



# TEST REPORT: EPP-400-12

## 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

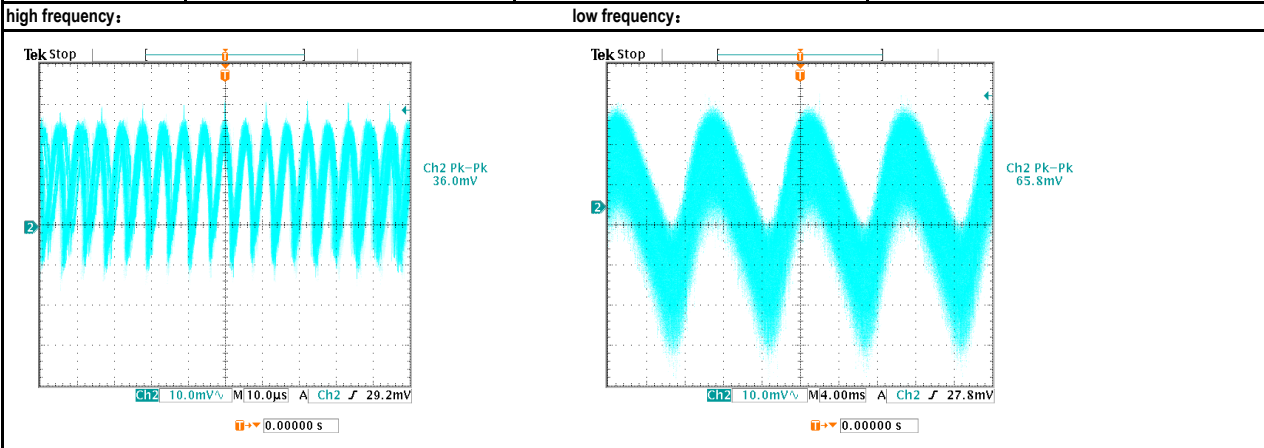
- Safety Test
- E.M.C. Test

### ■ RELIABILITY TEST

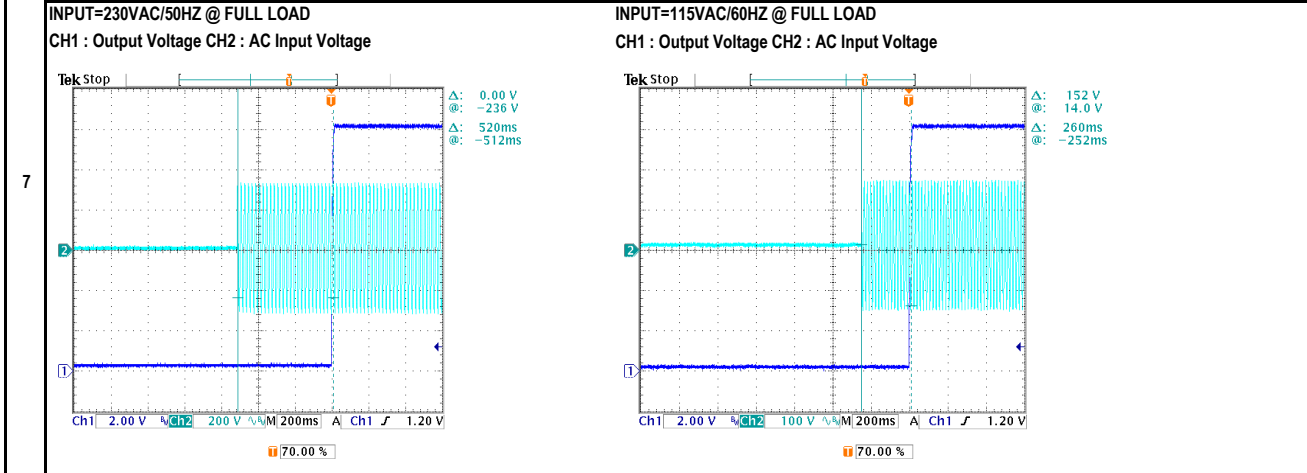
- ENVIRONMENT TEST

DESIGN VERIFY TEST  
OUTPUT FUNCTION

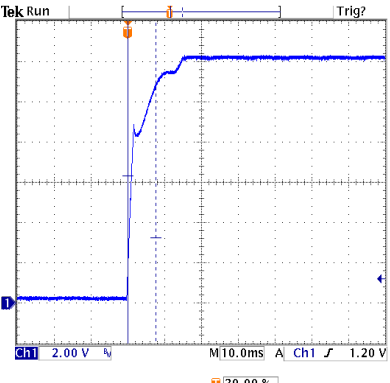
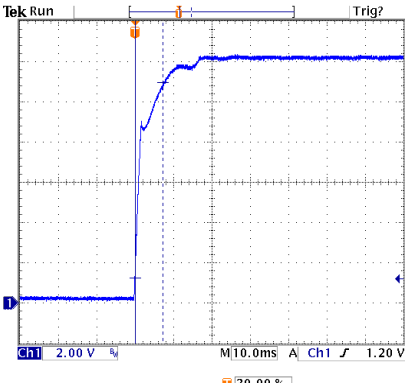
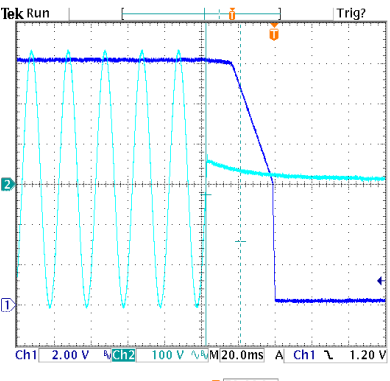
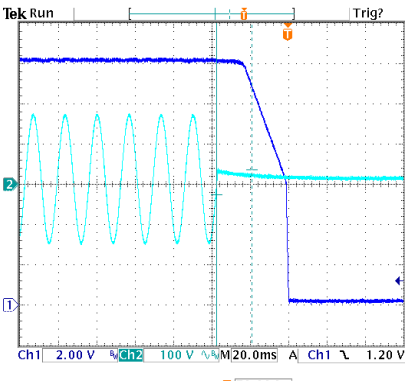
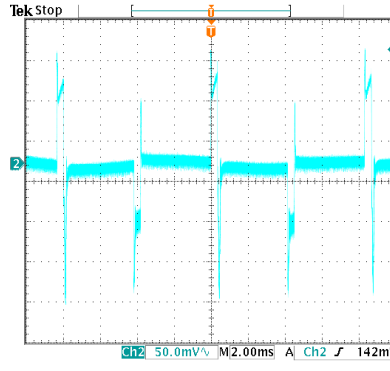
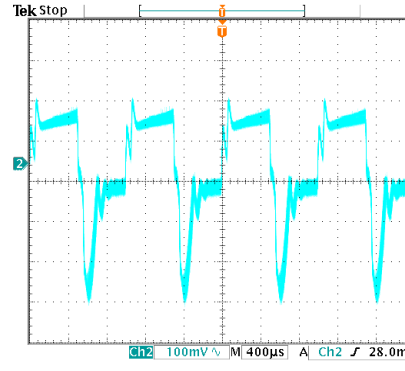
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 11.40V ~ 12.60V	I/P : 230VAC O/P: MIN LOAD TA : 25°C	CH1: 10.99V ~ 12.99V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 3.0% ~ -3.0%	I/P : 115VAC / 264VAC O/P: FULL / MINLOAD TA= 25°C	V1: 1.00% ~ 0.42%
3	LINE REGULATION (MAX.)	V1 : 0.5% ~ -0.5%	I/P : 115VAC / 264VAC O/P: FULL LOAD TA : 25°C	V1: 0.00% ~ -0.08%
4	LOAD REGULATION (MAX.)	V1 : 1.0% ~ -1.0%	I/P : 230VAC O/P: MIN LOAD ~ FULL LOAD TA : 25°C	V1: 0.33% ~ -0.25%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230VAC O/P: FULL LOAD TA : 25°C	TEST< 1.0 %
	RIPPLE & NOISE(Max)	V1 : 120 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25°C	V1 : 65.8 mVp-p



