



TEST REPORT: MPM-30-15

30W High Reliable Green Medical Encapsulated Type

■ 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



30W High Reliable Green Medical Encapsulated Type MPM-30 series

DESIGN VERIFY TEST OUTPUT FUNCTION

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|-----------------|--------------------------------|--|--|--------------------------------|
| 1 | OUTPUT VOLTAGE TOLERANCE (Max) | V1 : 2.0% ~ -2.0% | I/P : 80VAC / 264VAC O/P: FULL / MINLOAD TA: 25°C | V1: -0.13% ~ -0.20% |
| 2 | LINE REGULATION (MAX.) | V1 : 0.5% ~ -0.5% | I/P : 80VAC / 264VAC O/P: FULL LOAD TA: 25°C | V1: 0.00% ~ 0.00% |
| 3 | LOAD REGULATION(MAX.) | V1 : 0.5% ~ -0.5% | I/P : 230VAC O/P: MIN LOAD ~ FULL LOAD TA: 25°C | V1: 0.07% ~ 0.00% |
| 4 | OVER/UNDERSHOOT TEST | < ±5% | I/P : 230VAC O/P: FULL LOAD TA: 25°C | TEST< 2.7 % |
| | RIPPLE & NOISE(Max) | V1 : 120 mVp-p | I/P : 230VAC O/P: FULL LOAD TA: 25°C | V1 : 44.4 mVp-p |
| high frequency: | | low frequency: | | |
| 5 | | <p>Ch1 Pk-Pk 33.2mV</p> <p>23 Jun 2017 14:14:27</p> | <p>Ch1 Pk-Pk 44.4mV</p> <p>23 Jun 2017 14:09:57</p> | |
| 6 | SET UP TIME (MAX.) | 230VAC : 500ms 115VAC : 500ms | I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA: 25°C | 230VAC : 92ms 115VAC : 74ms |
| | | INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage | INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage | |
| | | <p>Δ: 276 V @: 8.00 V Δ: 92.0ms @: -76.0ms</p> <p>Ch1 5.00 V Ch2 200 V M 100ms A Ch1 1.50 V</p> <p>70.00 %</p> | <p>Δ: 152 V @: 12.0 V Δ: 74.0ms @: -60.0ms</p> <p>Ch1 5.00 V Ch2 200 V M 100ms A Ch1 1.50 V</p> <p>70.00 %</p> | |



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|---|--|--------------------------------|--|--|
| 7 | RISE TIME (MAX.) | 230VAC : 30ms 115VAC : 30ms | I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C | 230VAC : 13.8ms 115VAC : 13.4ms |
| | INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage | | INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage | |
| | | | | |
| 8 | HOLD UP TIME (TYP.) | 230VAC : 40ms 115VAC : 12ms | I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C | 230VAC : 66.0ms 115VAC : 16.0ms |
| | INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage | | INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage | |
| | | | | |
| 9 | DYNAMIC LOAD | V1 : 1500 mVp-p | I/P : 230VAC O/P: (1)Full/Min load 50%duty/120HZ (2)Full/Min load 50%duty/1KHZ TA : 25°C | (1). 404mv (2). 300mv unit:mVp-p |
| | FULL /MIN LOAD 50%DUTY / 120HZ | | FULL /MIN% LOAD 50%DUTY / 1KHZ | |
| | | | | |

23 Jun 2017 14:15:53

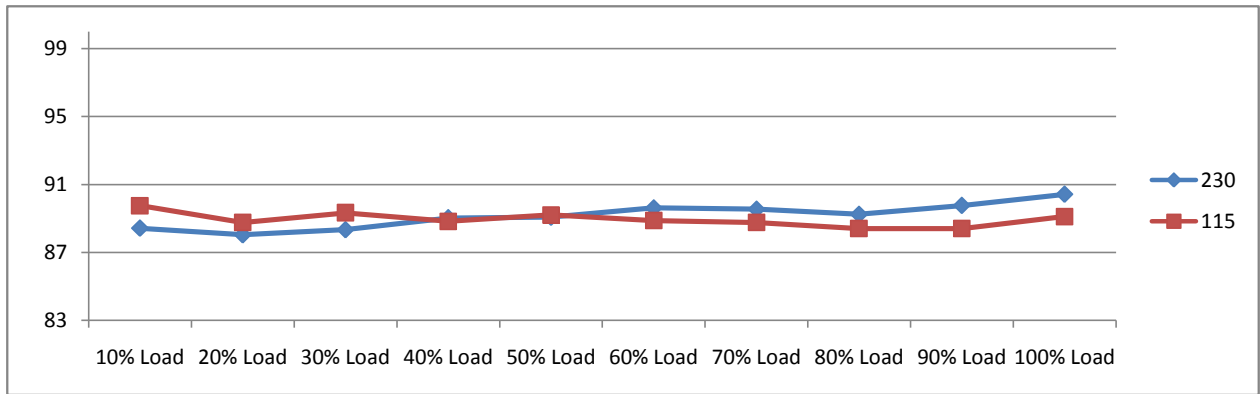
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30W High Reliable Green Medical Encapsulated Type MPM-30 series

