



Test Report: HRP-600N-36

600W 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

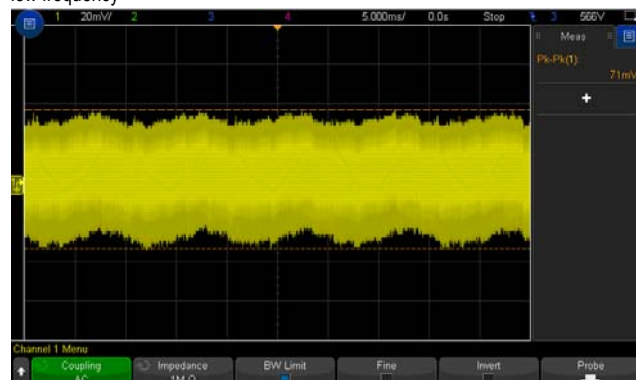
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 28.8 V~ 39.6 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	27.641V~42.92V/230VAC 27.642V~42.92V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.0 %~ +1.0 %	I/P: 85VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.0139%~ 0.0139 %
3	LINE REGULATION (Max)	V1: -0.2 %~ +0.2 %	I/P: 85VAC~264VAC O/P:FULL LOAD Ta:25°C	V1: -0.0028%~ 0.0083%
4	LOAD REGULATION(Max)	V1: -0.5 %~ +0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.0139%~ 0.0139 %
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	1.6%
6	RIPPLE & NOISE(Max)	V1: 200mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 71mVp-p

high frequency :



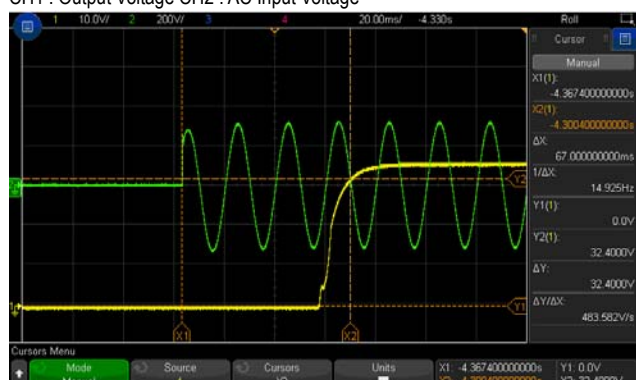
low frequency :



7	SET UP TIME(Max)	230VAC/ 1800ms 115VAC/ 3600ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 67 ms 115VAC/ 150 ms
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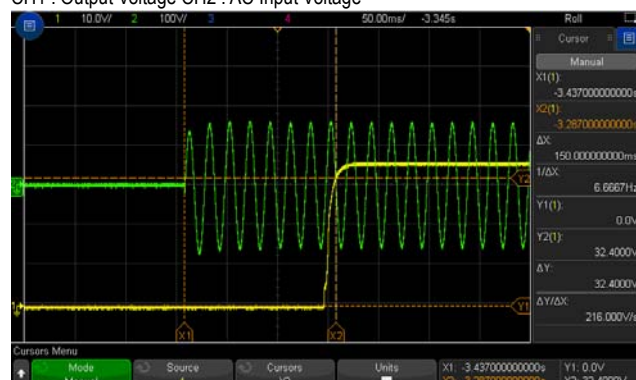
INPUT=230VAC/50HZ @ FULL LOAD

