



Test Report: TDR-480-24

480W Three Phase Industrial DIN RAIL with PFC Function

■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Component Stress Test

■ SAFETY & E.M.C. TEST

Safety Test

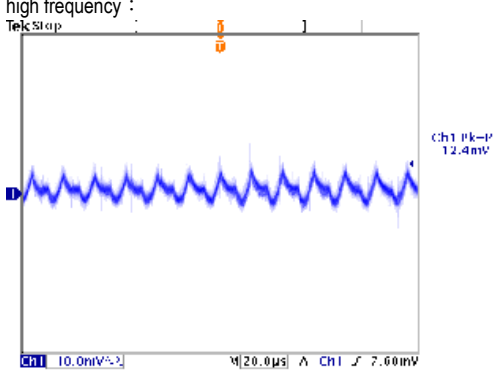
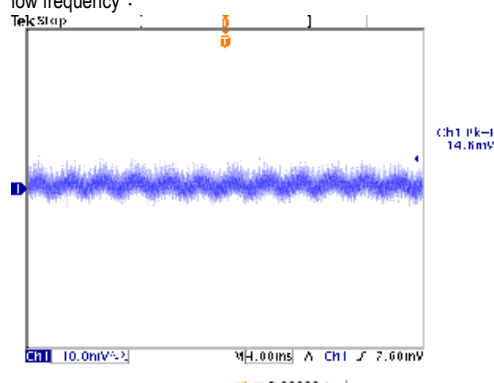
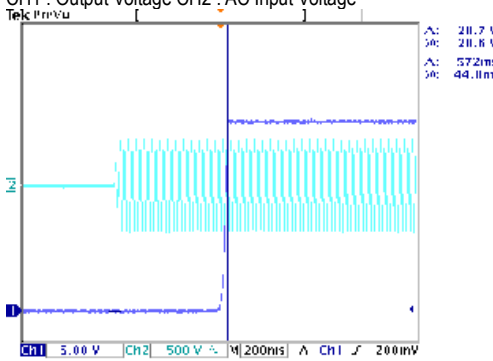
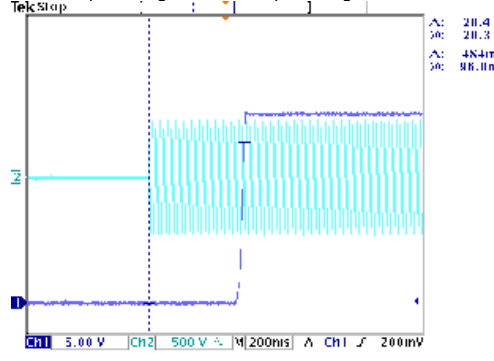
E.M.C. Test

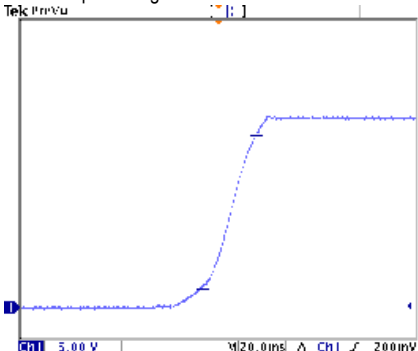
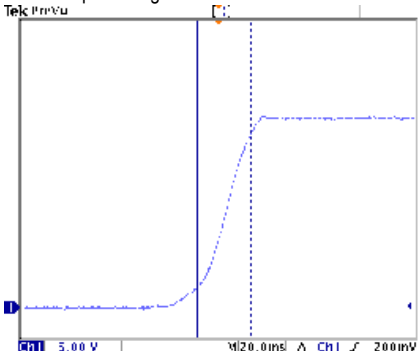
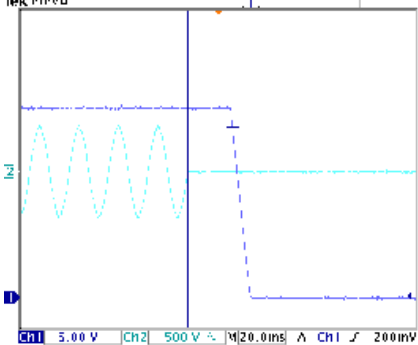
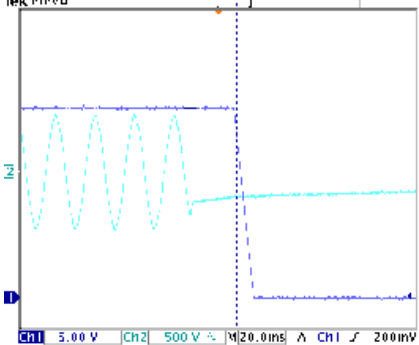
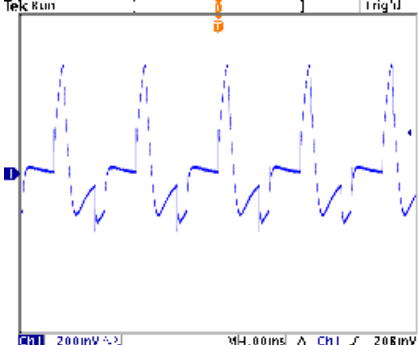
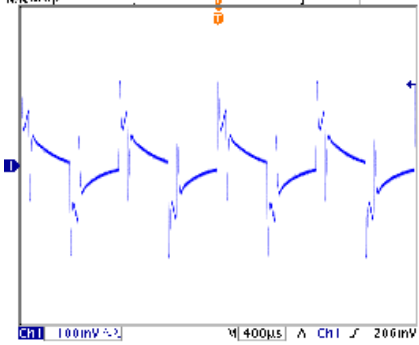
■ RELIABILITY TEST