INPUT FUNCTION TEST

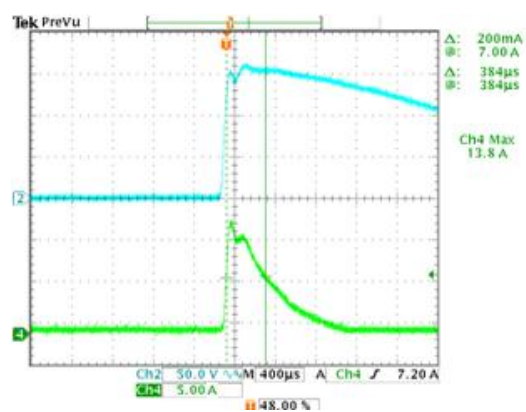
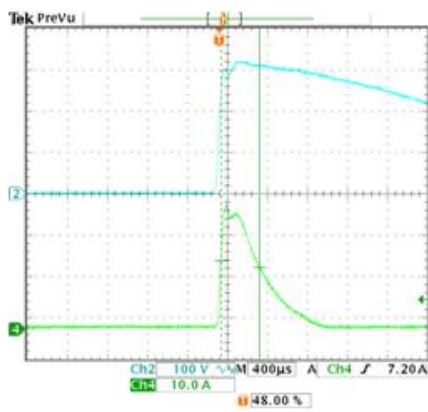
| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|---------------------------|----------------------------------|--|--|
| 1 | INPUT VOLTAGE RANGE | 80VAC ~ 264VAC | I/P : TESTING O/P : FULL LOAD Ta : 25°C | 72.0VAC ~ 264VAC |
| | | | I/P : LOW-LINE = 97VAC HIGH-LINE = 300VAC O/P : FULL/MIN LOAD ON:30 Sec ; OFF:30 Sec 10MIN (POWER ON/OFF NO DAMAGE) | TEST : OK |
| 2 | INPUT FREQUENCY RANGE | 47HZ ~ 63HZ NO DAMAGE | I/P : 80VAC ~ 264VAC O/P : FULL-MIN LOAD Ta : 25°C | TEST : OK |
| 3 | INPUT CURRENT (TYP.) | 0.50A / 230VAC 0.75A / 115VAC | I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C | I= 0.24A / 230VAC I= 0.46A / 115VAC |
| 4 | LEAKAGE CURRENT | < 80.00μA | I/P : 264VAC O/P : MIN LOAD TA : 25°C | 53.2 μA |
| 5 | NO LOAD POWER CONSUMPTION | < 0.075W | I/P : 230VAC O/P : MIN LOAD TA : 25°C | < 0.0439 W |
| 6 | EFFICIENCY (TYP.) | 89.0% | I/P : 230VAC O/P : FULL LOAD TA : 25°C | 90.43 % |
| | | | | |



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|---|-----------------------|--|--|---|
| 7 | INRUSH CURRENT (TYP.) | 45A / 230VAC 25A / 115VAC twidth= 555 us measured at 50% Ipeak COLD START | I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C | I= 30.2A / 230VAC I= 13.8A / 115VAC T50= 384.0us / 230VAC |
| | | INPUT=230VAC/50HZ @ FULL LOAD | INPUT=115VAC/50HZ @ FULL LOAD | |

CH2 : AC Input Voltage CH4 : Input current

CH2 : AC Input Voltage CH4 : Input current





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PROTECTION FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|-------------------------|--|---|--|
| 1 | OVER LOAD PROTECTION | 115% ~ 165% | I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P: TESTING Ta: 25°C | 158.00% 264VAC 152.00% 230VAC 143.50% 100VAC Hiccup Mode |
| 2 | OVER VOLTAGE PROTECTION | 15.80V ~ 20.30V | I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P: MIN LOAD Ta: 25°C | 19.10V 264VAC 19.20V 230VAC 19.10V 80VAC Shut down Re- power ON |
| 3 | SHORT PROTECTION | SHORT EVERY OUTPUT 1 HOUR NO DAMAGE | I/P: 264VAC I/P: 80VAC O/P: FULL LOAD Ta: 25°C | NO DAMAGE Hiccup Mode OK |