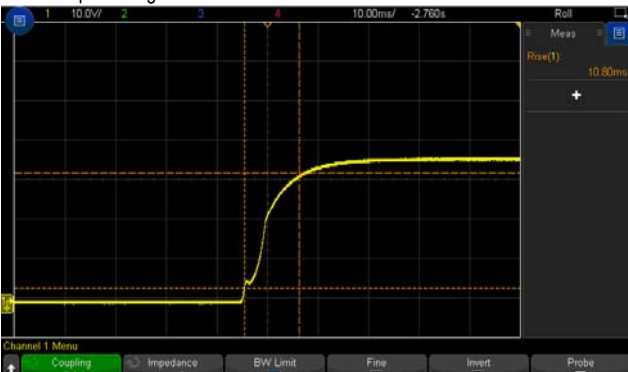
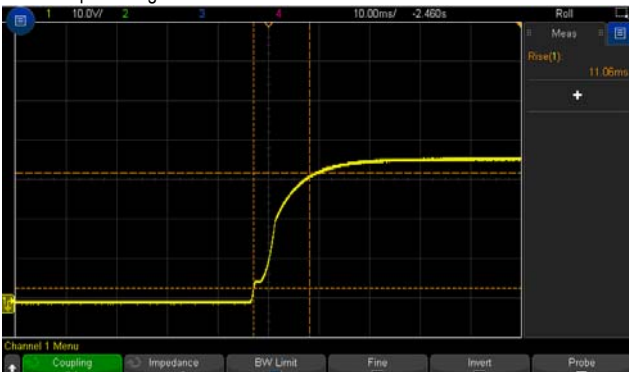
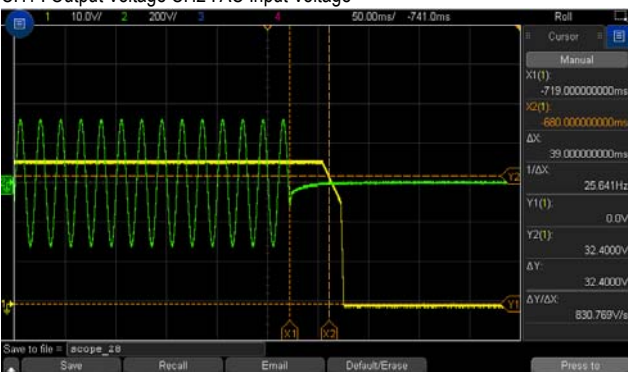
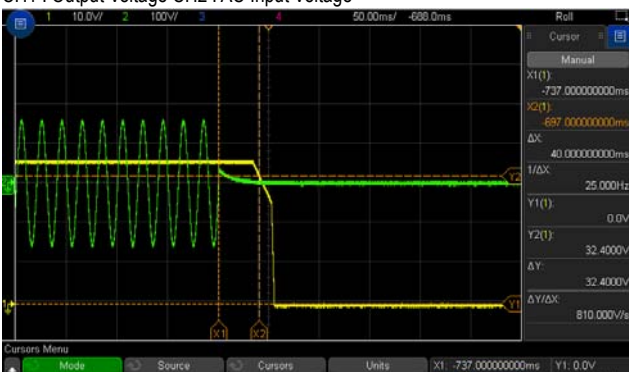
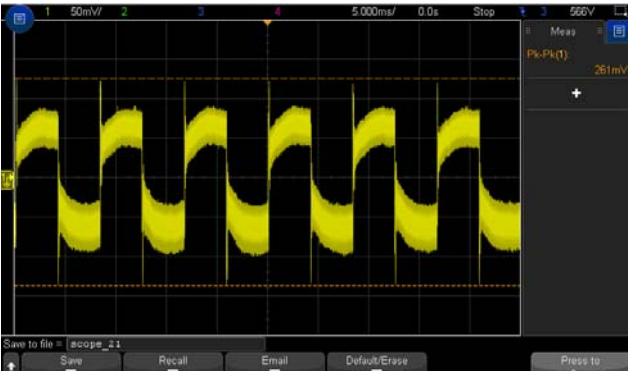
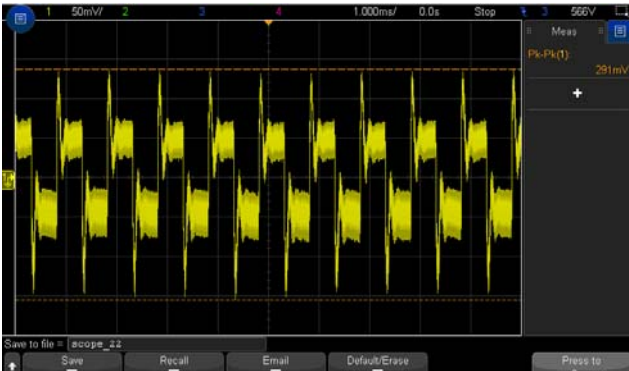
CH1 : Output Voltage CH2 : AC Input Voltage

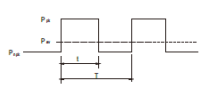
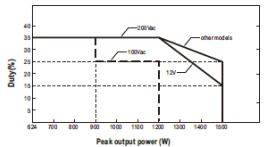


