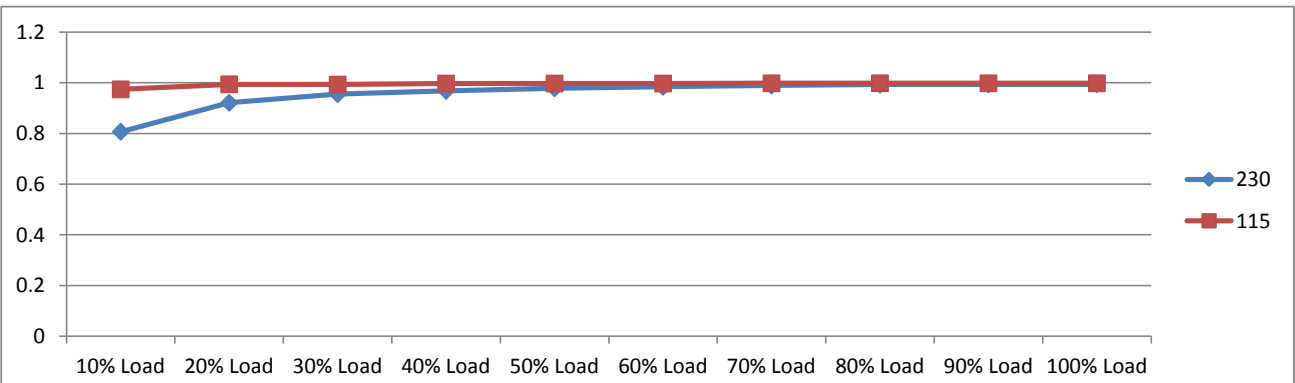
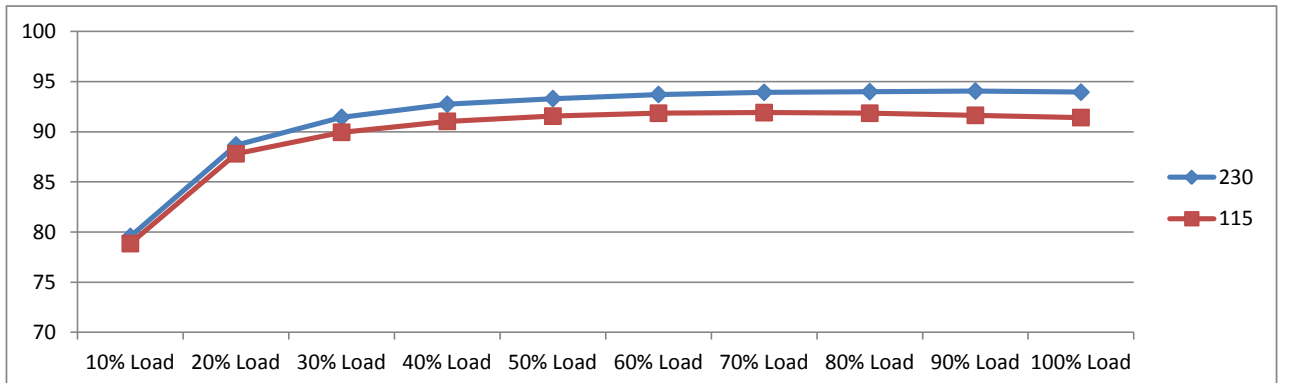
- ENVIRONMENT TEST