COMPONENT STRESS TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|----------------------|------------------------------------|--|---|
| 1 | PWM Power Transistor | Q1 Rated : 600V 7.5A | I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C | VIN: 267VAC VDS: (1). 468.00V (2). 536.00V (3). 474.00V |
| 2 | O/P MOSFET | Q100 Rated : 120V 20.0A Rated : | I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C | Q100 VDS : (1). 106.00V (2). 103.00V (3). 105.00V |
| 3 | Input Capacitor | C5 Rated : 56uf 400V | I/P : 267VAC O/P : (1)Full Load Turn on /Off (2)Min load Turn on /Off (3)Full Load /Min load Change (4)Full Load Continue Ta : 25°C | (1). 362.00V (2). 372.00V (3). 364.00V (4). 362.00V |
| 4 | Control IC | U1 Rated : 28V (max) -0.3 (min) | I/P : 267VAC O/P : (1)Full Load (2)Output Short (3)O.L.P (4)O.V.P (5)Low Line No Load Vo(min) Ta : 25°C | U1 (1). 19.30V (2). 12.50V (3). 19.80V (4). 23.00V (5). 18.60V |
| 5 | Clamp Diode | D5 Rated : 1000V 1.0A | I/P : 267VAC O/P : (1)Dynamic Load Full/Min Load (2)Full load continue Ta : 25°C | (1). 454.00V (2). 456.00V |

SAFETY & E.M.C. TEST

SAFETY TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|----------------------|--------------------------|--------------------------------------|--------------------------------|
| 1 | WITHSTAND VOLTAGE | I/P-O/P : 4.000KVAC /min | I/P-O/P: 4.250KVAC /min Ta : 25°C | I/P-O/P: 1.08mA NO DAMAGE |
| 2 | ISOLATION RESISTANCE | I/P-O/P : 500VDC>100MΩ | I/P-O/P: 500VDC Ta : 25°C/70%RH | I/P-O/P: 9999.0MΩ NO DAMAGE |

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°C | PASS |



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|---|------------|---|---|-------------------------------|
| 2 | CONDUCTION | EN55011 CLASS B | I/P : 230VAC /50HZ O/P : FULL LOAD / 50% LOAD Ta : 25°C | PASS Test by certified Lab |
| 3 | RADIATION | EN55011 CLASS B | I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C | PASS Test by certified Lab |
| 4 | E.S.D | EN61000-4-2 AIR: 15KV / Contact: 8KV | I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C | CRITERIA A |
| 5 | E.F.T | EN61000-4-4 MEDICAL INPUT: 2KV | I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C | CRITERIA A |
| 6 | SURGE | EN61000-4-5 MEDICAL LINE-LINE:1KV | I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C | CRITERIA A |

