



TEST DATA OF PMA60F-5

Regulated DC Power Supply
June 4, 2010

Approved by : Katsumi Ishikawa
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Design Manager

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Design Engineer

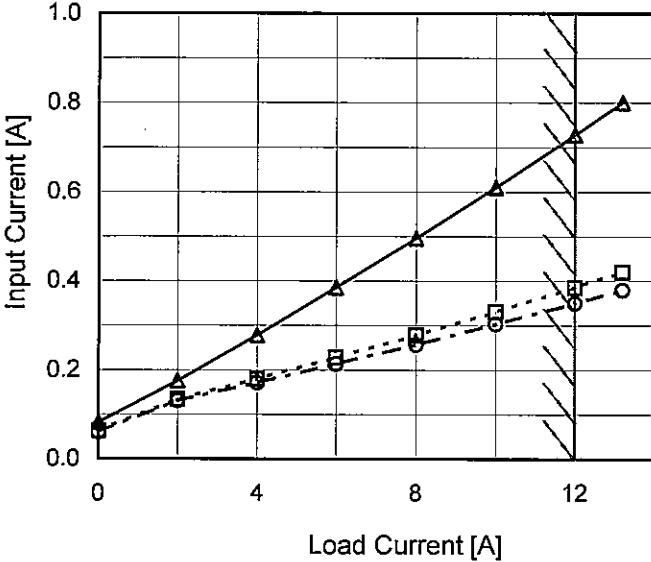
COSEL CO.,LTD.

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Model	PMA60F-5
Item	Input Current (by Load Current)
Object	—
1.Graph	<p>—△— Input Volt. 100V - - -□-- Input Volt. 200V - - ○--- Input Volt. 230V</p>  <p>Note: Slanted line shows the range of the rated load current.</p>

Temperature 25°C
 Testing Circuitry Figure A

2.Values

Load Current [A]	Input Current [A]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	0.082	0.063	0.059
2.0	0.176	0.133	0.131
4.0	0.278	0.180	0.171
6.0	0.385	0.228	0.214
8.0	0.496	0.278	0.257
10.0	0.610	0.331	0.303
12.0	0.728	0.386	0.350
13.2	0.800	0.420	0.379
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--	-	-	-
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	<p>The graph plots Input Power [W] on the Y-axis (0 to 100) against Load Current [A] on the X-axis (0 to 12). Three curves are shown for different input voltages: 100V (solid line with triangles), 200V (dashed line with squares), and 230V (dash-dot line with circles). All curves show a linear increase in power with load current. A slanted line is drawn across the graph, starting from approximately (0, 10) and ending at (12, 90), indicating the range of the rated load current.</p>	<table border="1"> <thead> <tr> <th rowspan="2">Load Current [A]</th> <th colspan="3">Input Power [W]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 200[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>6.15</td><td>6.20</td><td>6.20</td></tr> <tr><td>2.0</td><td>16.26</td><td>17.00</td><td>17.20</td></tr> <tr><td>4.0</td><td>26.87</td><td>27.20</td><td>27.50</td></tr> <tr><td>6.0</td><td>37.90</td><td>37.70</td><td>37.90</td></tr> <tr><td>8.0</td><td>49.10</td><td>48.40</td><td>48.50</td></tr> <tr><td>10.0</td><td>60.60</td><td>59.40</td><td>59.40</td></tr> <tr><td>12.0</td><td>72.50</td><td>70.80</td><td>70.60</td></tr> <tr><td>13.2</td><td>79.80</td><td>77.60</td><td>77.40</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> </tbody> </table>	Load Current [A]	Input Power [W]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.0	6.15	6.20	6.20	2.0	16.26	17.00	17.20	4.0	26.87	27.20	27.50	6.0	37.90	37.70	37.90	8.0	49.10	48.40	48.50	10.0	60.60	59.40	59.40	12.0	72.50	70.80	70.60	13.2	79.80	77.60	77.40	--	-	-	-	--	-	-	-	--	-	-	-	
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Note: Slanted line shows the range of the rated load current.