SET UP TIME (MAX.)	230VAC : 1000ms	I/P : 230VAC	230VAC : 520ms
	115VAC : 1500ms	I/P : 115VAC O/P: FULL LOAD TA : 25°C	115VAC : 260ms

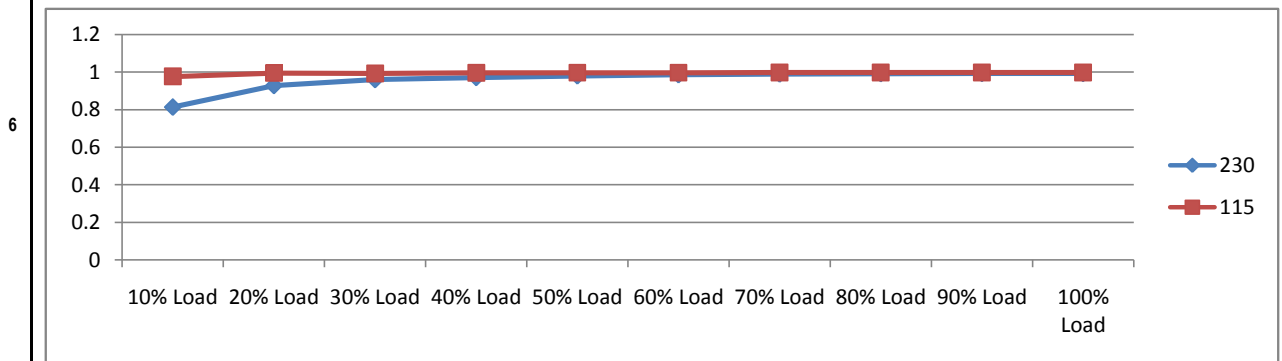




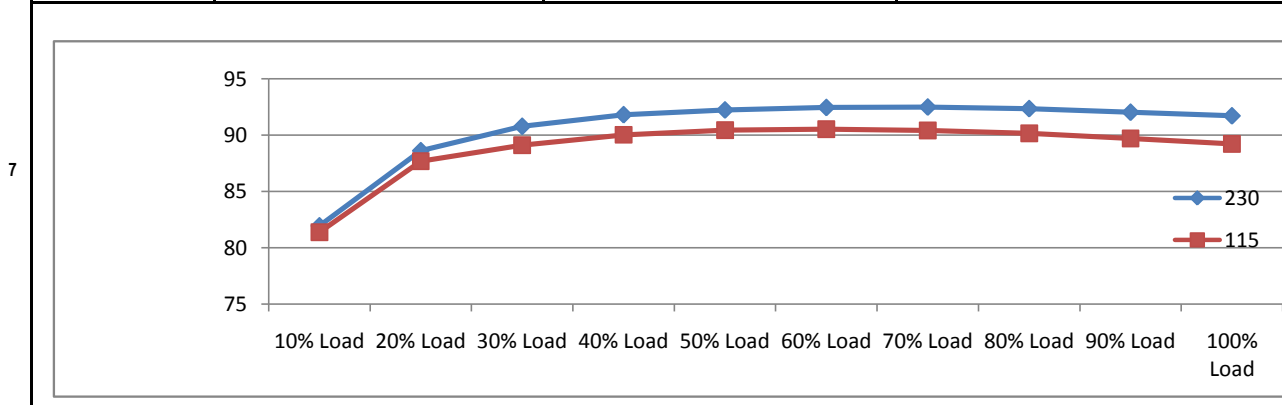
<p>RISE TIME (MAX.)</p>	<p>230VAC : 30ms 115VAC : 30ms</p>	<p>I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C</p>	<p>230VAC : 7.6ms 115VAC : 7.2ms</p>
<p>8</p>	<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage</p> 		<p>INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage</p> 
<p>9</p>	<p>HOLD UP TIME (TYP.)</p> <p>230VAC : 16ms 115VAC : 12ms</p>	<p>I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C</p>	<p>230VAC : 18.8ms 115VAC : 18.4ms</p>
<p>10</p>	<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p> 		<p>INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p> 
<p>DYNAMIC LOAD</p>	<p>V1 : 1200 mVp-p</p>	<p>I/P : 230VAC O/P: (1)Full/Min load 50%duty/120HZ (2)Full/Min load 50%duty/1KHZ TA : 25°C</p>	<p>V1: (1). 301mv (2). 504mv unit:mVp-p</p>
<p>FULL /MIN LOAD 50%DUTY / 120HZ</p> 	<p>FULL /MIN% LOAD 50%DUTY / 1KHZ</p> 		

