



# Test Report: HEP-1000-100

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1000W Switching Power Supply for Harsh Environment

## ■ 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

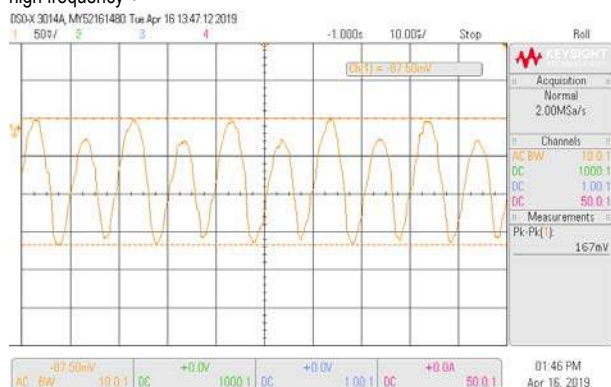
ENVIRONMENT TEST

## DESIGN VERIFY TEST

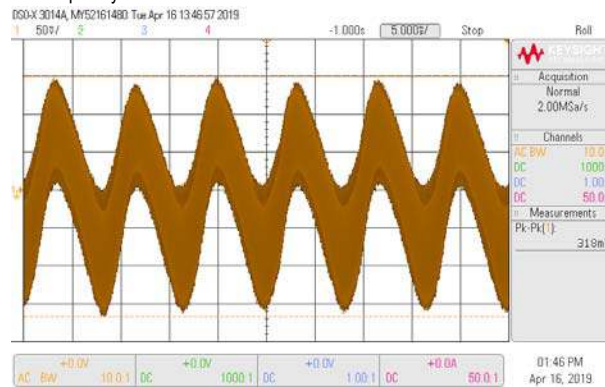
### OUTPUT FUNCTION TEST

| NO | TEST ITEM                        | SPECIFICATION    | TEST CONDITION                                                | RESULT                                          |
|----|----------------------------------|------------------|---------------------------------------------------------------|-------------------------------------------------|
| 1  | OUTPUT VOLTAGE<br>ADJUST RANGE   | CH1: 100V~ 125V  | I/P : 230 VAC<br>I/P : 115 VAC<br>O/P : MIN LOAD<br>Ta : 25°C | 97.65V~128.32V/230VAC<br>97.265V~128.31V/115VAC |
| 2  | OUTPUT VOLTAGE(Max)<br>TOLERANCE | V1: -1%~ +1%     | I/P: 90VAC /305VAC<br>O/P:FULL/ MIN. LOAD<br>Ta:25°C          | V1: - 0.065%~0.065%                             |
| 3  | LINE REGULATION (Max)            | V1: -0.5%~ +0.5% | I/P: 180VAC~ 305VAC<br>O/P:FULL LOAD<br>Ta:25°C               | V1: 0%~0.019 %                                  |
| 4  | LOAD REGULATION(Max)             | V1: -0.5%~ +0.5% | I/P: 230VAC<br>O/P:FULL ~MIN LOAD<br>Ta:25°C                  | V1: -0.069%~ 0.049 %                            |
| 5  | OVER/UNDERSHOOT TEST             | < ±5%            | I/P: 230VAC<br>O/P:FULL LOAD<br>Ta:25°C                       | < 5 %                                           |
| 6  | RIPPLE & NOISE(Max )             | V1: 500mVp-p     | I/P:230VAC<br>O/P:FULL LOAD<br>Ta:25°C                        | V1:318mVp-p                                     |

high frequency :



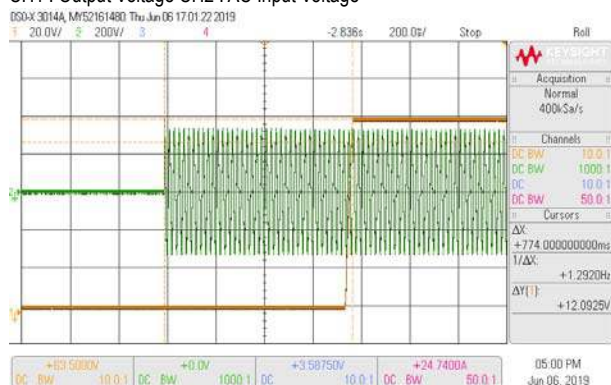
low frequency :



|   |                  |                                |                                                                                  |                                  |
|---|------------------|--------------------------------|----------------------------------------------------------------------------------|----------------------------------|
| 7 | SET UP TIME(Max) | 230VAC/1800ms<br>115VAC/1800ms | I/P : 230 VAC<br>O/P : FULL LOAD<br>I/P : 115 VAC<br>O/P : 71% LOAD<br>Ta : 25°C | 230VAC/ 774 ms<br>115VAC/ 822 ms |
|---|------------------|--------------------------------|----------------------------------------------------------------------------------|----------------------------------|