Model	PMA60F-5	Temperature	25°C																														
Item	Efficiency (by Input Voltage)	Testing Circuitry	Figure A																														
Object	_____																																
1. Graph			2. Values																														
<p>The graph plots Efficiency [%] on the y-axis (30 to 86) against Input Voltage [V] on the x-axis (50 to 300). Two data series are shown: Load 50% (dashed line with square markers) and Load 100% (solid line with triangle markers). Both series show efficiency increasing with input voltage. A slanted line indicates the rated input voltage range.</p> <table border="1"> <thead> <tr> <th>Input Voltage [V]</th> <th>Efficiency Load 50% [%]</th> <th>Efficiency Load 100% [%]</th> </tr> </thead> <tbody> <tr><td>75</td><td>77.0</td><td>79.3</td></tr> <tr><td>85</td><td>77.8</td><td>80.5</td></tr> <tr><td>100</td><td>78.2</td><td>81.6</td></tr> <tr><td>120</td><td>78.7</td><td>82.5</td></tr> <tr><td>200</td><td>78.4</td><td>83.5</td></tr> <tr><td>230</td><td>78.0</td><td>83.6</td></tr> <tr><td>264</td><td>77.4</td><td>83.6</td></tr> <tr><td>280</td><td>78.0</td><td>83.5</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>				Input Voltage [V]	Efficiency Load 50% [%]	Efficiency Load 100% [%]	75	77.0	79.3	85	77.8	80.5	100	78.2	81.6	120	78.7	82.5	200	78.4	83.5	230	78.0	83.6	264	77.4	83.6	280	78.0	83.5	--	-	-
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<p>Graph showing Power Factor vs Input Voltage for PMA60F-5 at 25°C. The Y-axis is Power Factor (0.4 to 1.0) and the X-axis is Input Voltage [V] (50 to 300). Two curves are shown: Load 50% (dashed line with squares) and Load 100% (solid line with triangles). Both curves show a decreasing trend as input voltage increases. A slanted line indicates the rated input voltage range.