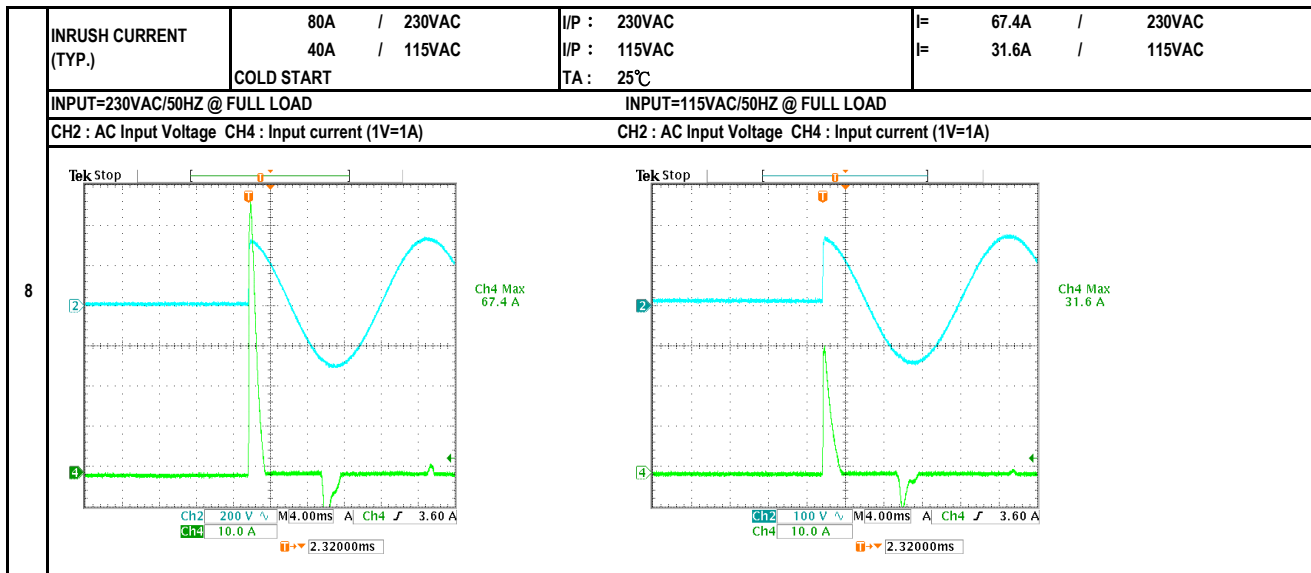
INPUT FUNCTION TEST

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 98.0VDC ~ 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= 1.92A / 230VAC I= 3.94A / 115VAC
4	LEAKAGE CURRENT	< 0.75mA	I/P : 240VAC O/P : MIN LOAD TA : 25°C	L-FG 0.18 mA N-FG 0.2 mA
5	NO LOAD POWER CONSUMPTION	< 0.50W	I/P : 230VAC O/P : MIN LOAD TA : 25°C	< 0.4053 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



EFFICIENCY (TYP.)	91.5%	I/P : 230VAC O/P : FULL LOAD TA : 25°C	91.71 %
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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	121.02% 264VAC 121.25% 230VAC 121.74% 115VAC Hiccup Mode, recovers automatically after fault condition
2	OVER VOLTAGE PROTECTION	13.20V ~ 15.60V	I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P: MIN LOAD TA : 25°C	14.20V 264VAC 14.20V 230VAC 14.20V 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