INPUT=115VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



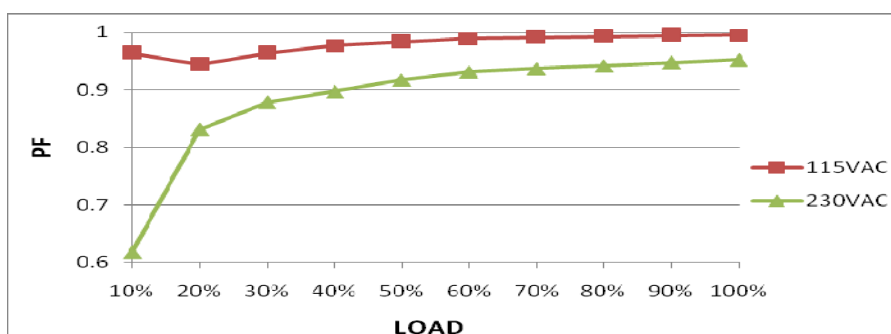
8	RISE TIME (Max)	230VAC/50ms 115VAC/50ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 10.8 ms 115VAC/ 11.06 ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage 	
9	HOLD UP TIME (Typ.)	230VAC/16ms 115VAC/16ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 39 ms 115VAC/ 40 ms
	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 /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	261mVp-p 291mVp-p
	FULL /50% LOAD 50%DUTY / 120HZ 		FULL /50% LOAD 50%DUTY / 1KHZ 	
11	PEAK POWER	NO DAMAGE	I/P : 230 VAC O/P:TESTING Ta:25°C	TEST:OK

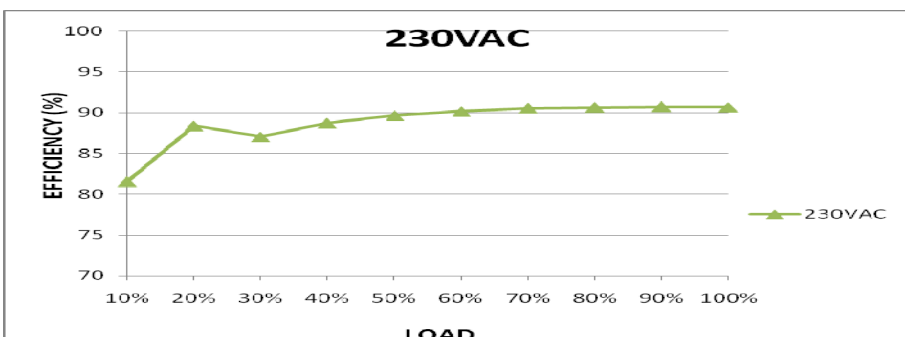
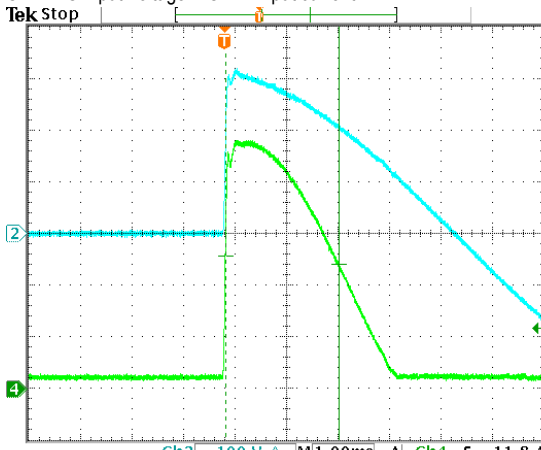
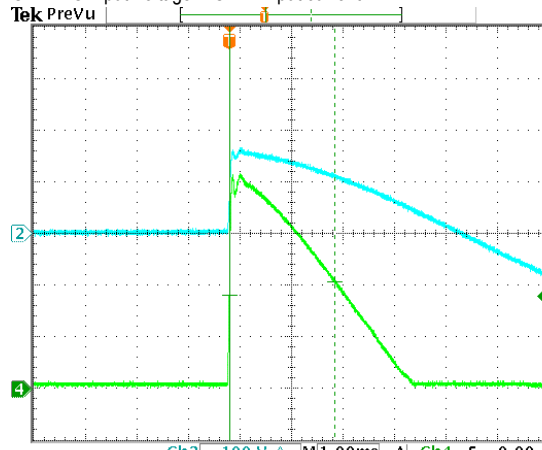
		$P_{avg} = \frac{P_{pk} \times t}{T} \leq P_{avg}$ $Duty \leq 100\% \leq 35\%$ $t \leq 5 \text{ sec}$   For example (12V model): $V_{in} = 100V$ $Duty_{max} = 20\%$ $P_{pk} = P_{rated} = 600W$ $P_{avg} = 1200W$ $t \leq 5 \text{ sec}$ $T \geq 20 \text{ sec}$ $P_{avg} = \frac{P_{pk} \times t}{T} = \frac{1200W \times 5}{20} = 300W \leq 600W$		
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INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	85VAC~264VAC 120VDC~ 370VDC	(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) 79.2V~264V (2) 106.77Vdc~370Vdc/FULL LOAD 107.09Vdc~370Vdc/50% LOAD (3) 106.77Vdc~370Vdc/FULL LOAD 107.09Vdc~370Vdc/50% LOAD
			I/P: LOW-LINE-3V=82 V HIGH-LINE+15%=300 V 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:85 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 3.6 A 115V/ 7.6A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I=3.17A/ 230VAC I=6.29A/115VAC
4	LEAKAGE CURRENT	< 1.5mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	1.263mA
5	POWER FACTOR (Typ.)	0.94/ 230VAC 0.98/115VAC	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF=0.9533/230VAC PF=0.9946/115VAC