</p>			<table border="1"> <thead> <tr> <th rowspan="2">Input Voltage [V]</th> <th colspan="2">Power Factor</th> </tr> <tr> <th>Load 50%</th> <th>Load 100%</th> </tr> </thead> <tbody> <tr> <td>75</td> <td>0.997</td> <td>0.999</td> </tr> <tr> <td>85</td> <td>0.992</td> <td>0.999</td> </tr> <tr> <td>100</td> <td>0.982</td> <td>0.997</td> </tr> <tr> <td>120</td> <td>0.962</td> <td>0.989</td> </tr> <tr> <td>200</td> <td>0.829</td> <td>0.915</td> </tr> <tr> <td>230</td> <td>0.770</td> <td>0.877</td> </tr> <tr> <td>264</td> <td>0.695</td> <td>0.834</td> </tr> <tr> <td>280</td> <td>0.602</td> <td>0.768</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> </tr> </tbody> </table>	Input Voltage [V]	Power Factor		Load 50%	Load 100%	75	0.997	0.999	85	0.992	0.999	100	0.982	0.997	120	0.962	0.989	200	0.829	0.915	230	0.770	0.877	264	0.695	0.834	280	0.602	0.768	--	-	-
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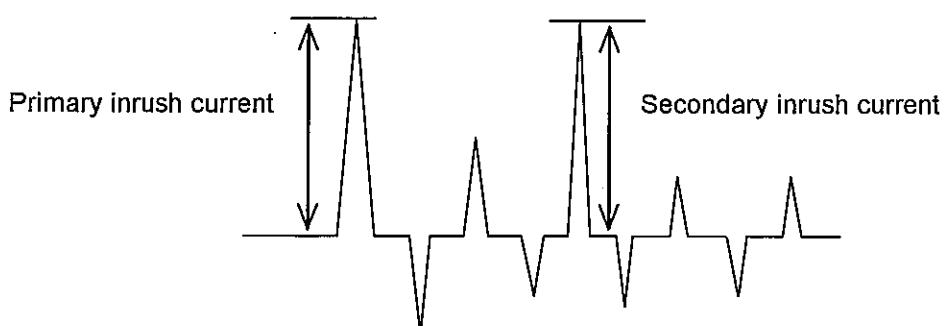
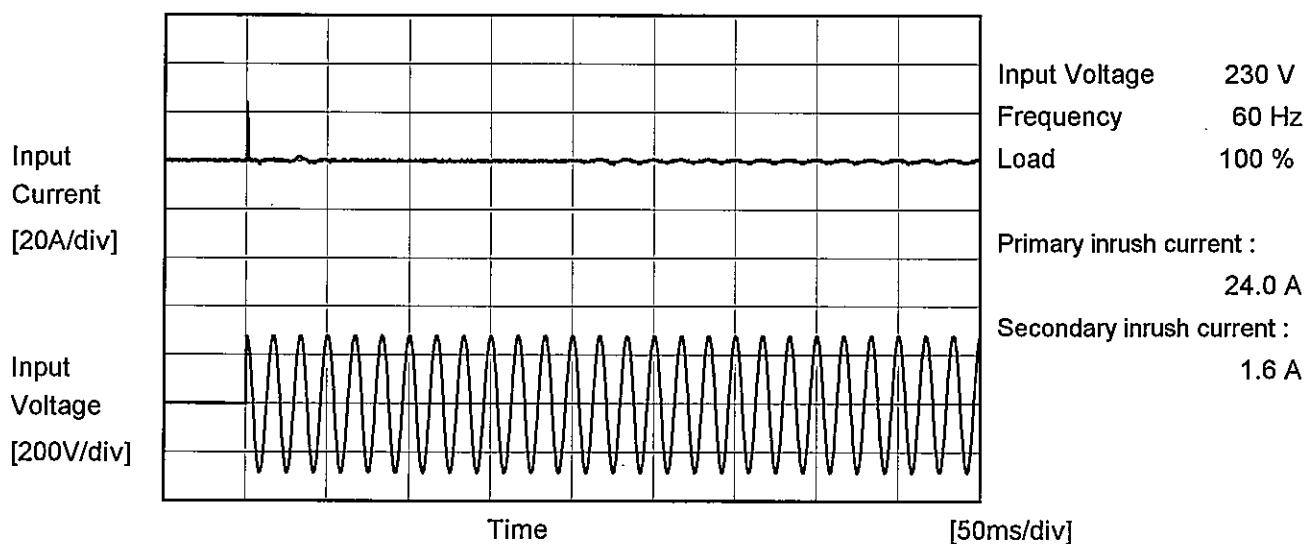
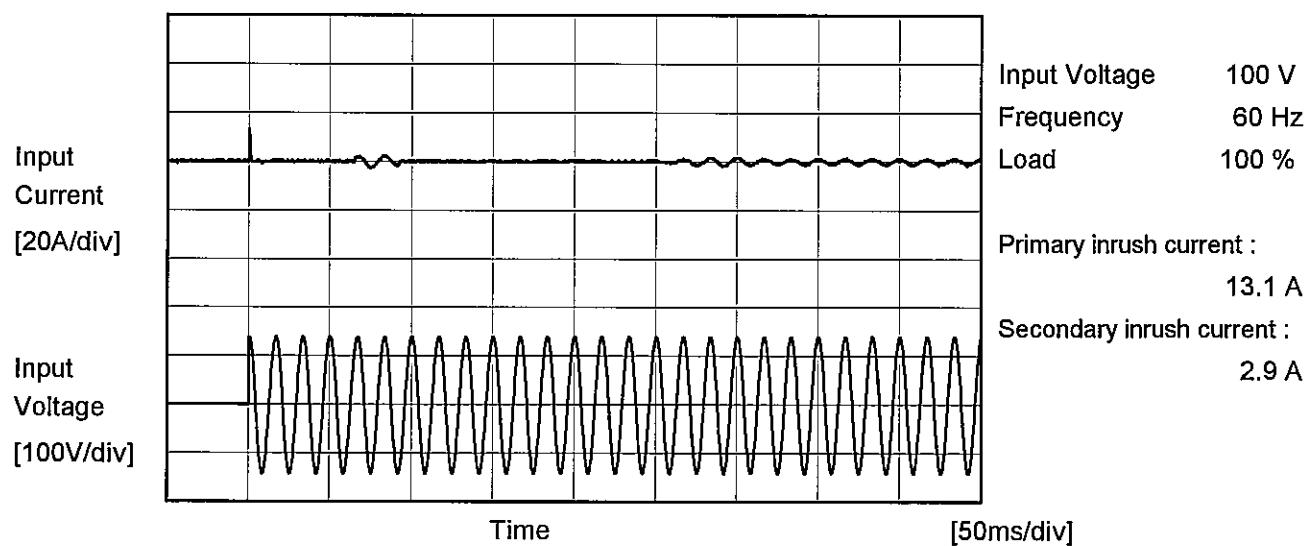
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<p>Legend:</p> <ul style="list-style-type: none"> Input Volt. 100V Input Volt. 200V Input Volt. 230V 		<table border="1"> <thead> <tr> <th rowspan="2">Load Current [A]</th> <th colspan="3">Power Factor</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 200[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>0.749</td><td>0.492</td><td>0.456</td></tr> <tr><td>2.0</td><td>0.925</td><td>0.637</td><td>0.573</td></tr> <tr><td>4.0</td><td>0.966</td><td>0.756</td><td>0.698</td></tr> <tr><td>6.0</td><td>0.984</td><td>0.829</td><td>0.772</td></tr> <tr><td>8.0</td><td>0.992</td><td>0.869</td><td>0.821</td></tr> <tr><td>10.0</td><td>0.993</td><td>0.897</td><td>0.852</td></tr> <tr><td>12.0</td><td>0.997</td><td>0.916</td><td>0.877</td></tr> <tr><td>13.2</td><td>0.998</td><td>0.925</td><td>0.889</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> </tbody> </table>		Load Current [A]	Power Factor			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.0	0.749	0.492	0.456	2.0	0.925	0.637	0.573	4.0	0.966	0.756	0.698	6.0	0.984	0.829	0.772	8.0	0.992	0.869	0.821	10.0	0.993	0.897	0.852	12.0	0.997	0.916	0.877	13.2	0.998	0.925	0.889	--	-	-	-	--	-	-	-	--	-	-	-
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Note: Slanted line shows the range of the rated load current.

