



# Test Report: LRS-450-36

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450W Single Output Switching 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

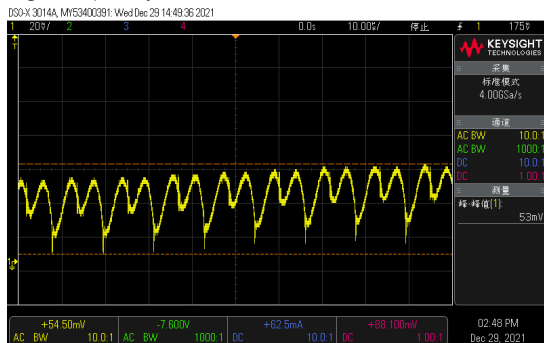
ENVIRONMENT TEST

■ DESIGN VERIFY TEST

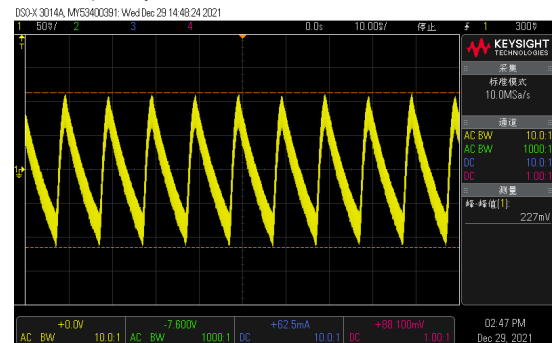
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 34.2 V~39.6V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	32.886V~40.986V/230VAC 32.901V~40.984V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1%~ 1%	I/P: 90VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: 0.02%~0.22%
3	LINE REGULATION (Max)	V1: -0.5 %~0.5%	I/P: 90VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: 0.11%~0.14%
4	LOAD REGULATION(Max)	V1: -0.5 %~0.5%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0.027%~0.055 %
5	RIPPLE & NOISE(Max )	V1: 360 mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 227mVp-p

high frequency :



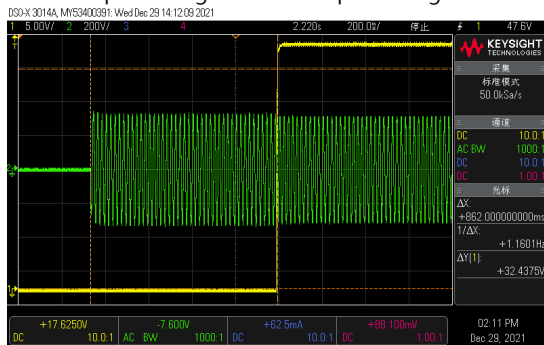
low frequency :



6	SET UP TIME(Max)	230VAC/1500ms 115VAC/1500ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/862ms 115VAC/878ms
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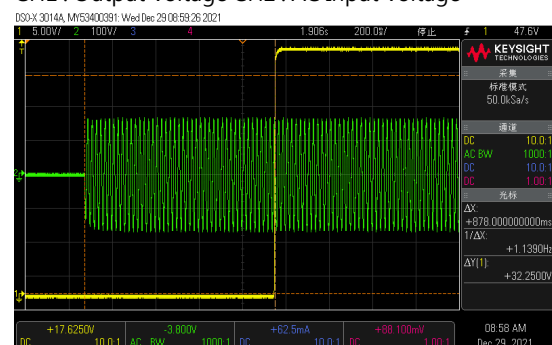
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