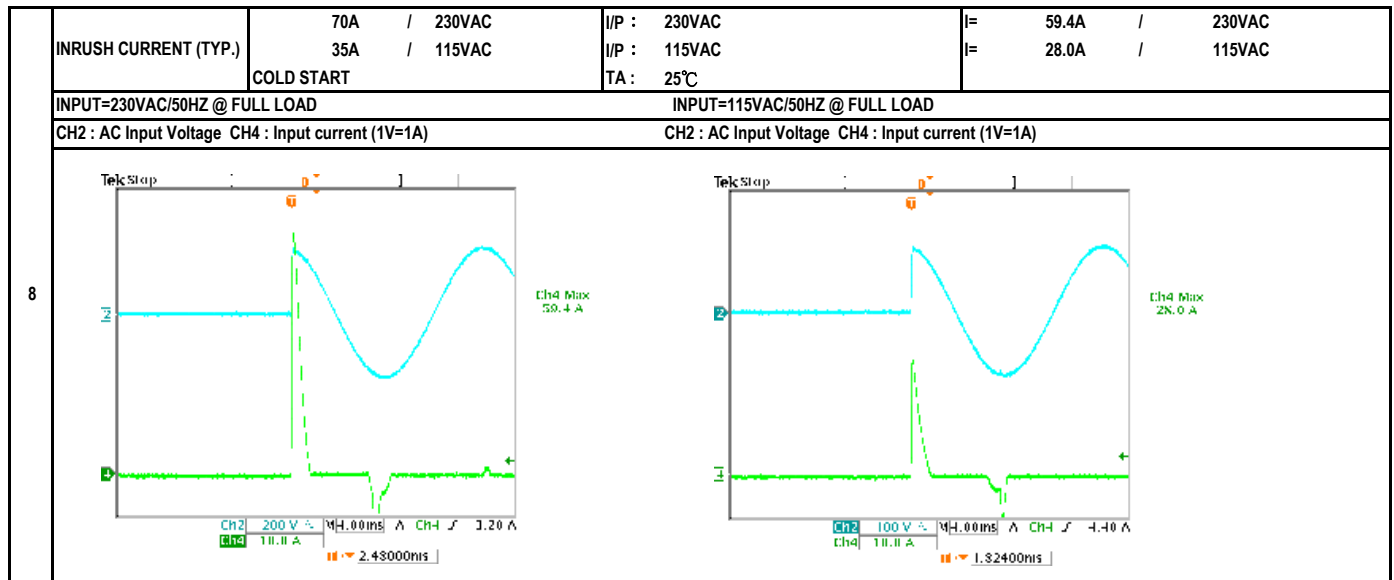
DESIGN VERIFY TEST OUTPUT FUNCTION

CONVERSION				
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 34.20V ~ 37.80V	I/P : 230VAC O/P: MIN LOAD TA : 25°C	CH1: 33.02V ~ 39.83V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 1.0% ~ -1.0%	I/P : 115VAC / 264VAC O/P: FULL / MINLOAD TA= 25°C	V1: 0.33% ~ 0.08%
3	LINE REGULATION (MAX.)	V1 : 0.5% ~ -0.5%	I/P : 115VAC / 264VAC O/P: FULL LOAD TA : 25°C	V1: 0.00% ~ 0.00%
4	LOAD REGULATION (MAX.)	V1 : 1.0% ~ -1.0%	I/P : 230VAC O/P: MIN LOAD ~ FULL LOAD TA : 25°C	V1: 0.14% ~ -0.08%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230VAC O/P: FULL LOAD TA : 25°C	TEST< 2.2 %
6	RIPPLE & NOISE(Max)	V1 : 200 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25°C	V1 : 96 mVp-p
		high frequency:		low frequency:
				
7	SET UP TIME (MAX.)	230VAC : 1000ms 115VAC : 1500ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C	230VAC : 588ms 115VAC : 252ms
		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°C	230VAC : 5.4ms 115VAC : 4.8ms
	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°C	230VAC : 20.4ms 115VAC : 20.8ms
	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 : 3600 mVp-p	I/P : 230VAC O/P: (1)Full/Min load 50%duty/120HZ (2)Full/Min load 50%duty/1KHZ TA: 25°C	V1: (1). 596mv (2). 784mv unit:mVp-p
	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°C	66.0VAC ~ 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°C	TEST : OK
3	INPUT CURRENT (TYP.)	2.10A / 230VAC 4.20A / 115VAC	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C	I= 1.88A / 230VAC I= 3.92A / 115VAC
4	LEAKAGE CURRENT	< 200uA Earth leakage current	I/P : 264VAC O/P : MIN LOAD TA : 25°C	L-FG 123 uA N-FG 119 uA
		< 70uA Touch leakage current	I/P : 264VAC O/P : MIN LOAD TA : 25°C	L-V-: 21 uA N-V- 24 uA
5	NO LOAD POWER CONSUMPTION		O/P : MIN LOAD TA : 25°C	
6	POWER FACTOR (TYP.)	0.94 / 230VAC 0.98 / 115VAC	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C	PF= 0.994 / 230VAC PF= 0.998 / 115VAC
				