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Model	PMA60F-5	Temperature	25°C
Item	Inrush Current	Testing Circuitry	Figure A
Object	_____		





Model	PMA60F-5	Temperature	25°C
Item	Leakage Current	Testing Circuitry	Figure B
Object	<hr/>		

1. Results

Standards		Input Volt.			Note
		100 [V]	200 [V]	240 [V]	
IEC60601	Both phases	0.05	0.12	0.14	Operation
	One of phases	0.08	0.19	0.21	Stand by

The value for "One of phases" is the reference value only.

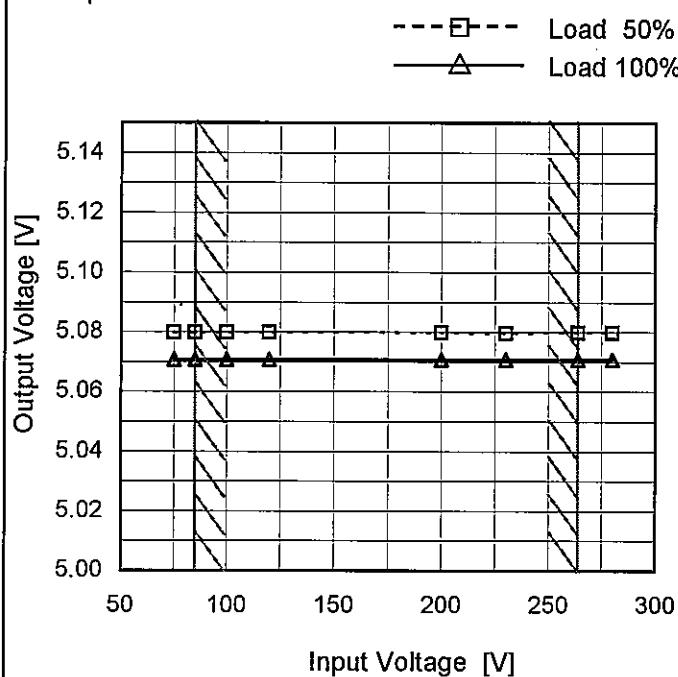
2. Condition

Leakage current value is concluded after measuring both phases of AC input and by choosing the larger one.