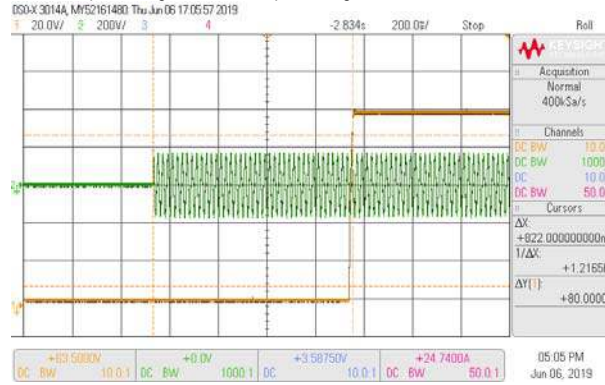
INPUT=230VAC/50HZ @ FULL LOAD

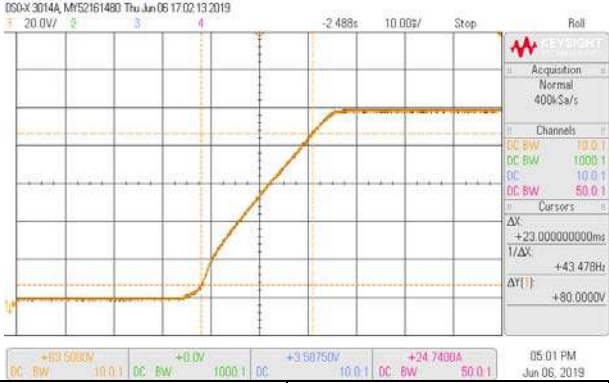
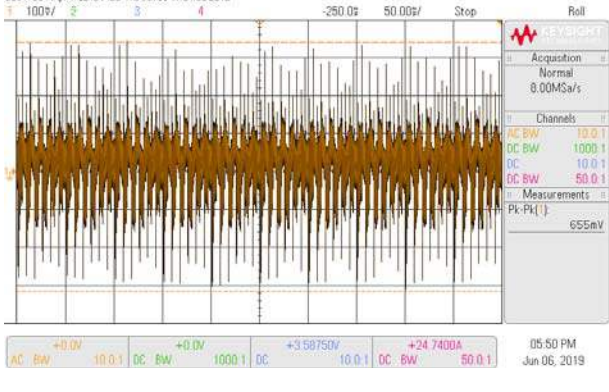
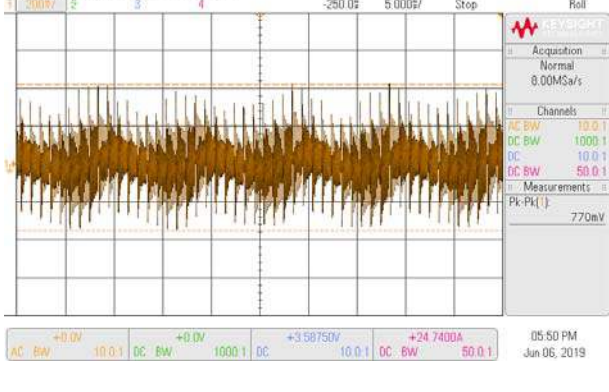
CH1 : Output Voltage CH2 : AC Input Voltage



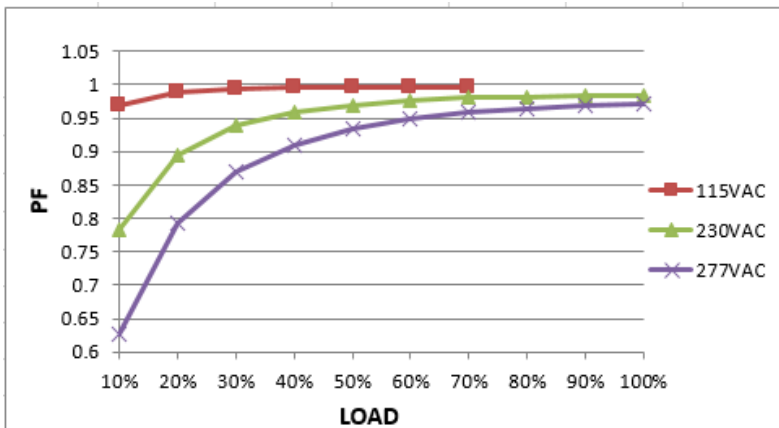
INPUT=115VAC/60HZ @ 71% LOAD

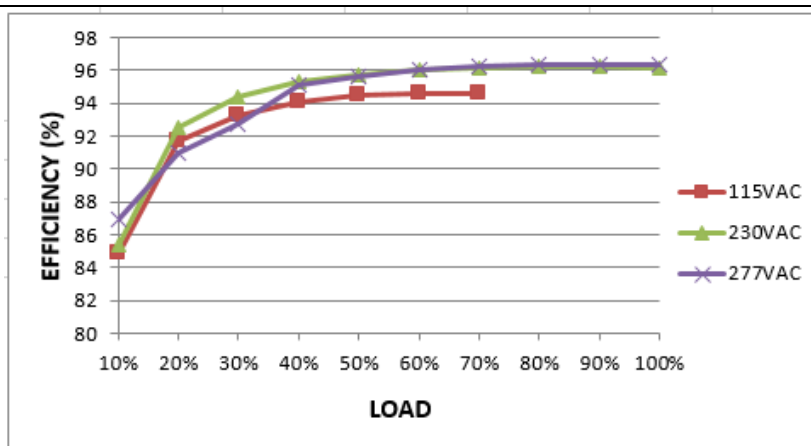
CH1 : Output Voltage CH2 : AC Input Voltage

