



# TEST REPORT: EPP-400-15

## 400W Single Output with PFC Function

### ■ 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

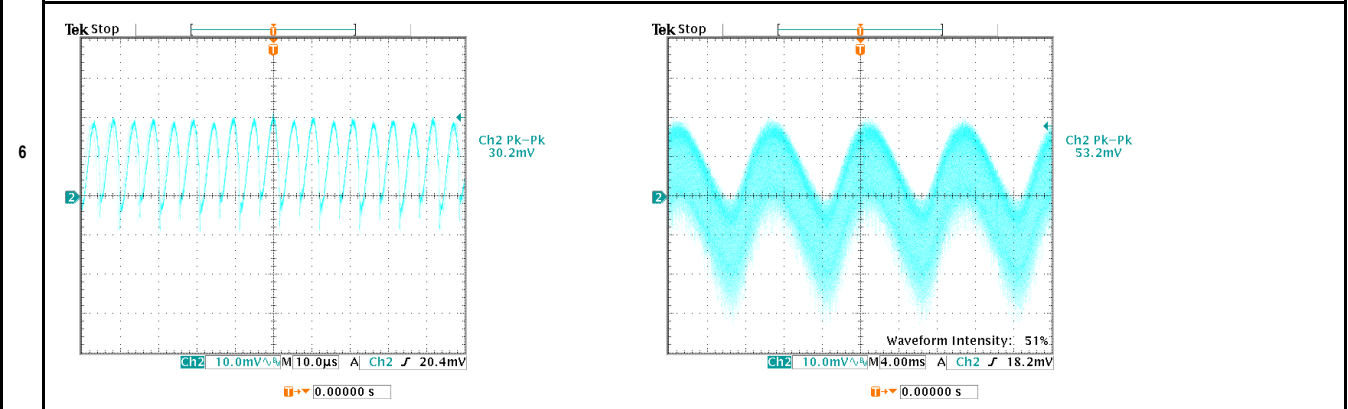
ENVIRONMENT TEST

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°C	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°C	V1: 0.73% ~ 0.33%
3	LINE REGULATION (MAX.)	V1 : 0.5% ~ -0.5%	I/P : 115VAC / 264VAC O/P: FULL LOAD TA : 25°C	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°C	V1: 0.20% ~ -0.13%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230VAC O/P: FULL LOAD TA : 25°C	TEST< 2.0 %
	RIPPLE & NOISE(Max)	V1 : 120 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25°C	V1 : 53.2 mVp-p

high frequency:

low frequency:



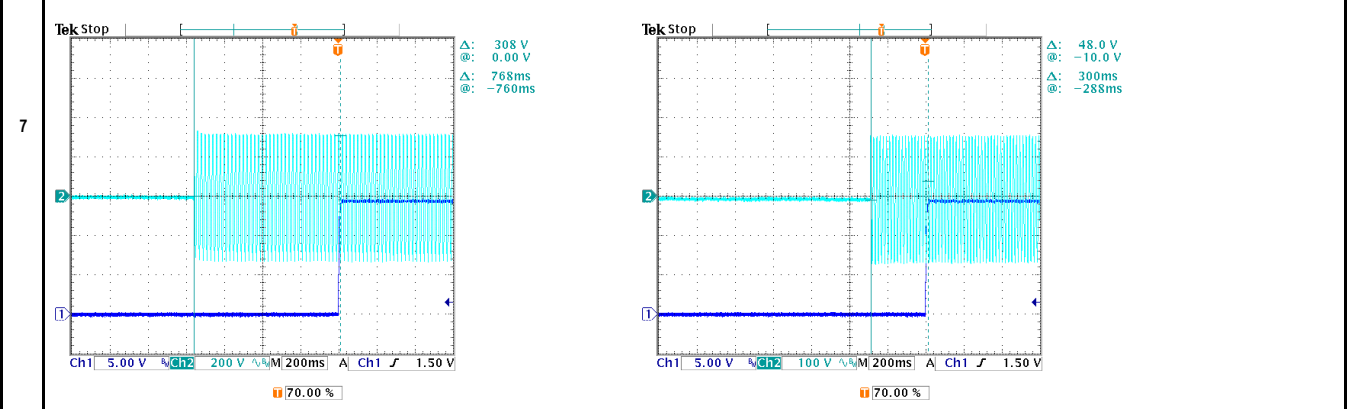
SET UP TIME (MAX.)	230VAC : 1000ms	I/P : 230VAC	230VAC : 768ms
	115VAC : 1500ms	I/P : 115VAC O/P: FULL LOAD TA : 25°C	115VAC : 300ms

INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

INPUT=115VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



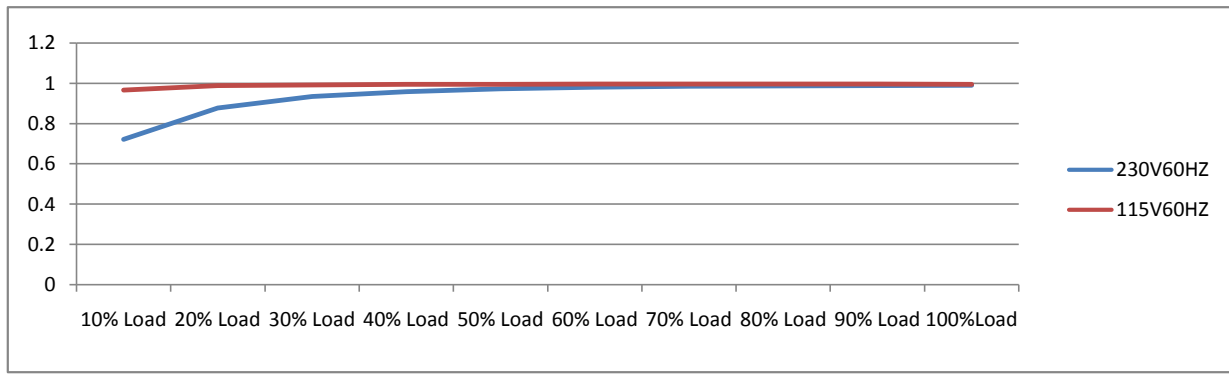
8	RISE TIME (MAX.)	230VAC : 30ms 115VAC : 30ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C	230VAC : 10.4ms 115VAC : 9.0ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage	INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage		
9	HOLD UP TIME (TYP.)	230VAC : 16ms 115VAC : 12ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C	230VAC : 16.7ms 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°C	V1: (1). 1200mv (2). 812mv unit:mVp-p
	FULL /MIN LOAD 50%DUTY / 120HZ	FULL /MIN% LOAD 50%DUTY / 1KHZ		



INPUT FUNCTION TEST

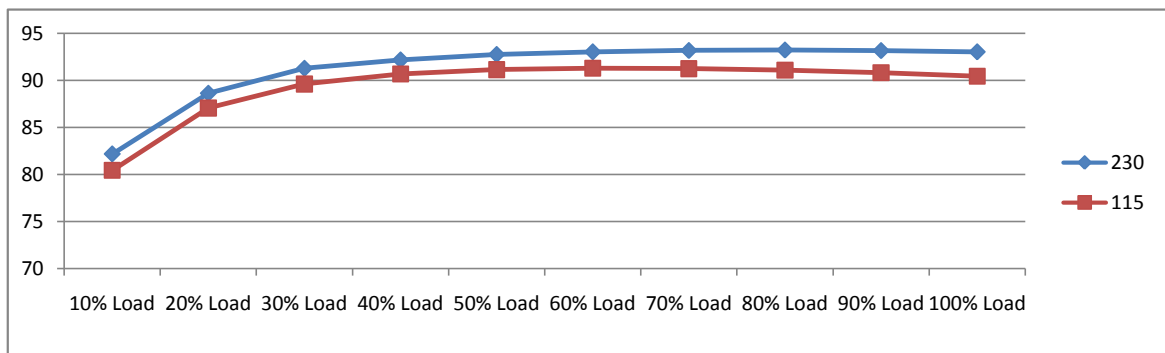
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC ~ 264VAC 113VDC ~ 370VDC	I/P : TESTING O/P : FULL LOAD Ta : 25°C	68.0VAC ~ 264VAC 99.0VDC ~ 370VDC
			I/P : LOW-LINE = 112VAC HIGH-LINE = 300VAC O/P : FULL/MIN LOAD ON:30 Sec ; OFF:30 Sec 10MIN ( POWER ON/OFF NO DAMAGE )	TEST : 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.)	2.1A / 230VAC 4.2A / 115VAC	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C	I= 1.917A / 230VAC I= 3.97A / 115VAC
4	LEAKAGE CURRENT	< 0.75mA	I/P : 240VAC O/P : MIN LOAD TA : 25°C	L-FG 0.23 mA N-FG 0.26 mA
5	NO LOAD POWER CONSUMPTION	< 0.50W	I/P : 230VAC O/P : MIN LOAD TA : 25°C	< 0.417 W
	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