**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	4.955 V/ 0.9949 A ripple & noise: 38.2 mv Tolerance: ±0.9 %
3	FAN SUPPLY	12V / 0.5A Tolerance: ±10%	I/P: 230VAC O/P: FULL LOAD TA : 25°C	11.58 V/ 0.4997 A Tolerance: ±4.8 %
4	POWER GOOD/ POWER FAIL	> 1ms 10ms< PG < 500ms	I/P: 230VAC I/P: 115VAC O/P: FULL LOAD TA : 25°C	99.1ms 7.8ms /230VAC 104.0ms 6.0ms /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). 394.00V (2). 416.00V (3). 394.00V
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). 394.00V (2). 424.00V (3). 394.00V
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). 484.00V (2). 496.00V (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 Q102 VDS : VDS : (1). 36.00V 36.80V (2). 13.60V 13.40V (3). 35.80V 36.80V
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). 384.00V (2). 384.00V (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). 15.50V 13.80V (2). 15.70V 13.80V (3). 15.40V 13.80V (4). 15.50V 13.70V (5). 16.60V 14.00V
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). 6.50V (3). 11.60V (4). 11.50V (5). 11.50V
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 PASS Ta : 25°C	VIN: 267VAC VDS: (1). 468.00V (2). 404.00V (3). 452.00V
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). 394.00V (2). 386.00V (3). 396.00V (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: 1.43mA I/P-FG: 1.53mA O/P-FG: 0.51mA 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 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																																																																																																				
1	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																																																																																																						
			<table border="1"> <thead> <tr> <th>NO.</th> <th>Position</th> <th>ROOM AMBIENT 25.5°C</th> <th>HIGH AMBIENT Ta: 44.9°C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>62.5°C</td><td>78.2°C</td></tr> <tr><td>2</td><td>LF3</td><td>40.6°C</td><td>57.3°C</td></tr> <tr><td>3</td><td>C1</td><td>42.0°C</td><td>58.7°C</td></tr> <tr><td>4</td><td>LF1</td><td>42.9°C</td><td>59.7°C</td></tr> <tr><td>5</td><td>LF2</td><td>49.8°C</td><td>65.7°C</td></tr> <tr><td>6</td><td>C2</td><td>47.4°C</td><td>62.3°C</td></tr> <tr><td>7</td><td>Q5</td><td>80.8°C</td><td>95.6°C</td></tr> <tr><td>8</td><td>Q6</td><td>74.3°C</td><td>89.6°C</td></tr> <tr><td>9</td><td>L1</td><td>79.4°C</td><td>95.0°C</td></tr> <tr><td>10</td><td>D10</td><td>71.0°C</td><td>86.2°C</td></tr> <tr><td>11</td><td>Q1</td><td>72.1°C</td><td>87.3°C</td></tr> <tr><td>12</td><td>T1COIL</td><td>83.5°C</td><td>97.3°C</td></tr> <tr><td>13</td><td>T1COIL</td><td>74.2°C</td><td>89.1°C</td></tr> <tr><td>14</td><td>C5</td><td>69.4°C</td><td>82.5°C</td></tr> <tr><td>15</td><td>L2</td><td>84.1°C</td><td>96.9°C</td></tr> <tr><td>16</td><td>Q101</td><td>79.3°C</td><td>94.9°C</td></tr> <tr><td>17</td><td>Q102</td><td>67.8°C</td><td>83.4°C</td></tr> <tr><td>18</td><td>TSW1</td><td>65.7°C</td><td>80.8°C</td></tr> <tr><td>19</td><td>C105</td><td>73.3°C</td><td>89.0°C</td></tr> <tr><td>20</td><td>U900</td><td>73.5°C</td><td>88.5°C</td></tr> <tr><td>21</td><td>U2</td><td>68.9°C</td><td>84.3°C</td></tr> <tr><td>22</td><td>U1</td><td>68.5°C</td><td>82.7°C</td></tr> <tr><td>23</td><td>D911</td><td>72.7°C</td><td>87.1°C</td></tr> <tr><td>24</td><td>T900</td><td>64.5°C</td><td>80.0°C</td></tr> </tbody> </table>	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	
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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