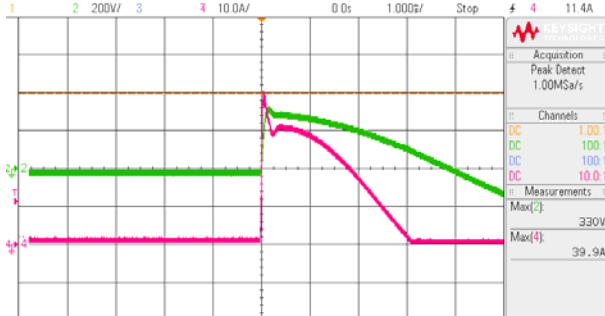


|                                                                                                                                                                     |                                                                           |                                                                                                                                                                     |                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| 8                                                                                                                                                                   | RISE TIME (Max)<br><br>230VAC/80ms<br>115VAC/80ms                         | I/P : 230 VAC<br>O/P : FULL LOAD<br>I/P : 115 VAC<br>O/P : 71% LOAD<br>Ta : 25°C                                                                                    | 230VAC/ 23 ms<br>115VAC/ 13.1 ms                     |
| INPUT=230VAC/50HZ @ FULL LOAD<br>CH1 : Output Voltage<br>                          |                                                                           | INPUT=115VAC/60HZ @ 71% LOAD<br>CH1 : Output Voltage<br>                          |                                                      |
| 9                                                                                                                                                                   | HOLD UP TIME (Typ.)<br><br>230VAC/12ms @FULL LOAD<br>230VAC/16ms @75%LOAD | I/P : 230 VAC<br>O/P : FULL LOAD /75% LOAD<br>Ta : 25°C                                                                                                             | 230VAC/ 19.8 ms@ FULL LOAD<br>230VAC/ 31.2ms@75%LOAD |
| INPUT=230VAC/50HZ @ FULL LOAD<br>CH1 : Output Voltage CH2 : AC Input Voltage<br> |                                                                           | INPUT=230VAC/50HZ @ 75% LOAD<br>CH1 : Output Voltage CH2 : AC Input Voltage<br> |                                                      |
| 10                                                                                                                                                                  | DYNAMIC LOAD<br><br>V1: 10000mVp-p                                        | I/P: 230VAC<br>O/P:<br>(1)FULL /50% LOAD 50%DUTY / 120HZ<br>(2)FULL /50% LOAD 50%DUTY / 1KHZ<br>Ta:25°C                                                             | 655mVp-p<br>770mVp-p                                 |
| FULL /50% LOAD 50%DUTY / 120HZ<br>                                               |                                                                           | FULL /50% LOAD 50%DUTY / 1KHZ<br>                                               |                                                      |

## INPUT FUNCTION TEST

| NO                                                                                               | TEST ITEM             | SPECIFICATION                               | TEST CONDITION                                                                                                                                                    | RESULT                                                |
|--------------------------------------------------------------------------------------------------|-----------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| 1                                                                                                | INPUT VOLTAGE RANGE   | 90VAC~305VAC                                | I/P:TESTING<br>O/P:FULL LOAD/ Derating Load<br>Ta:25°C                                                                                                            | 158V~305V/ Full Load<br>57V~305V/ Derating Load       |
|                                                                                                  |                       |                                             | I/P:<br>LOW-LINE-3V=87 V<br>HIGH-LINE+15%=315 V<br>O/P:FULL/MIN LOAD<br>(PLEASE CHECK DERATING CURVE)<br>ON: 30 Sec OFF: 30 Sec 10MIN<br>(POWER ON/OFF NO DAMAGE) | TEST:OK                                               |
| 2                                                                                                | INPUT FREQUENCY RANGE | 47HZ ~63 HZ<br>NO DAMAGE                    | I/P:90 VAC ~305 VAC<br>O/P:FULL~MIN LOAD<br>Ta:25°C                                                                                                               | TEST: OK                                              |
| 3                                                                                                | INPUT CURRENT (Typ.)  | 277V/ 4.5A<br>230V/ 5.3A<br>115V/ 10.1A     | I/P : 277 VAC<br>I/P : 230 VAC<br>O/P : FULL LOAD<br>I/P : 115 VAC<br>O/P : 71% LOAD<br>Ta : 25°C                                                                 | I=3.92A/ 277VAC<br>I=4.65A/ 230VAC<br>I=6.56A/ 115VAC |
| 4                                                                                                | LEAKAGE CURRENT       | <0.75 mA / 240 VAC                          | I/P : 240 VAC<br>O/P : Min LOAD<br>Ta : 25°C                                                                                                                      | L-FG : 0.48 mA<br>N-FG : 0.52 mA                      |
| 5                                                                                                | POWER FACTOR (Typ.)   | 0.93/ 277VAC<br>0.95/ 230VAC<br>0.99/115VAC | I/P : 277 VAC<br>I/P : 230 VAC<br>O/P : FULL LOAD<br>I/P : 115 VAC<br>O/P : 71% LOAD<br>Ta : 25°C                                                                 | PF=0.967/277VAC<br>PF=0.983/230VAC<br>PF=0.995/115VAC |
| P.F vs LOAD  |                       |                                             |                                                                                                                                                                   |                                                       |
| 6                                                                                                | EFFICIENCY(Typ.)      | 96%                                         | I/P:230 VAC<br>O/P:FULL LOAD<br>Ta:25°C                                                                                                                           | 96.2%                                                 |
| EFFICIENCY vs LOAD                                                                               |                       |                                             |                                                                                                                                                                   |                                                       |



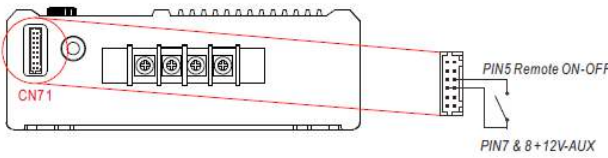
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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------------|-----------------------------------------------|--------------------------------------|
| 7                                                                                                                                                                                                                                                                                                    | INRUSH CURRENT(Typ.) | 230V/40A<br>COLD START | I/P : 230 VAC<br>O/P : FULL LOAD<br>Ta : 25°C | I=39.9A/ 230VAC<br>T50= 1760 us/230V |
| <p>INPUT=230VAC/50HZ @ FULL LOAD</p> <p>CH2 : AC Input Voltage CH4 : Input current</p> <p>030-X 3024A, MY55140430 Thu Jun 06 15:08:10 2019</p>  <p>Max(2): 330V<br/>Max(4): 39.9A</p> <p>03:07 PM Jun 06, 2019</p> |                      |                        |                                               |                                      |