P.F vs LOAD



6	EFFICIENCY(Typ.)	89%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	90.59%
EFFICIENCY vs LOAD 				
7	INRUSH CURRENT(Typ.)	230V/70A 115V/35A COLD START	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I=48.2A/ 230VAC I=20.9A/ 115VAC
INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current  INPUT=115VAC/ 60HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current 				

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105 %~ 200 % /5S 280% LOAD > 5s	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P:TESTING Ta:25°C	111.71%/ 264VAC 111.83%/ 230VAC 111.94%/100VAC 5S TEST: OK PROTECTION TYPE : Normally works within 105%~200% rated power for more than 5seconds and than shut down o/p voltage, re-power on to recover ; Constant current limiting for output power >280% rated for more than 5seconds and than shut down o/p voltage, re-power on to recover

2	OVER VOLTAGE PROTECTION	41.4V~48.6V	I/P: 264VAC I/P: 230VAC I/P: 85VAC O/P: MIN LOAD Ta: 25°C	46.0V/ 264VAC 46.0V/ 230VAC 46.0V/ 85VAC PROTECTION TYPE : Shut down o/p voltage , re-power on to recover .
3	OVER TEMPERATURE PROTECTION	Protection type : Shut down o/p voltage , recovers automatically after temperature goes down	I/P: 264VAC I/P: 85VAC O/P: FULL LOAD	O.T.P. Active Protection type : 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: 85VAC O/P: FULL LOAD Ta: 25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting, and shut down after 5 seconds , re-power on to recover .

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT						
1	REMOTE SENSE	S+ / S- >0.3V Compensate voltage drop on the load wiring up to 0.5V.	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	0.324V						
2	DC OK SIGNAL	High (3.3 ~ 5.6V) :PSU turn on Low (0 ~ 1V) : PSU turn off. I/P: 230 VAC O/P:FULL LOAD Ta:25°C Test Result : <table><tr><th>Vout</th><th>DC OK SIGNAL</th></tr><tr><td>PSU turn on</td><td>5.196V</td></tr><tr><td>PSU turn off</td><td>0V</td></tr></table>			Vout	DC OK SIGNAL	PSU turn on	5.196V	PSU turn off	0V
Vout	DC OK SIGNAL									
PSU turn on	5.196V									
PSU turn off	0V									
3	FAN ON/OFF CONTROL	Load 35±15% or RTH2≥50°C FAN ON	I/P: 230 VAC O/P:TESTING	<table><tr><td></td><td>RTH(°C)</td><td>LOAD(%)</td></tr><tr><td>FAN ON</td><td>OK</td><td>26.78%</td></tr></table>		RTH(°C)	LOAD(%)	FAN ON	OK	26.78%
	RTH(°C)	LOAD(%)								
FAN ON	OK	26.78%								

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q 3/Q4 Rated : 32A/ 650 V VGS ± 25 V	AC ON/OFF I/P: High-Line = 300V 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. Ta: 25°C	Q3 Q4 VDS: VDS: (1) 553V (1) 497V (2) 605V (2) 587V (3) 565V (3) 545V (4) 549V (4) 517V (5) 549V (5) 497V (6) 553V (6) 513V (7) 601V (7) 585V