ENVIRONMENT TEST

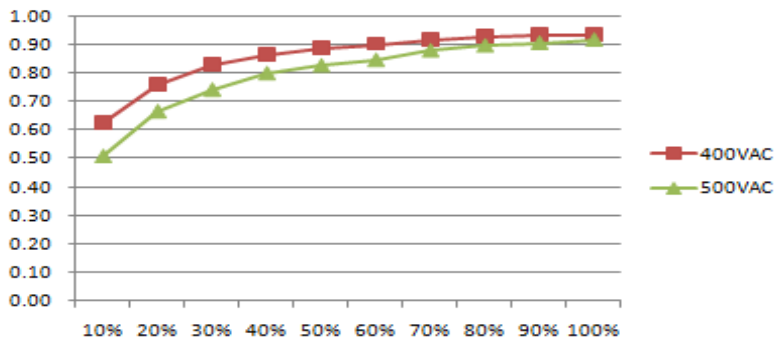
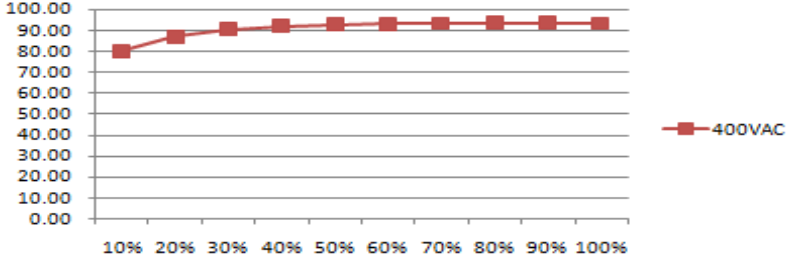
DESIGN VERIFY TEST

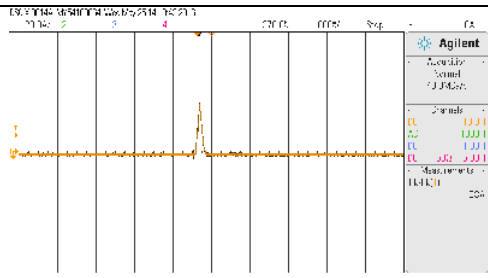
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 24 V~ 28 V	I/P : 400 VAC I/P : 500 VAC O/P : MIN LOAD Ta : 25°C	23.36V~28.89V/400VAC 23.36V~28.90V/500VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1 %~ -1 %	I/P: 380VAC /550VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1:- 0.294%~ 0.221%
3	LINE REGULATION (Max)	V1: 0.5 %~ -0.5 %	I/P: 380VAC /550VAC O/P:FULL LOAD Ta:25°C	V1:- 0 %~0%
4	LOAD REGULATION(Max)	V1: 1 %~ -1 %	I/P: 400VAC O/P:FULL ~MIN LOAD Ta:25°C	V1:- 0.3605%~ 0.3357%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 400VAC O/P:FULL LOAD Ta:25°C	1.25%
6	RIPPLE & NOISE(Max)	V1: 150 mVp-p	I/P:400VAC O/P:FULL LOAD Ta:25°C	V1: 14.6mVp-p
high frequency :  Ch1 Pk-Pk 12.4mV low frequency :  Ch1 Pk-Pk 14.8mV				
7	SET UP TIME(Max)	400VAC/1200ms 500VAC/800ms	I/P : 400 VAC I/P : 500 VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 572ms 500VAC/ 484ms
INPUT=400VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage  Ch1 5.00 V Ch2 500 V INPUT=500VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage  Ch1 5.00 V Ch2 500 V				