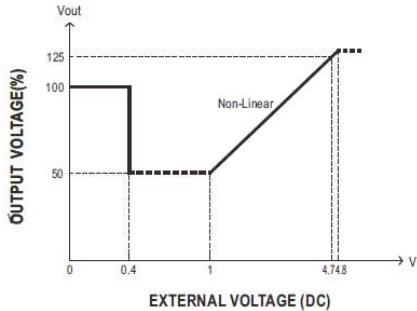
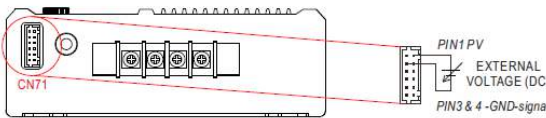
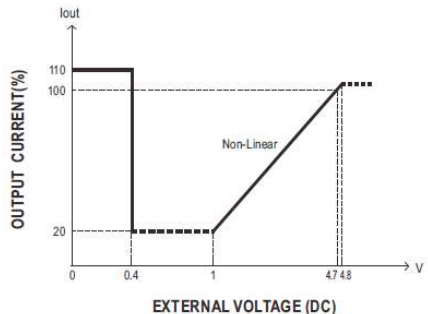
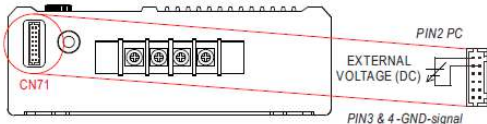
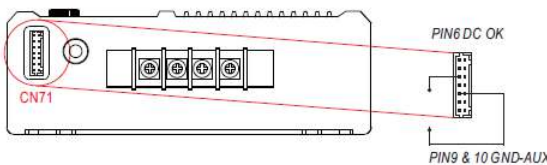
## PROTECTION FUNCTION TEST

| NO | TEST ITEM                   | SPECIFICATION                                                                                                       | TEST CONDITION                                                      | RESULT                                                                                                                                                     |
|----|-----------------------------|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | OVER LOAD PROTECTION        | 105%~ 125%<br>PROTECTION TYPE :<br>Constant current limiting,unit will shutdown after 5 sec,re-power on to recover. | I/P: 305VAC<br>I/P: 230VAC<br>I/P: 180VAC<br>O/P:TESTING<br>Ta:25°C | 112.6%/ 305VAC<br>112.6%/ 230VAC<br>112.6%/180VAC<br>PROTECTION TYPE :<br>Constant current limiting,unit will shutdown after 5 sec,re-power on to recover. |
| 2  | OVER VOLTAGE PROTECTION     | 125V~145V<br>Protection type :<br>Shut down O/P voltage,re-power on to recover.                                     | I/P: 305VAC<br>I/P: 230VAC<br>I/P: 90VAC<br>O/P:MIN LOAD<br>Ta:25°C | 134.5V/ 305VAC<br>134.19V/ 230VAC<br>134.43V/ 90VAC<br>PROTECTION TYPE :<br>Shut down O/P voltage,re-power on to recover.                                  |
| 3  | OVER TEMPERATURE PROTECTION | Protection type :<br>Shut down O/P voltage,, recovers automatically after temperature goes down                     | I/P: 305VAC<br>O/P:FULL LOAD<br>I/P: 90VAC<br>O/P:70% LOAD          | O.T.P.Active<br>Protection type :<br>Shut down O/P voltage,, recovers automatically after temperature goes down                                            |

|   |                  |                                                                                                                                                 |                                                        |                                                                                                                    |
|---|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| 4 | SHORT PROTECTION | SHORT EVERY OUTPUT<br>1 HOUR NO DAMAGE<br>PROTECTION TYPE :<br>Constant current limiting,unit will shutdown after 5 sec,re-power on to recover. | I/P: 305VAC<br>I/P: 90VAC<br>O/P: FULL LOAD<br>Ta:25°C | NO DAMAGE<br>PROTECTION TYPE :<br>Constant current limiting,unit will shutdown after 5 sec,re-power on to recover. |
|---|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|

## CONTROL FUNCTION TEST

| NO                         | TEST ITEM             | SPECIFICATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | TEST CONDITION | RESULT |                            |                     |          |             |            |             |               |                     |               |    |              |     |
|----------------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------|----------------------------|---------------------|----------|-------------|------------|-------------|---------------|---------------------|---------------|----|--------------|-----|
| 1                          | AUXILIARY POWER (AUX) | <div>I/P: 230 VAC<br/>O/P:FULL LOAD<br/>Ta:25°C<br/>Test Result :</div> <table><tr><td>AUX</td><td>TOLERANCE</td><td>RIPPLE</td><td>TEST RESULT</td></tr><tr><td>12V / 0.5A</td><td>10.8~13.2 V</td><td>150mVp-p</td><td>11.7V/21mvp-p</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                     |                |        | AUX                        | TOLERANCE           | RIPPLE   | TEST RESULT | 12V / 0.5A | 10.8~13.2 V | 150mVp-p      | 11.7V/21mvp-p       |               |    |              |     |
| AUX                        | TOLERANCE             | RIPPLE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TEST RESULT    |        |                            |                     |          |             |            |             |               |                     |               |    |              |     |
| 12V / 0.5A                 | 10.8~13.2 V           | 150mVp-p                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 11.7V/21mvp-p  |        |                            |                     |          |             |            |             |               |                     |               |    |              |     |
| 2                          | REMOTE ON/OFF CONTROL | <div>The power supply can be turned ON/OFF individually or along with other units in parallel by using the "Remote ON-OFF" function.</div> <div></div> <div><div>I/P: 230 VAC<br/>O/P:FULL LOAD<br/>Ta:25°C<br/>Test Result :</div><table><tr><td>Between ON/OFF and +5V-AUX</td><td>Power Supply Status</td></tr><tr><td>SW SHORT</td><td>ON</td></tr><tr><td>SW OPEN</td><td>OFF</td></tr></table></div> <table><tr><td>Remote ON-OFF</td><td>Power Supply Status</td></tr><tr><td>Short circuit</td><td>ON</td></tr><tr><td>Open circuit</td><td>OFF</td></tr></table> |                |        | Between ON/OFF and +5V-AUX | Power Supply Status | SW SHORT | ON          | SW OPEN    | OFF         | Remote ON-OFF | Power Supply Status | Short circuit | ON | Open circuit | OFF |
| Between ON/OFF and +5V-AUX | Power Supply Status   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |        |                            |                     |          |             |            |             |               |                     |               |    |              |     |
| SW SHORT                   | ON                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |        |                            |                     |          |             |            |             |               |                     |               |    |              |     |
| SW OPEN                    | OFF                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |        |                            |                     |          |             |            |             |               |                     |               |    |              |     |
| Remote ON-OFF              | Power Supply Status   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |        |                            |                     |          |             |            |             |               |                     |               |    |              |     |
| Short circuit              | ON                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |        |                            |                     |          |             |            |             |               |                     |               |    |              |     |
| Open circuit               | OFF                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |        |                            |                     |          |             |            |             |               |                     |               |    |              |     |