RELIABILITY TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----|--|---|---|----------------------|----------|---------------------|-------------------------|---|-----|--------|--------|---|-----|--------|--------|---|----|--------|--------|---|-----|--------|--------|---|-----|--------|--------|---|----|--------|--------|---|----|--------|--------|---|------|--------|--------|---|------|--------|--------|----|------|--------|--------|----|----|--------|--------|----|----|--------|--------|----|----|--------|--------|----|-----|--------|--------|----|----|--------|--------|--|
| 1 | TEMPERATURE RISE TEST | MODEL : MPM-30-24 1. ROOM AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 100% LOAD TA= 29.2°C 2. HIGH AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 100% LOAD TA= 61.3°C | <table border="1"> <thead> <tr> <th>NO.</th> <th>Position</th> <th>ROOM AMBIENT 29.2°C</th> <th>HIGH AMBIENT Ta: 61.3°C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>56.0°C</td><td>83.8°C</td></tr> <tr><td>2</td><td>LF2</td><td>57.4°C</td><td>84.6°C</td></tr> <tr><td>3</td><td>C5</td><td>60.1°C</td><td>88.5°C</td></tr> <tr><td>4</td><td>C40</td><td>58.8°C</td><td>87.5°C</td></tr> <tr><td>5</td><td>BD1</td><td>61.2°C</td><td>89.1°C</td></tr> <tr><td>6</td><td>R7</td><td>69.3°C</td><td>96.2°C</td></tr> <tr><td>7</td><td>T1</td><td>68.0°C</td><td>97.0°C</td></tr> <tr><td>8</td><td>Q100</td><td>66.3°C</td><td>94.9°C</td></tr> <tr><td>9</td><td>C105</td><td>63.0°C</td><td>91.6°C</td></tr> <tr><td>10</td><td>L100</td><td>53.7°C</td><td>83.2°C</td></tr> <tr><td>11</td><td>Q1</td><td>65.4°C</td><td>93.2°C</td></tr> <tr><td>12</td><td>U1</td><td>60.5°C</td><td>86.9°C</td></tr> <tr><td>13</td><td>D5</td><td>69.6°C</td><td>96.6°C</td></tr> <tr><td>14</td><td>R40</td><td>65.3°C</td><td>93.0°C</td></tr> <tr><td>60</td><td>TA</td><td>29.2°C</td><td>61.3°C</td></tr> </tbody> </table> | NO. | Position | ROOM AMBIENT 29.2°C | HIGH AMBIENT Ta: 61.3°C | 1 | LF1 | 56.0°C | 83.8°C | 2 | LF2 | 57.4°C | 84.6°C | 3 | C5 | 60.1°C | 88.5°C | 4 | C40 | 58.8°C | 87.5°C | 5 | BD1 | 61.2°C | 89.1°C | 6 | R7 | 69.3°C | 96.2°C | 7 | T1 | 68.0°C | 97.0°C | 8 | Q100 | 66.3°C | 94.9°C | 9 | C105 | 63.0°C | 91.6°C | 10 | L100 | 53.7°C | 83.2°C | 11 | Q1 | 65.4°C | 93.2°C | 12 | U1 | 60.5°C | 86.9°C | 13 | D5 | 69.6°C | 96.6°C | 14 | R40 | 65.3°C | 93.0°C | 60 | TA | 29.2°C | 61.3°C | |
| NO. | Position | ROOM AMBIENT 29.2°C | HIGH AMBIENT Ta: 61.3°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | LF1 | 56.0°C | 83.8°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | LF2 | 57.4°C | 84.6°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | C5 | 60.1°C | 88.5°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | C40 | 58.8°C | 87.5°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | BD1 | 61.2°C | 89.1°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | R7 | 69.3°C | 96.2°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | T1 | 68.0°C | 97.0°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Q100 | 66.3°C | 94.9°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | C105 | 63.0°C | 91.6°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | L100 | 53.7°C | 83.2°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | Q1 | 65.4°C | 93.2°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | U1 | 60.5°C | 86.9°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | D5 | 69.6°C | 96.6°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | R40 | 65.3°C | 93.0°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 60 | TA | 29.2°C | 61.3°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | OVER LOAD BURN-IN TEST | NO DAMAGE 1 HOUR (MIN) | I/P : 230VAC O/P : 164.0% LOAD Ta : 25°C | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | LOW TEMPERATURE TURN ON TEST | NO DAMAGE 1 HOUR (MIN) | I/P : 264VAC / 100VAC O/P : FULL LOAD Ta : -40.0°C | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST | AFTER 12 HOURS IN CHAMBER ON CONTROL 60°C NO DAMAGE | I/P : 272VAC O/P : FULL LOAD Ta : 60°C HUMIDITY= 95.0% RH | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | TEMPERATURE COEFFICIENT | ±0.03% /°C(0~60°C) | I/P : 230VAC O/P : FULL LOAD | ±0.0039% /°C(0~60°C) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | STORAGE TEMPERATURE TEST | 1. Thermal shock Temperature : -50°C~+125°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 100 CYCLE 5. Input/Output condition : STATIC | | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | THERMAL SHOCK TEST | 1. Thermal shock Temperature : -45°C ~ 65°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 : 230VAC Full Load AC ON/OFF test turn on 3sec ; turn off 1sec @ 15CYCLE 230VAC Full Load AC ON turn on continue @ 1CYCLE | | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



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| 8 | VIBRATION TEST | 1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (4) Acceleration : 2G (Blank) /5G (ST) (5) Test Time : 60min in each axis (X,Y,Z) (6) Ta : 25°C | TEST : OK |
| 9 | CAPACITOR LIFE CYCLE | :SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25°C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 60°C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 60°C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 60°C LIFE TIME | (1). 348686.2 HRS (2). 39278.6 HRS (3). 53973.1 HRS (4). 92840.8 HRS |
| 10 | MTBF | Conducted by Parts Stress Analysis Prediction 6325.8K hrs min. Telcordia SR-332 (Bellcore) ; 778.9K hrs min. MIL-HDBK-217F (25°C) | |
| 11 | DMTBF /Accelerated Life test | Demonstration Mean Time Between Failure (Expected Life): 30000HRS @ TA 60°C | |

| | | | |
|-------------|--------|--------|----------|
| TEST RESULT | TESTER | REVIEW | APPROVAL |
| PASS | LIUTT | | WANGDZ |