7	EFFICIENCY (TYP.)	94.0%	I/P : 230VAC O/P : FULL LOAD TA : 25°C	94.05 %
				



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°C	116.80% 264VAC 116.80% 230VAC 116.80% 115VAC Hiccup Mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	39.60V ~ 46.80V	I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P: MIN LOAD TA : 25°C	43.40V 264VAC 43.40V 230VAC 43.40V 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°C	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°C	OK
2	5V STANDBY	5V / 1.0A ripple & noise: 120 mv Tolerance: ±2%	I/P: 230VAC O/P: FULL LOAD TA : 25°C	4.975 V/ 0.9918 A ripple & noise: 45.8 mv Tolerance: ±0.5 %
3	FAN SUPPLY	12V / 0.5A Tolerance: ±10%	I/P: 230VAC O/P: FULL LOAD TA : 25°C	11.889 V/ 0.4963 A Tolerance: ±0.925 %
4	POWER GOOD/ POWER FAIL	> 1ms 10ms< PG < 500ms	I/P: 230VAC I/P: 115VAC O/P: FULL LOAD TA : 25°C	100.0ms 7.0ms /230VAC 98.8ms 7.0ms /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)Full load continue Ta : 25°C	VIN: 267VAC VDS: (1). 411.00V (2). 442.00V (3). 398.00V
2	PWM Power Transistor	Q6 Rated : 600V 30.0A	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	VIN: 267VAC VDS: (1). 396.00V (2). 446.00V (3). 396.00V
3	PWM Power Transistor	U900 Rated : 725V 0.7A	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	VIN: 267VAC VDS: (1). 494.00V (2). 520.00V (3). 494.00V
4	O/P MOSFET	Q101 Rated : 100V 100.0A Q102 Rated : 100V 100.0A	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	Q101 Q102 VDS : VDS : (1). 88.80V 88.80V (2). 9.60V 9.40V (3). 87.60V 88.00V
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°C	(1). 390.00V (2). 398.00V (3). 388.00V
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°C	U2 U1 (1). 16.50V 13.90V (2). 16.10V 13.90V (3). 15.60V 13.90V (4). 15.70V 13.70V (5). 16.20V 13.70V
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°C	U101 (1). 11.50V (2). 2.14V (3). 11.50V (4). 11.60V (5). 11.40V
8	PFC Power Transistor	Q1 Rated : 600V 35.0A	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	VIN: 267VAC VDS: (1). 468.00V (2). 544.00V (3). 456.00V
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°C	267VAC (1). 398.00V (2). 428.00V (3). 398.00V (4). 402.00V

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°C	I/P-O/P: 1.43mA I/P-FG: 1.63mA O/P-FG: 0.54mA 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°C/70%RH	I/P-O/P: 9999MΩ I/P-FG: 9999MΩ O/P-FG: 9999MΩ 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°C	PASS
2	CONDUCTION	EN55022 CLASS B	I/P : 230VAC /50HZ O/P : FULL LOAD / 50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	EN55022 CLASS B	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 MEDICAL AIR: 15KV / Contact: 8KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT: 2KV	I/P : 230VAC /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 : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A

RELIABILITY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
-	TEMPERATURE RISE TEST	MODEL : EPP-400-24 1. ROOM AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 250W TA= 25.5°C 2. HIGH AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 250W TA= 42.1°C		
-			NO. Position ROOM AMBIENT 25.5°C HIGH AMBIENT Ta: 42.1°C	
-			1 BD1 62.0°C 78.6°C	
-			2 LF1 41.7°C 58.8°C	
-			3 LF2 43.0°C 59.4°C	
-			4 Q5 75.3°C 91.8°C	
-			5 Q6 71.0°C 86.7°C	
-			6 L1 81.2°C 97.8°C	
-			7 D10 70.7°C 86.2°C	
-			8 Q1 74.1°C 89.2°C	
-			9 C33 58.1°C 76.3°C	
-			10 C5 69.0°C 82.7°C	
-			11 T1COIL 69.3°C 83.1°C	
-			12 T1COIL 65.8°C 81.1°C	
-			13 L2 74.6°C 87.7°C	
-			14 Q101 53.5°C 70.0°C	
-			15 Q102 59.5°C 74.8°C	
-			16 TSW1 66.5°C 81.4°C	
-			17 C106 48.1°C 64.1°C	
-			18 C105 51.3°C 66.6°C	
-			19 U900 74.7°C 89.3°C	
-			20 U1 69.8°C 84.4°C	
-			21 U2 73.7°C 90.1°C	
-			22 T900 62.5°C 78.5°C	
-			23 LF3 37.8°C 55.1°C	
-			24 C1 37.3°C 54.3°C	
-			25 C2 39.1°C 55.7°C	
-			26 D911 69.1°C 84.0°C	



2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230VAC O/P : 123.00% LOAD Ta : 25°C	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 264VAC / 115VAC O/P : FULL LOAD Ta : -30.0°C	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 45°C NO DAMAGE	I/P : 272VAC O/P : FULL LOAD Ta : 45°C HUMIDITY= 95.0% RH	TEST : OK
5	TEMPERATURE COEFFICIENT	±0.03% / (0°C~50°C)	I/P : 230VAC O/P : FULL LOAD	±0.005% / (0°C~50°C)
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -40°C ~ +85°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		TEST : OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -35°C ~ +50°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		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°C		TEST : OK
9	CAPACITOR LIFE CYCLE	:SUPPOSE C106 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25.0°C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 45.0°C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 45.0°C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 45.0°C LIFE TIME		(1). 505637 HRS (2). 131777.8 HRS (3). 219984.4 HRS (4). 321245.6 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 194.1K hrs min. MIL-HDBK-217F (25°C)		
11	DMTBF /Accelerated Life test	Demonstration Mean Time Between Failure (Expected Life): Above 30000HRS @ TA 45°C O/P : FULL LOAD		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	frank	GESG	WANGDZ

12.10.30 A50-F031