| 3                | OUTPUT VOLTAGE PROGRAMMABLE(PV)  | <p>※ In addition to the adjustment via the built-in potentiometer, the output voltage can be trimmed by applying EXTERNAL VOLTAGE.</p> <div></div> <p>I/P: 230 VAC<br/>O/P:FULL LOAD<br/>Ta:25°C<br/>TEST RESULT :</p> <table><tr><th>PV</th><th>&lt;0.4V</th><th>1V</th><th>4.7V</th><th>4.8V</th></tr><tr><th>MODEL</th><td></td><td></td><td></td><td></td></tr><tr><th>SPEC</th><td>100V±5%</td><td>50V±5%</td><td>125V±5%</td><td>127V±5%</td></tr><tr><th>Vout</th><td>100.01V</td><td>49.83V</td><td>124.97V</td><td>127.26V</td></tr></table> | PV           | <0.4V               | 1V               | 4.7V | 4.8V            | MODEL |              |                     |                  |           | SPEC            | 100V±5%     | 50V±5% | 125V±5% | 127V±5% | Vout | 100.01V | 49.83V | 124.97V | 127.26V |
|------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------|------------------|------|-----------------|-------|--------------|---------------------|------------------|-----------|-----------------|-------------|--------|---------|---------|------|---------|--------|---------|---------|
| PV               | <0.4V                            | 1V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4.7V         | 4.8V                |                  |      |                 |       |              |                     |                  |           |                 |             |        |         |         |      |         |        |         |         |
| MODEL            |                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |                     |                  |      |                 |       |              |                     |                  |           |                 |             |        |         |         |      |         |        |         |         |
| SPEC             | 100V±5%                          | 50V±5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 125V±5%      | 127V±5%             |                  |      |                 |       |              |                     |                  |           |                 |             |        |         |         |      |         |        |         |         |
| Vout             | 100.01V                          | 49.83V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 124.97V      | 127.26V             |                  |      |                 |       |              |                     |                  |           |                 |             |        |         |         |      |         |        |         |         |
| 4                | OUTPUT CURRENT PROGRAMMABLE (PC) | <p>※ The output current can be trimmed to 20~100% of the rated current by applying EXTERNAL VOLTAGE.</p> <div></div> <p>I/P: 230 VAC<br/>O/P:TESTING<br/>Ta:25°C</p> <table><tr><th>ADJ V</th><th>&lt;0.4V</th><th>1V</th><th>4.7V</th><th>4.8V</th></tr><tr><th>SPEC</th><td>110%±5%</td><td>20%±5%</td><td>100%±5%</td><td>100%±5%</td></tr><tr><th>TEST</th><td>111.10%</td><td>21.10%</td><td>101.20%</td><td>103.80%</td></tr></table>                                                                                                       | ADJ V        | <0.4V               | 1V               | 4.7V | 4.8V            | SPEC  | 110%±5%      | 20%±5%              | 100%±5%          | 100%±5%   | TEST            | 111.10%     | 21.10% | 101.20% | 103.80% |      |         |        |         |         |
| ADJ V            | <0.4V                            | 1V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4.7V         | 4.8V                |                  |      |                 |       |              |                     |                  |           |                 |             |        |         |         |      |         |        |         |         |
| SPEC             | 110%±5%                          | 20%±5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 100%±5%      | 100%±5%             |                  |      |                 |       |              |                     |                  |           |                 |             |        |         |         |      |         |        |         |         |
| TEST             | 111.10%                          | 21.10%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 101.20%      | 103.80%             |                  |      |                 |       |              |                     |                  |           |                 |             |        |         |         |      |         |        |         |         |
| 5                | DC-OK SIGNAL                     | <p>DC-OK signal is a TTL level signal. The maximum source current is 10mA and the maximum external voltage is 5.5V.</p> <div><table><tr><th>DC-OK signal</th><th>Power Supply Status</th></tr><tr><td>"High" &gt;4.4~5.5V</td><td>ON</td></tr><tr><td>"Low" &lt;0.5~0.5V</td><td>OFF</td></tr></table></div> <p>I/P:230VAC<br/>O/P:FULL LOAD<br/>Ta:25°C</p> <table><tr><th>DC-OK signal</th><th>Power Supply Status</th></tr><tr><td>"High" &gt;4.5~5.5V</td><td>ON(5.15v)</td></tr><tr><td>"Low" &lt;0.5~0.5V</td><td>OFF(-0.04V)</td></tr></table>                                                                                  | DC-OK signal | Power Supply Status | "High" >4.4~5.5V | ON   | "Low" <0.5~0.5V | OFF   | DC-OK signal | Power Supply Status | "High" >4.5~5.5V | ON(5.15v) | "Low" <0.5~0.5V | OFF(-0.04V) |        |         |         |      |         |        |         |         |
| DC-OK signal     | Power Supply Status              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |                     |                  |      |                 |       |              |                     |                  |           |                 |             |        |         |         |      |         |        |         |         |
| "High" >4.4~5.5V | ON                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |                     |                  |      |                 |       |              |                     |                  |           |                 |             |        |         |         |      |         |        |         |         |
| "Low" <0.5~0.5V  | OFF                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |                     |                  |      |                 |       |              |                     |                  |           |                 |             |        |         |         |      |         |        |         |         |
| DC-OK signal     | Power Supply Status              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |                     |                  |      |                 |       |              |                     |                  |           |                 |             |        |         |         |      |         |        |         |         |
| "High" >4.5~5.5V | ON(5.15v)                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |                     |                  |      |                 |       |              |                     |                  |           |                 |             |        |         |         |      |         |        |         |         |
| "Low" <0.5~0.5V  | OFF(-0.04V)                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |                     |                  |      |                 |       |              |                     |                  |           |                 |             |        |         |         |      |         |        |         |         |