8	RISE TIME (Max)	400VAC/60ms 500VAC/60ms	I/P : 400 VAC I/P : 500 VAC O/P : FULL LOAD Ta : 25°C	400VAC/ 27.2ms 500VAC/ 27.2ms
	INPUT=400VAC/50HZ @ FULL LOAD CH1 : Output Voltage 		INPUT=500VAC/60HZ @ FULL LOAD CH1 : Output Voltage 	
9	HOLD UP TIME (Typ.)	400VAC/20ms 500VAC/20ms	I/P : 400 VAC I/P : 500 VAC O/P : FULL LOAD Ta : 25°C	400VAC/22.8ms 500VAC/ 23.6ms
	INPUT=400VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 		INPUT=500VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 	
10	DYNAMIC LOAD	V1: 2400 mVp-p	I/P: 400VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	852mVp-p 450mVp-p
	FULL /50% LOAD 50%DUTY / 120HZ 		FULL /50% LOAD 50%DUTY / 1KHZ 	

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	340VAC~550VAC	I/P:TESTING O/P:FULL LOAD Ta:25℃	334V~550V
			I/P: LOW-LINE-3V=337 V HIGH-LINE+10V=560 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:340 VAC ~550 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST:OK
3	INPUT CURRENT (Typ.)	400V/ 0.85A 500V/ 0.7A	I/P : 400 VAC I/P : 500 VAC O/P : FULL LOAD Ta : 25℃	I =0.794A/ 400VAC I =0.658A/ 500VAC
5	POWER FACTOR (Typ.)	0.9/ 400VAC 0.88/500VAC	I/P : 400 VAC I/P : 500 VAC O/P : FULL LOAD Ta : 25℃	PF=0.935/400VAC PF=0.913/500VAC
P.F vs LOAD 				
6	EFFICIENCY(Typ.)	92.5%	I/P:400 VAC O/P:FULL LOAD Ta:25℃	93.36 %
EFFICIENCY vs LOAD EFF 				
7	INRUSH CURRENT(Typ.)	400V/50A COLD START	I/P : 400 VAC O/P : FULL LOAD Ta : 25℃	I = 38 A/ 400VAC
INPUT=400VAC/50HZ @ FULL LOAD CH1 : Input current (1V=1A)				

				
8	LEAKAGE CURRENT	< 3.5	mA/550VAC For Touch	I/P:550 VAC O/P:MIN LOAD Ta:25°C
N1, N2, N3 and Earth: 1.45 mA				

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105 %~ 130 %	I/P: 550VAC I/P: 400VAC I/P: 340VAC O/P:TESTING Ta:25°C	118.0%/ 550VAC 118.0%/ 400VAC 118.0%/340VAC PROTECTION TYPE : Constant current limiting, unit will shut down after 3 sec. ,re-power on to recover
2	OVER VOLTAGE PROTECTION	29V~33V	I/P: 550VAC I/P: 400VAC I/P: 340VAC O/P:MIN LOAD Ta:25°C	31.1V/ 550VAC 31.1V/ 400VAC 31.0V/ 340VAC PROTECTION TYPE : Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	Protection type : Shut down o/p voltage, recovers automatically after temperature goes down	I/P: 550VAC I/P: 340VAC O/P:FULL LOAD	O.T.P.Active Protection type : Shut down o/p voltage, recovers automatically after temperature goes down
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 550VAC I/P: 340VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting, unit will shut down after 3 sec. ,re-power on to recover

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated :20A/600 V	I/P:High-Line +3V =553V AC ON/OFF VDS: O/P: (1)Full Load (2)Output Short (3) Full Load Continue Ta:25°C	VDS: (1)388V (2)396V (3)388V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q902 Rated : 12A/950 V	I/P:High-Line +3V =553 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3) Full Load Continue Ta:25°C	VDS: (1)820V (1)812V (3)820V