2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated : 34 A/ 600 V	I/P: High-Line =264V AC ON/OFF 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℃	Q1 VDS: (1) 464V (2) 424V (3) 501V (4) 452V (5) 452V (6) 458V (7) 464V
3	P.F.C DIODE	D1 Rated : 6A/ 650 V	I/P: High-Line =264V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (4)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz Ta:25℃	(1) 400V (2) 408V (3) 396V (4) 392V
4	Diode Peak Voltage	Q101 Rated : 20 A/ 200 V Q104 Rated : 20 A/ 300 V	AC ON/OFF I/P: High-Line =300V VOmax 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 VO: O/P: (1)Full Load Ta:25℃	Q101: VOmax VDS: (1) 136.1V (2) 130.5V (3) 139.3V (4) 134.5V (5) 135V (6) 144.2V (7) 135.3V (8) 127.3V VO: (1) 135.3V Q104: VOmax VDS: (1) 220V (2) 264V (3) 246V (4) 236V (5) 230V (6) 220V (7) 240V (8) 214V VO: (1) 224V
5	Input Capacitor Voltage	C5 Rated: : 680 μ / 400 V	I/P High-Line =300V 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℃	(1) 397V (2) 396V (3) 397V (4) 384V
6	Control IC Voltage Test	PWM IC U1 Rated 11V~ 30 V O/P IC U202/ U203 Rated -0.3 V~ 30 V	AC ON/OFF I/P: High-Line =300V O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VRmin(LOW LINE) Ta:25℃	U1 (1) 16.8V (2) 17.6V (3) 17.0V (4) 17.0 (5) 15.4V U202/ U203 (1) 11.77V

			(2) 11.85V (3) 11.93V (4) 12.09V (5) 11.93V
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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℃	I/P-O/P:7.81mA I/P-FG:7.88mA O/P-FG:3.21mA 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℃	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℃	5 mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25℃	PASS
2	CONDUCTION	EN55032 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25℃	PASS Test by certified Lab
3	RADIATION	EN55032 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25℃	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 AIR: 8KV / Contact: 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
5	E.F.T	EN61000-4-4 INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
6	SURGE	IEC61000-4-5 L-N : 2KV L,N-PE : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
7	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 : HRP-600N-36 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 25.0 ℃ 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 50.0℃		

NO	Position	ROOM AMBIENT Ta= 25.0 °C	HIGH AMBIENT Ta= 50.0 °C
1	ZNR1	24.3°C	51.6°C
2	LF1	25.8°C	53.5°C
3	C61	25.1°C	52.5°C
4	LF2	25.1°C	52.7°C
5	RTH1	24.5°C	52.1°C
6	C10	25.6°C	53.1°C
7	BD1	39.1°C	66.7°C
8	Q2	38.1°C	66.6°C
9	TSW1	32.0°C	60.1°C
10	D1	43.7°C	72.1°C
11	L3	29.0°C	57.0°C
12	C5	27.9°C	55.4°C
13	U1	26.7°C	54.5°C
14	T2core	26.9°C	54.7°C
15	T2coil	27.1°C	55.0°C
16	T1 coil	51.7°C	80.2°C
17	T1 core	42.7°C	70.8°C
18	TSW2	48.6°C	76.7°C
19	Q102	47.6°C	75.7°C
20	D22	36.5°C	65.5°C
21	RTH2	32.1°C	60.6°C
22	RG1	40.3°C	69.2°C
23	U202	30.6°C	58.9°C
24	C106	33.8°C	62.5°C
25	Q103	45.0°C	72.6°C
26	Q105	45.3°C	73.2°C
27	L100	46.3°C	75.7°C
28	Q100	54.0°C	82.6°C
29	C107	33.0°C	61.5°C
30	J115	41.3°C	70.0°C
31	R106	51.5°C	83.6°C
32	R167	41.0°C	70.2°C
33	D30	31.9°C	60.1°C
34	Q19	27.6°C	55.7°C

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 111 % 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= -45 °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	$\pm 0.03 \text{ }^{\circ}\text{C} (0\sim 50^{\circ}\text{C})$	I/P : 230 VAC O/P : FULL LOAD	$\pm 0.0067 \text{ }^{\circ}\text{C} (0\sim 50^{\circ}\text{C})$
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	-40~50°C	1. Thermal shock Temperature : -45°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 : 10min/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) 2020906.8HRS (2) 276433.2HRS (3) 350899HRS (4) 403085.1HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 452.04K hrs min. Telcordia TR/SR-332 (Bellcore) ; 191.26K 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 :50,000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ

2018.4.30 GP-A50-F010