## CHARGER MODE

### OUTPUT FUNCTION TEST

| NO | TEST ITEM            | SPECIFICATION | TEST CONDITION                              | RESULT   |
|----|----------------------|---------------|---------------------------------------------|----------|
| 1  | BOOST CHARGE VOLTAGE | 115.2V±1V     | I/P: 230 VAC<br>O/P: C.V MODE-1V<br>Ta:25°C | 115.18 V |
| 2  | FLOAT CHARGE VOLTAGE | 110.4V±1V     | I/P: 230 VAC<br>O/P: C.V MODE-1V<br>Ta:25°C | 110.44V  |
| 3  | OUTPUT CURRENT       | 8.7A±0.22A    | I/P: 230 VAC<br>O/P: C.V MODE-1V<br>Ta:25°C | 8.8A     |

### INPUT FUNCTION TEST

| NO | TEST ITEM           | SPECIFICATION                                   | TEST CONDITION                                                             | RESULT                                                   |
|----|---------------------|-------------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------|
| 1  | INPUT CURRENT (TYP) | 230 V/ 4.5A<br>230 V/ 5.3 A<br>115 V/ 10.1 A    | I/P: 277VAC<br>I/P: 230 VAC<br>I/P: 115 VAC<br>O/P: C.V MODE-1V<br>Ta:25°C | I =3.91A/ 277VAC<br>I =4.61A/ 230VAC<br>I =6.92A/ 115VAC |
| 2  | POWER FACTOR (TYP)  | 0.93/ 277 VAC<br>0.95/ 230 VAC<br>0.99/ 115 VAC | I/P: 277VAC<br>I/P: 230 VAC<br>I/P: 115 VAC<br>O/P: C.V MODE-1V<br>Ta:25°C | PF= 0.97/ 277VAC<br>PF= 0.99/ 230VAC<br>PF=0.99/ 115VAC  |
| 3  | EFFICIENCY (TYP)    | 96%                                             | I/P: 230 VAC<br>O/P: C.V MODE-1V<br>Ta:25°C                                | 96.2%                                                    |

## COMPONENT STRESS TEST

| NO | TEST ITEM                                              | SPECIFICATION           | TEST CONDITION                                                                                                                                                                                                                                                                                                                                           | RESULT                                                                                 |
|----|--------------------------------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 1  | PWM Transistor<br>( D to S) or (C to E) Peak Voltage   | Q902 Rated<br>16A/ 650V | AC ON/OFF<br><br>I/P:High-Line +3V =308V<br>VDS:<br>O/P: (1)Full Load<br>(2)Output Short<br>(3)Dynamic Load Full Load/<br>Min. Load 90%Duty/1KHz<br>(4)Dynamic Load Full Load/<br>Min. Load 90%Duty/3KHz<br>(5)Dynamic Load Full Load/<br>Min. Load 90%Duty/5KHz<br>(6)Dynamic Load 100% Load/<br>Min. Load 50%Duty/120Hz<br>(7)0%→400% Load.<br>Ta:25°C | VDS<br>(1) 435V<br>(2) 439V<br>(3) 439V<br>(4) 435V<br>(5) 439V<br>(6) 439V<br>(7)447V |
| 2  | P.F.C Transistor<br>( D to S) or (C to E) Peak Voltage | Q66 Rated<br>16A/ 650V  | I/P:High-Line +3V =308V<br>AC ON/OFF<br>O/P: (1)Full Load                                                                                                                                                                                                                                                                                                | VDS<br>(1) 451V                                                                        |