3	Diode Peak Voltage	Q100 Rated: : 90A/80V	I/P:High-Line +3V =553 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3) Full Load Continue (4)BURST MODE(15 % LOAD) Ta:25°C	Q100: VDS: (1)59.6V (2)3.7V (3)59.6V (4)58.0V
4	Input Capacitor Voltage	C905 Rated: :150 μ / 400V 105 °C	I/P:High-Line +3V =553V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue Ta:25°C	(1)396V (2)398V (3)398V (4)396 V
5	Control IC Voltage Test	PWM IC U2 Rated: : 16V 8.85 V(MIN.) PFC IC U901 Rated: : 22V -0.3V(MIN.) O/P IC U121Rated: : 20 V -0.3 V(MIN.)	I/P:High-Line +3V =553 V AC ON/OFF O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VR MIN LOW LINE Ta:25°C	(1) 14.0V (2) 13.9V (3) 13.9V (4) 13.4V (5) 13.0V (1)19.6V (2)18.3V (3)18.3V (4)15.4V (5)15.0V (1)12.9V (2)12.0V (3)13.4V (4)12.7V (5)12.5V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG :2KVAC/min O/P-FG:0.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:0.6 KVAC/min Ta:25°C	I/P-O/P:4.4mA I/P-FG:3.6mA O/P-FG:5.1m A NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100M Ω I/P-FG: 500VDC>100M Ω O/P-FG:500VDC>100M Ω	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C	I/P-O/P: 9999M Ω I/P-FG: 9999M Ω O/P-FG: 9999M Ω NO DAMAGE

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:400VAC/50HZ O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
2	CONDUCTION	EN55022 CLASS B	I/P : 400 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab



3	RADIATION	EN55022 1 CLASS B	I/P : 400 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 Din rail Model : AIR : 15KV / Contact : 8KV	I/P : 400 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT : 2KV	I/P : 400 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N : 2KV L,N-PE : 4KV	I/P : 400 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
7	Test by certified Lab & Test Report Prepare			

RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																																																																																									
1	TEMPERATURE RISE TEST	MODEL : TDR-480-24																																																																																																																																																											
		1. ROOM AMBIENT BURN-IN : 1 HRS																																																																																																																																																											
		I/P : 230VAC O/P : FULL LOAD Ta= 25.2℃																																																																																																																																																											
		2. HIGH AMBIENT BURN-IN : 1 HRS																																																																																																																																																											
		I/P : 230VAC O/P : FULL LOAD Ta= 45.2℃																																																																																																																																																											
		<table><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=25.2℃</th><th>HIGH AMBIENT Ta=45.2℃</th></tr><tr><td>1</td><td>LF1</td><td>59.1℃</td><td>79.7℃</td></tr><tr><td>2</td><td>T1</td><td>84.7℃</td><td>96.4℃</td></tr><tr><td>3</td><td>L1</td><td>43.8℃</td><td>64.1℃</td></tr><tr><td>4</td><td>L2</td><td>48.1℃</td><td>68.4℃</td></tr><tr><td>5</td><td>L3</td><td>48.8℃</td><td>69.3℃</td></tr><tr><td>6</td><td>ZR2</td><td>53.3℃</td><td>74.2℃</td></tr><tr><td>7</td><td>D7</td><td>72.5℃</td><td>92.1℃</td></tr><tr><td>8</td><td>D8</td><td>76.0℃</td><td>95.1℃</td></tr><tr><td>9</td><td>D9</td><td>72.2℃</td><td>91.8℃</td></tr><tr><td>10</td><td>C12</td><td>64.0℃</td><td>83.8℃</td></tr><tr><td>11</td><td>LF2</td><td>62.7℃</td><td>82.9℃</td></tr><tr><td>12</td><td>L191</td><td>77.8℃</td><td>97.9℃</td></tr><tr><td>13</td><td>RY31</td><td>71.8℃</td><td>91.0℃</td></tr><tr><td>14</td><td>C104</td><td>64.5℃</td><td>85.4℃</td></tr><tr><td>15</td><td>Q100</td><td>62.3℃</td><td>82.5℃</td></tr><tr><td>16</td><td>C51</td><td>67.8℃</td><td>87.7℃</td></tr><tr><td>17</td><td>C5</td><td>61.8℃</td><td>81.7℃</td></tr><tr><td>18</td><td>C42</td><td>61.6℃</td><td>81.4℃</td></tr><tr><td>19</td><td>Q1</td><td>72.7℃</td><td>94.1℃</td></tr><tr><td>20</td><td>C45</td><td>62.4℃</td><td>83.6℃</td></tr><tr><td>21</td><td>C203</td><td>61.9℃</td><td>83.1℃</td></tr><tr><td>22</td><td>RT1</td><td>56.5℃</td><td>77.1℃</td></tr><tr><td>23</td><td>L8</td><td>58.6℃</td><td>79.3℃</td></tr><tr><td>24</td><td>C910</td><td>60.3℃</td><td>81.0℃</td></tr><tr><td>25</td><td>T902</td><td>73.0℃</td><td>93.5℃</td></tr><tr><td>26</td><td>D912</td><td>65.7℃</td><td>87.7℃</td></tr><tr><td>27</td><td>Q901</td><td>70.5℃</td><td>92.1℃</td></tr><tr><td>28</td><td>L901</td><td>52.3℃</td><td>73.4℃</td></tr><tr><td>29</td><td>D910</td><td>65.3℃</td><td>86.2℃</td></tr><tr><td>30</td><td>C906</td><td>63.2℃</td><td>83.8℃</td></tr><tr><td>31</td><td>C944</td><td>59.8℃</td><td>80.2℃</td></tr><tr><td>32</td><td>C943</td><td>55.8℃</td><td>76.3℃</td></tr><tr><td>33</td><td>C927</td><td>54.9℃</td><td>75.6℃</td></tr><tr><td>34</td><td>C926</td><td>61.8℃</td><td>82.4℃</td></tr><tr><td>35</td><td>TSW1</td><td>61.6℃</td><td>82.6℃</td></tr><tr><td>36</td><td>U150</td><td>66.2℃</td><td>86.5℃</td></tr><tr><td>37</td><td>U2</td><td>66.4℃</td><td>86.9℃</td></tr></table>				NO	Position	ROOM AMBIENT Ta=25.2℃	HIGH AMBIENT Ta=45.2℃	1	LF1	59.1℃	79.7℃	2	T1	84.7℃	96.4℃	3	L1	43.8℃	64.1℃	4	L2	48.1℃	68.4℃	5	L3	48.8℃	69.3℃	6	ZR2	53.3℃	74.2℃	7	D7	72.5℃	92.1℃	8	D8	76.0℃	95.1℃	9	D9	72.2℃	91.8℃	10	C12	64.0℃	83.8℃	11	LF2	62.7℃	82.9℃	12	L191	77.8℃	97.9℃	13	RY31	71.8℃	91.0℃	14	C104	64.5℃	85.4℃	15	Q100	62.3℃	82.5℃	16	C51	67.8℃	87.7℃	17	C5	61.8℃	81.7℃	18	C42	61.6℃	81.4℃	19	Q1	72.7℃	94.1℃	20	C45	62.4℃	83.6℃	21	C203	61.9℃	83.1℃	22	RT1	56.5℃	77.1℃	23	L8	58.6℃	79.3℃	24	C910	60.3℃	81.0℃	25	T902	73.0℃	93.5℃	26	D912	65.7℃	87.7℃	27	Q901	70.5℃	92.1℃	28	L901	52.3℃	73.4℃	29	D910	65.3℃	86.2℃	30	C906	63.2℃	83.8℃	31	C944	59.8℃	80.2℃	32	C943	55.8℃	76.3℃	33	C927	54.9℃	75.6℃	34	C926	61.8℃	82.4℃	35	TSW1	61.6℃	82.6℃	36	U150	66.2℃	86.5℃	37	U2	66.4℃	86.9℃
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35	TSW1	61.6℃	82.6℃																																																																																																																																																										
36	U150	66.2℃	86.5℃																																																																																																																																																										
37	U2	66.4℃	86.9℃																																																																																																																																																										
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 118 % LOAD Ta : 25℃	TEST : OK																																																																																																																																																									

3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/100VAC O/P : 100 % LOAD Ta= -30 °C	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK
5	TEMPERATURE COEFFICIENT	± 0.03 %/°C (0~50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.0108 %/°C (0~50°C)
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -40°C ~ +85°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 5 CYCLE 5. Input/Output condition : STATIC		OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -30°C ~ +70°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : 230VAC/Full Load AC ON/OFF TEST turn on 58sec : turn off 2sec		OK
8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 2G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C		TEST : OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C 105 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 50 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 50 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 50 °C LIFE TIME		(1) 220920HRS (2) 36688HRS (3) 73755HRS (4) 126175HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 391.7K hrs min. Telcordia SR-332 (Bellcore) ; 108.2K hrs min. MIL-HDBK-217F (25°C)		
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 50°C		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	FRANK	GESG	WANGDZ

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