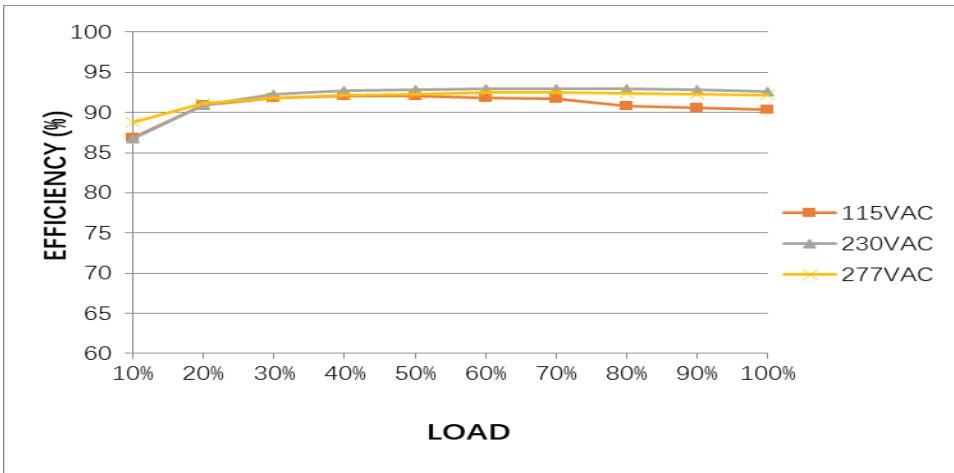
INPUT=115VAC/60HZ @ FULL LOAD

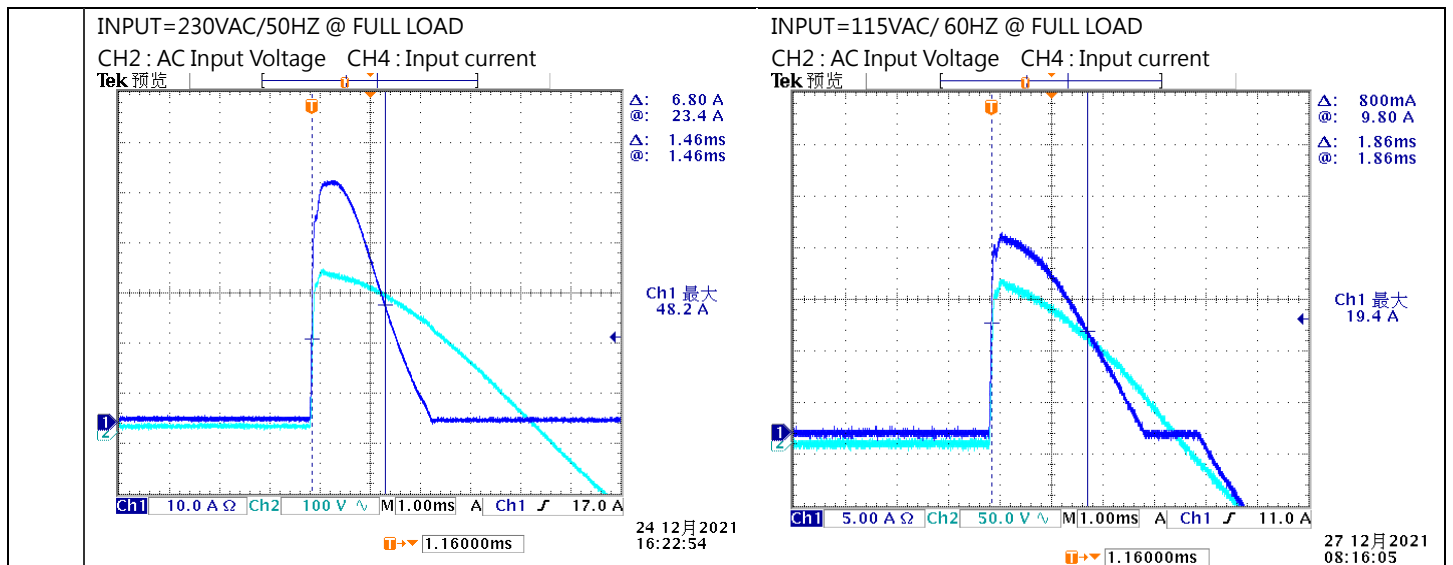
CH1 : Output Voltage CH2 : AC Input Voltage



7	RISE TIME (Max)	230VAC/50ms 115VAC/50ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/6.7 ms 115VAC/ 7.1ms
INPUT=230VAC/50HZ @ FULL LOAD		INPUT=115VAC/60HZ @ FULL LOAD		
CH1 : Output Voltage		CH1 : Output Voltage		
8	HOLD UP TIME (Typ.)	230VAC/16ms 115VAC/12ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/19.8ms 115VAC/20.8ms
INPUT=230VAC/50HZ @ FULL LOAD		INPUT=115VAC/60HZ @ FULL LOAD		
CH1 : Output Voltage CH2 : AC Input Voltage		CH1 : Output Voltage CH2 : AC Input Voltage		
9	DYNAMIC LOAD	V1:3600mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	263mVp-p  273mVp-p
FULL /50% LOAD 50%DUTY / 120HZ		FULL /50% LOAD 50%DUTY / 1KHZ		

### INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																												
1	INPUT VOLTAGE RANGE	90 ~ 132VAC / 180 ~ 264VAC by switch  250VDC~ 370VDC (switch on 230VAC)	(1) I/P:TESTING O/P:FULL LOAD (2) I/P:DC TESTING(L:+ N:-) O/P: FULL / 50% LOAD (3) I/P:DC TESTING(L:- N:+) O/P: FULL / 50% LOAD Ta:25°C	(1) 87VAC~ 267VAC (2)250Vdc~370Vdc/FULL LOAD 250Vdc~370Vdc/50% LOAD (3) 250Vdc~370Vdc/FULL LOAD 250Vdc~370Vdc/50% LOAD																																												
			I/P: LOW-LINE-3V=87 V HIGH-LINE+3V=267V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN ( POWER ON/OFF NO DAMAGE )	TEST: OK																																												
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:90 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST: OK																																												
3	INPUT CURRENT (Typ.)	230V/ 6A 115V/10A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =3.613A/ 230VAC I =6.247A/ 115VAC																																												
4	LEAKAGE CURRENT	< 2mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.8043 mA N-FG : 0.8126 mA																																												
5	EFFICIENCY(Typ.)	92%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	92.63 %																																												
<p>EFFICIENCY vs LOAD</p>  <table border="1"> <caption>Efficiency vs Load Data</caption> <thead> <tr> <th>LOAD (%)</th> <th>115VAC (%)</th> <th>230VAC (%)</th> <th>277VAC (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>87</td><td>88</td><td>89</td></tr> <tr><td>20%</td><td>91</td><td>91</td><td>91</td></tr> <tr><td>30%</td><td>92</td><td>92</td><td>92</td></tr> <tr><td>40%</td><td>92</td><td>92</td><td>92</td></tr> <tr><td>50%</td><td>92</td><td>92</td><td>92</td></tr> <tr><td>60%</td><td>92</td><td>92</td><td>92</td></tr> <tr><td>70%</td><td>92</td><td>92</td><td>92</td></tr> <tr><td>80%</td><td>91</td><td>92</td><td>92</td></tr> <tr><td>90%</td><td>91</td><td>92</td><td>92</td></tr> <tr><td>100%</td><td>91</td><td>92</td><td>92</td></tr> </tbody> </table>					LOAD (%)	115VAC (%)	230VAC (%)	277VAC (%)	10%	87	88	89	20%	91	91	91	30%	92	92	92	40%	92	92	92	50%	92	92	92	60%	92	92	92	70%	92	92	92	80%	91	92	92	90%	91	92	92	100%	91	92	92
LOAD (%)	115VAC (%)	230VAC (%)	277VAC (%)																																													
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50%	92	92	92																																													
60%	92	92	92																																													
70%	92	92	92																																													
80%	91	92	92																																													
90%	91	92	92																																													
100%	91	92	92																																													
6	INRUSH CURRENT(Typ.)	230V/60A 115V/35A COLD START	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =48.2A/ 230VAC I =19.4A/ 115VAC T50=1860us/230V																																												



### PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105 %~ 140 %	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P: TESTING Ta: 25°C	125.76%/ 264VAC 125.76%/ 230VAC 125.76%/100VAC PROTECTION TYPE : Constant current limiting, unit will shut down after 3 sec. re-power on to recover
2	OVER VOLTAGE PROTECTION	41.4V~48.6V	I/P: 264VAC I/P: 230VAC I/P: 90VAC O/P: MIN LOAD Ta: 25°C	44.8V/ 264VAC 44.8V/ 230VAC 44.8V/ 90VAC PROTECTION TYPE : Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 264VAC I/P: 90VAC O/P: FULL LOAD	O.T.P. Active OK Protection type : Shut down o/p voltage, re-power on to recover

### CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	FAN ON/OFF CONTROL (Typ)	RTH3 ≥ 50°C FAN ON RTH3 ≤ 40°C FAN OFF	I/P: 230 VAC O/P: FULL LOAD	RTH3 > 50°C FAN ON RTH3 < 40°C FAN OFF

### COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor ( D to S) or (C to E) Peak Voltage	Q2 Rated 18A/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/ 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.  I/P:Low-Line -3V = 97V 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. Ta:25°C	VDS: (1) 479V (2) 467V (3) 471V (4) 475V (5) 475V (6) 487V (7) 467V  VDS: (1) 294V (2) 332V (3) 284V (4) 288V (5) 288V (6) 292V (7) 324V
2	Diode Peak Voltage	D101 Rated 30A/150V  D104 Rated 30A/150V	AC ON/OFF  I/P:High-Line +3V =267 V 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  Ta:25°C	D101:                   D104: VDS:                    VDS: (1) 95.3V               (1) 94.5V (2) 8.09V              (2) 12.7V (3) 94.5V              (3) 95.5V (4) 95.3V              (4) 94.7V (5) 95.3V              (5) 96.3V (6) 94.5V              (6) 96.3V (7) 96.1V              (7) 101.2V (8) 91.3V              (8) 90.5V