|   |                         |                                                  |                                                                                                                                                                                                                                                                                                                                                            |                                                                                                       |
|---|-------------------------|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
|   |                         |                                                  | (2)Output Short<br>(3)Dynamic Load Full Load/<br>Min. Load 90%Duty/1KHz<br>(4)Dynamic Load Full Load/<br>Min. Load 90%Duty/3KHz<br>(5)Dynamic Load Full Load/<br>Min. Load 90%Duty/5KHz<br>(6)Dynamic Load 100% Load/<br>Min. Load 50%Duty/120Hz<br>(7)0%→400% Load.<br>Ta:25℃                                                                             | (2) 451V<br>(3) 451V<br>(4) 451V<br>(5) 447V<br>(6) 443V<br>(7) 451V                                  |
| 3 | P.F.C DIODE             | D14 Rated<br>8A/ 650V                            | I/P:High-Line +3V =308V<br>AC ON/OFF<br>O/P: (1)Full Load<br>(2)Output Short<br>Ta:25℃                                                                                                                                                                                                                                                                     | (1) 391V<br>(2) 399V                                                                                  |
| 4 | Diode Peak Voltage      | Q101 Rated<br>38A/ 300V                          | AC ON/OFF<br>I/P:High-Line +3V =308V<br>O/P: (1)Full Load<br>(2)Output Short<br>(3)Dynamic Load Full Load/<br>Min. Load 90%Duty/1KHz<br>(4)Dynamic Load Full Load/<br>Min. Load 90%Duty/3KHz<br>(5)Dynamic Load Full Load/<br>Min. Load 90%Duty/5KHz<br>(6)Dynamic Load 100% Load/<br>Min. Load 50%Duty/120Hz<br>(7)0%→400% Load.<br>(8).NO LOAD<br>Ta:25℃ | Q101:<br>VDS:<br>(1)194V<br>(2)194V<br>(3)206V<br>(4)206V<br>(5)210V<br>(6)206V<br>(7)210V<br>(8)214V |
| 5 | Input Capacitor Voltage | C5 Rated:<br>: 220μ/ 450 V<br>105 °C/ TXW Series | I/P:High-Line +3V =308V<br>O/P: (1) Min load continue<br>(2)Full load continue<br>Ta:25℃                                                                                                                                                                                                                                                                   | (1) 447V<br>(2) 443V                                                                                  |

## SAFETY TEST

| NO | TEST ITEM            | SPECIFICATION                                                       | TEST CONDITION                                                                 | RESULT                                                           |
|----|----------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------------------------------|
| 1  | WITHSTAND VOLTAGE    | I/P-O/P: 3KVAC/min<br>I/P-FG :2KVAC/min<br>O/P-FG:1.25KVAC/min      | I/P-O/P: 3.6 KVAC/min<br>I/P-FG: 2.4 KVAC/min<br>O/P-FG:1.5 KVAC/min<br>Ta:25℃ | I/P-O/P: 6.7mA<br>I/P-FG: 6.43mA<br>O/P-FG: 6.28mA<br>NO DAMAGE  |
| 2  | ISOLATION RESISTANCE | I/P-O/P:500VDC>100MΩ<br>I/P-FG: 500VDC>100MΩ<br>O/P-FG:500VDC>100MΩ | I/P-O/P: 500 VDC<br>I/P-FG: 500 VDC<br>O/P-FG: 500 VDC<br>Ta:25℃               | I/P-O/P: 7.88GΩ<br>I/P-FG: 7.53GΩ<br>O/P-FG: 4.42GΩ<br>NO DAMAGE |
| 3  | GROUNDING CONTINUITY | FG(PE) TO CHASSIS<br>OR TRACE < 100 mΩ                              | 40A / 2min<br>Ta:25℃                                                           | 22mΩ                                                             |

## E.M.C TEST

| NO | TEST ITEM                                                                                                                        | SPECIFICATION                                         | TEST CONDITION                                           | RESULT                        |
|----|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------|-------------------------------|
| 1  | HARMONIC                                                                                                                         | EN61000-3-2<br>CLASS A                                | I/P:230VAC/50HZ<br>O/P:FULL LOAD<br>Ta:25°C              | PASS<br>FAIL                  |
| 2  | CONDUCTION                                                                                                                       | EN55032<br>CLASS B                                    | I/P : 230 VAC (50HZ)<br>O/P : FULL/50% LOAD<br>Ta : 25°C | PASS<br>Test by certified Lab |
| 3  | RADIATION                                                                                                                        | EN55032<br>CLASS B                                    | I/P : 230 VAC (50HZ)<br>O/P : FULL LOAD<br>Ta : 25°C     | PASS<br>Test by certified Lab |
| 4  | E.S.D                                                                                                                            | EN61000-4-2<br>INDUSTRY<br>AIR: 8KV / Contact: 4KV    | I/P : 230 VAC/50HZ<br>O/P : FULL LOAD<br>Ta : 25°C       | CRITERIA A                    |
| 5  | E.F.T                                                                                                                            | EN61000-4-4<br>INDUSTRY<br>INPUT : 2KV                | I/P : 230 VAC/50HZ<br>O/P : FULL LOAD<br>Ta : 25°C       | CRITERIA A                    |
| 6  | SURGE                                                                                                                            | IEC61000-6-2<br>INDUSTRY<br>L-N : 2KV<br>L,N-PE : 4KV | I/P : 230 VAC/50HZ<br>O/P : FULL LOAD<br>Ta : 25°C       | 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 : HEP-1000-100<br>1. ROOM AMBIENT BURN-IN : 1.5 HRS<br>I/P : 230VAC O/P : FULL LOAD Ta= 25 °C<br>2. HIGH AMBIENT BURN-IN : 3 HRS<br>I/P : 230VAC O/P : FULL LOAD Ta= 50 °C |                |        |