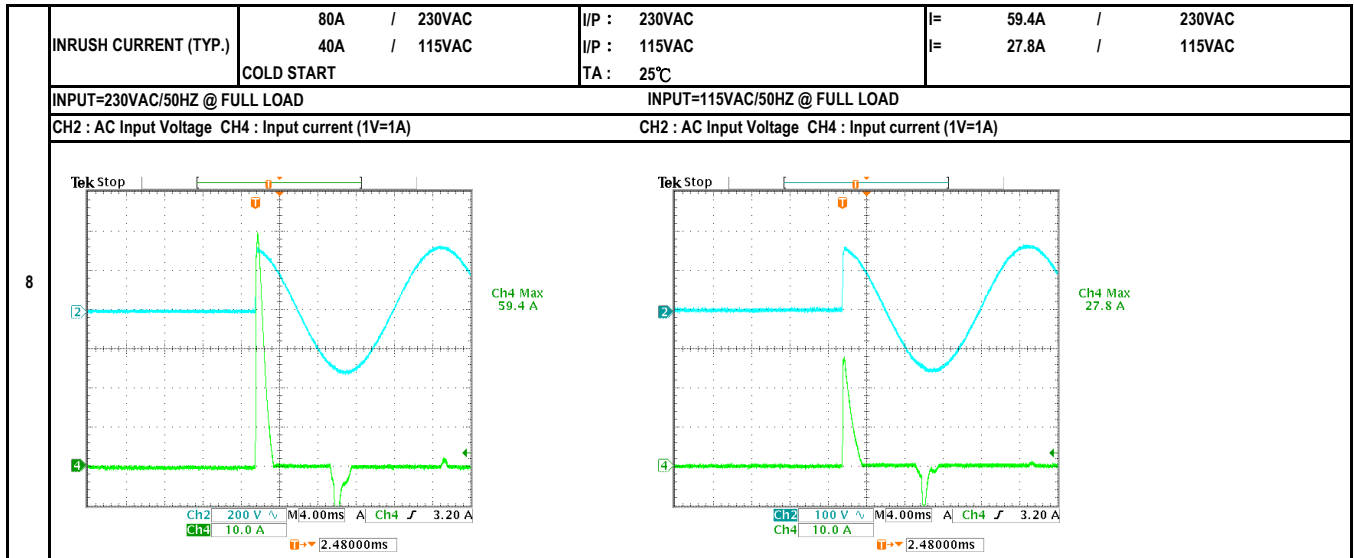
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EFFICIENCY (TYP.)	92.0%	I/P : 230VAC O/P : FULL LOAD TA : 25°C	92.3 %
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**PROTECTION FUNCTION TEST**

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	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°C	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°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	4.97 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°C	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°C	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)Full load continue Ta : 25°C	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)Full load continue Ta : 25°C	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)Full load continue Ta : 25°C	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)Full load continue Ta : 25°C	Q101 VDS : Q102 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°C	(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°C	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°C	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)Full load contin. PASS Ta : 25°C	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°C	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 : 3KV /min I/P-FG : 2KV /min O/P-FG : 0.5KV /min	I/P-O/P: 3.600KVAC /min I/P-FG: 2.400KVAC /min O/P-FG: 0.600KVAC /min Ta : 25°C	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°C/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°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 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	
4	TEMPERATURE RISE TEST	MODEL : EPP-400-12			
		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= 44.9°C			
			NO. Position ROOM AMBIENT 25.5°C HIGH AMBIENT Ta: 44.9°C		
			1 BD1 62.5°C 78.2°C		
			2 LF3 40.6°C 57.3°C		
			3 C1 42.0°C 58.7°C		
			4 LF1 42.9°C 59.7°C		
			5 LF2 49.8°C 65.7°C		
			6 C2 47.4°C 62.3°C		
			7 Q5 80.8°C 95.6°C		
			8 Q6 74.3°C 89.6°C		
			9 L1 79.4°C 95.0°C		
			10 D10 71.0°C 86.2°C		
			11 Q1 72.1°C 87.3°C		
			12 T1COIL 83.5°C 97.3°C		
			13 T1COIL 74.2°C 89.1°C		
			14 C5 69.4°C 82.5°C		
			15 L2 84.1°C 96.9°C		
			16 Q101 79.3°C 94.9°C		
			17 Q102 67.8°C 83.4°C		
			18 TSW1 65.7°C 80.8°C		
			19 C105 73.3°C 89.0°C		
			20 U900 73.5°C 88.5°C		
			21 U2 68.9°C 84.3°C		
	22 U1 68.5°C 82.7°C				
	23 D911 72.7°C 87.1°C				
	24 T900 64.5°C 80.0°C				



2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230VAC O/P : 121.00% 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	±0.0043% / (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 C105 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). 75771.6 HRS (2). 31213.5 HRS (3). 71286 HRS (4). 174348 HRS	
10	MTBF	1395.2K hrs min. Telcordia SR-332 (Bellcore) ; 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		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	frank	GESG	WANGDZ

12.10.30 A50-F031