3	Input Voltage	Capacitor C5 Rated: 680μ / 200 V	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)195V (2)193V (3)195V (4) 195V
4	Control IC Test	IC Voltage PWM IC U2 Rated 8.9V~ 15.5V	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) (6)NO LOAD(AC continue) Ta:25°C	U2 (1) 14.9V (2) 14.9V (3) 14.9V (4) 14.9V (5) 14.9V (6) 13.7V
5	VCC Diode Peak Voltage	D30 Rated : 400V 1A  D34 Rated : 400 V 2 A  D200 Rated : 400V 2A	AC ON/OFF  I/P : High-Line +3V = 267 V O/P : (1) Full load (2) Full load continue (3) Dynamic Load 90%Duty/1KHz  Ta : 25°C	D30 (1)68.4 V (2)55.5 V (3) 70.0V  D200 (1) 51.1V (2) 38.8V (3)51.7V  D34 (1)53.5V (2) 43.9V (3) 53.5V

## ■ SAFETY& E.M.C. TEST

### SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG :2KVAC/min O/P-FG:0.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:0.6 KVAC/min Ta:25°C	I/P-O/P:2.508mA I/P-FG:2.248mA O/P-FG:2.557m A 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: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C	I/P-O/P: 9999MΩ I/P-FG: 9999MΩ O/P-FG: 9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	3 mΩ

### E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONDUCTION	EN55032 CLASS A	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
2	RADIATION	EN55032 CLASS A	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
3	E.S.D	EN61000-4-2 INDUSTRY AIR : 8KV / Contact : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
4	E.F.T	EN61000-4-4 INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	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
6	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 : LRS-450-24 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=32.5 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=53.4 °C																																																																										
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta=32.5 °C</th> <th>HIGH AMBIENT Ta=50 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>43.0°C</td><td>60.7°C</td></tr> <tr><td>2</td><td>C5</td><td>44.2°C</td><td>61.9°C</td></tr> <tr><td>3</td><td>C6</td><td>43.8°C</td><td>61.0°C</td></tr> <tr><td>4</td><td>Q1</td><td>53.0°C</td><td>72.8°C</td></tr> <tr><td>5</td><td>Q2</td><td>59.2°C</td><td>80.1°C</td></tr> <tr><td>6</td><td>C36</td><td>42.8°C</td><td>62.8°C</td></tr> <tr><td>7</td><td>T1</td><td>77.5°C</td><td>99.7°C</td></tr> <tr><td>8</td><td>RG201</td><td>53.3°C</td><td>72.1°C</td></tr> <tr><td>9</td><td>C205</td><td>45.6°C</td><td>64.4°C</td></tr> <tr><td>10</td><td>Q100</td><td>52.6°C</td><td>71.3°C</td></tr> <tr><td>11</td><td>Q101</td><td>47.6°C</td><td>66.0°C</td></tr> <tr><td>12</td><td>Q103</td><td>61.2°C</td><td>81.1°C</td></tr> <tr><td>13</td><td>Q104</td><td>59.6°C</td><td>78.0°C</td></tr> <tr><td>14</td><td>C105</td><td>38.4°C</td><td>58.2°C</td></tr> <tr><td>15</td><td>C106</td><td>40.5°C</td><td>60.6°C</td></tr> <tr><td>16</td><td>J111</td><td>57.8°C</td><td>75.9°C</td></tr> <tr><td>17</td><td>RTH3</td><td>52.4°C</td><td>70.6°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=32.5 °C	HIGH AMBIENT Ta=50 °C	1	BD1	43.0°C	60.7°C	2	C5	44.2°C	61.9°C	3	C6	43.8°C	61.0°C	4	Q1	53.0°C	72.8°C	5	Q2	59.2°C	80.1°C	6	C36	42.8°C	62.8°C	7	T1	77.5°C	99.7°C	8	RG201	53.3°C	72.1°C	9	C205	45.6°C	64.4°C	10	Q100	52.6°C	71.3°C	11	Q101	47.6°C	66.0°C	12	Q103	61.2°C	81.1°C	13	Q104	59.6°C	78.0°C	14	C105	38.4°C	58.2°C	15	C106	40.5°C	60.6°C	16	J111	57.8°C	75.9°C	17	RTH3	52.4°C	70.6°C
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : 114.3 % LOAD Ta : 25°C	TEST : OK																																																																								
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/100VAC O/P : 100 % LOAD Ta=-25 °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	± 0.017 %/°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	-20~50°C	1. Thermal shock Temperature : -25°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, 5G 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 : 6G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C
9	CAPACITOR LIFE CYCLE	SUPPOSE C106 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	(1) 2018883HRS (2) 298035HRS (3) 415821HRS (4) 510272HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1508.9K hrs min. Telcordia SR-332 (Bellcore) ; 252.2K 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	WUWQ/HUANGMK	WENF	LINKX

2020.10.1 TAG-QA-009