|   |                                                                   |                                                                                                                                                                                                                                                                                                               |                                                                   |          |                        |                       |  |
|---|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----------|------------------------|-----------------------|--|
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | NO                                                                | Position | ROOM AMBIENT Ta= 25 °C | HIGH AMBIENT Ta= 50°C |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 1                                                                 | BD1      | 71.4°C                 | 98.7°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 2                                                                 | ZNR2     | 61.8°C                 | 89.9°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 3                                                                 | C2       | 59.6°C                 | 87.5°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 4                                                                 | D10      | 72.0°C                 | 100.0°C               |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 5                                                                 | Q51      | 64.5°C                 | 91.9°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 6                                                                 | Q65      | 65.7°C                 | 93.4°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 7                                                                 | T51      | 64.7°C                 | 92.8°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 8                                                                 | C417     | 61.3°C                 | 89.8°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 9                                                                 | C8       | 61.9°C                 | 90.3°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 10                                                                | L2       | 66.2°C                 | 94.8°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 11                                                                | L3       | 70.3°C                 | 100.7°C               |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 12                                                                | Q903     | 66.9°C                 | 96.4°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 13                                                                | T1       | 70.3°C                 | 101.2°C               |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 14                                                                | T2       | 67.8°C                 | 97.9°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 15                                                                | Q113     | 63.7°C                 | 92.9°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 16                                                                | C114     | 60.3°C                 | 89.3°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 17                                                                | C118     | 59.9°C                 | 89.2°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 18                                                                | U601     | 73.0°C                 | 100.4°C               |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 19                                                                | U702     | 59.6°C                 | 88.9°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 20                                                                | U100     | 62.7°C                 | 91.5°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 21                                                                | RT21     | 61.8°C                 | 89.8°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 22                                                                | RTH4     | 61.3°C                 | 88.8°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 23                                                                | RTH5     | 60.7°C                 | 89.0°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 24                                                                | RG61     | 67.4°C                 | 96.7°C                |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 25                                                                | T601     | 79.5°C                 | 104.8°C               |  |
|   |                                                                   |                                                                                                                                                                                                                                                                                                               | 26                                                                | C652     | 68.1°C                 | 96.8°C                |  |
| 2 | OVER LOAD BURN-IN TEST                                            | NO DAMAGE<br>1 HOUR ( MIN )                                                                                                                                                                                                                                                                                   | I/P : 230 VAC<br>O/P : 107 % LOAD<br>Ta : 25°C                    |          | TEST : OK              |                       |  |
| 3 | LOW TEMPERATURE<br>TURN ON TEST                                   | TURN ON AFTER 2 HOUR                                                                                                                                                                                                                                                                                          | I/P : 264VAC/180VAC/90VAC<br>O/P : 100 % / 65% LOAD<br>Ta= -45 °C |          | TEST : OK              |                       |  |
| 4 | HIGH HUMIDITY<br>HIGH TEMPERATURE<br>HIGH VOLTAGE<br>TURN ON TEST | AFTER 12 HOURS<br>IN CHAMBER ON<br>CONTROL 50°C<br>NO DAMAGE                                                                                                                                                                                                                                                  | I/P : 272 VAC<br>O/P : FULL LOAD<br>Ta= 50°C<br>HUMIDITY= 95 %R.H |          | TEST : OK              |                       |  |
| 5 | TEMPERATURE<br>COEFFICIENT                                        | ± 0.03 %/°C (0~50°C)                                                                                                                                                                                                                                                                                          | I/P : 230 VAC<br>O/P : FULL LOAD                                  |          | ± 0 %/°C (0~50°C)      |                       |  |
| 6 | STORAGE TEMPERATURE TEST                                          | 1. Thermal shock Temperature : -45°C~ +90°C<br>2. Temperature change rate : 25°C / MIN<br>3. Dwell time low and high temperature : 30 MIN/EACH<br>4. Total test cycle : 10 CYCLE<br>5. Input/Output condition : STATIC                                                                                        |                                                                   |          |                        | OK                    |  |
| 7 | THERMAL SHOCK TEST                                                | 1. Thermal shock Temperature : -45°C~ +55°C<br>2. Temperature change rate : 25°C / MIN<br>3. Dwell time low and high temperature : 30 MIN/EACH<br>4. Total test cycle : 16 CYCLE<br>5. Input/Output condition :<br>15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST<br>1cycle:230V/ FULL LOAD Burn In Test |                                                                   |          |                        | OK                    |  |

|    |                          |                                                                                                                                                                                                                                                                       |                                                                 |
|----|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| 8  | VIBRATION TEST           | 1 Carton & 1 Set<br>(1) Waveform : Sine Wave<br>(2) Frequency : 10~500Hz<br>(3) Sweep Time : 12min/sweep cycle<br>(4) Acceleration : 10G<br>(5) Test Time : 72min in each axis (X.Y.Z)<br>(6) Ta : 25°C                                                               | TEST : OK                                                       |
| 9  | CAPACITOR LIFE CYCLE     | SUPPOSE C120 IS THE MOST CRITICAL COMPONENT<br>(1) I/P : 230VAC O/P : FULL LOAD Ta= 25°C LIFE TIME<br>(2) I/P : 230VAC O/P : FULL LOAD Ta= 50°C LIFE TIME<br>(3) I/P : 230VAC O/P : 75% LOAD Ta= 50°C LIFE TIME<br>(4) I/P : 230VAC O/P : 50% LOAD Ta= 50°C LIFE TIME | (1) 302449 HRS<br>(2) 40519HRS<br>(3) 85924HRS<br>(4) 136524HRS |
| 10 | MTBF                     | Conducted by Parts Stress Analysis Prediction<br>197.9K hrs min. Telcordia SR-332 (Bellcore) ; 52.32K hrs min. MIL-HDBK-217F (25°C)                                                                                                                                   |                                                                 |
| 11 | Ongoing reliability test | I/P : 230VAC O/P : FULL LOAD TA=50 °C<br>Demonstration Mean Time Between Failure : 55000 hours                                                                                                                                                                        |                                                                 |

| TEST RESULT | TESTER     | REVIEW     | APPROVAL      |
|-------------|------------|------------|---------------|
| PASS        | DANIEL GAO | SANFORD SU | VINCENT TSENG |

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