Model	PMA60F-5
Item	Line Regulation
Object	+5V12A

Temperature 25°C
Testing Circuitry Figure A

1. Graph



Note: Slanted line shows the range of the rated input voltage.

2. Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
75	5.080	5.071
85	5.080	5.071
100	5.080	5.071
120	5.080	5.071
200	5.080	5.071
230	5.080	5.071
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12.0	5.071	5.071	5.071																																		
13.2	5.069	5.069	5.069																																		
2.Values																																					

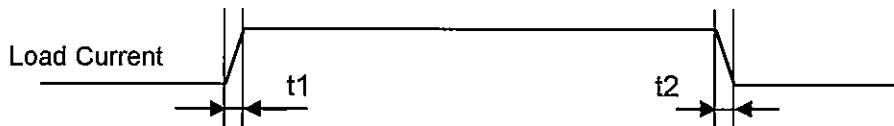
Note: Slanted line shows the range of the rated load current.

COSEL

Model PMA60F-5

Item Dynamic Load Response

Object +5V12A

Temperature
Testing Circuitry 25°C
Figure AInput Volt. 100 V
Cycle 1000 msResponse. $t_1=t_2 \approx 50\mu s$. TypMin. Load (0A) ↔
Load 100% (12A)

100 mV/div

10 ms/div

10 ms/div

Min. Load (0A) ↔
Load 50% (6A)

100 mV/div

10 ms/div

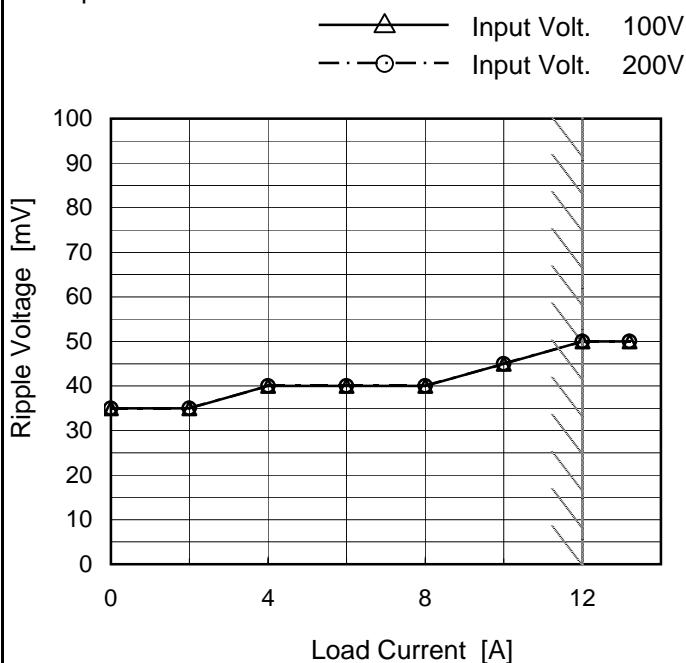
10 ms/div

COSEL

Model	PMA60F-5
Item	Ripple Voltage (by Load Current)
Object	+5V12A

Temperature 25°C
Testing Circuitry Figure A

1.Graph



2.Values

Load Current [A]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 200 [V]
0.0	35	35
2.0	35	35
4.0	40	40
6.0	40	40
8.0	40	40
10.0	45	45
12.0	50	50
13.2	50	50
--	-	-
--	-	-
--	-	-

Measured by 20 MHz Oscilloscope.

Ripple Voltage is shown as p-p in the figure below.

Note: Slanted line shows the range of the rated load current.

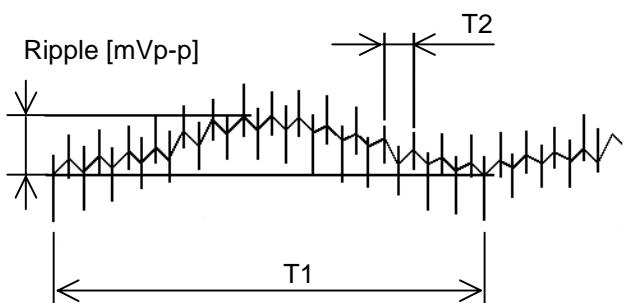
T1: Due to AC Input Line
T2: Due to Switching

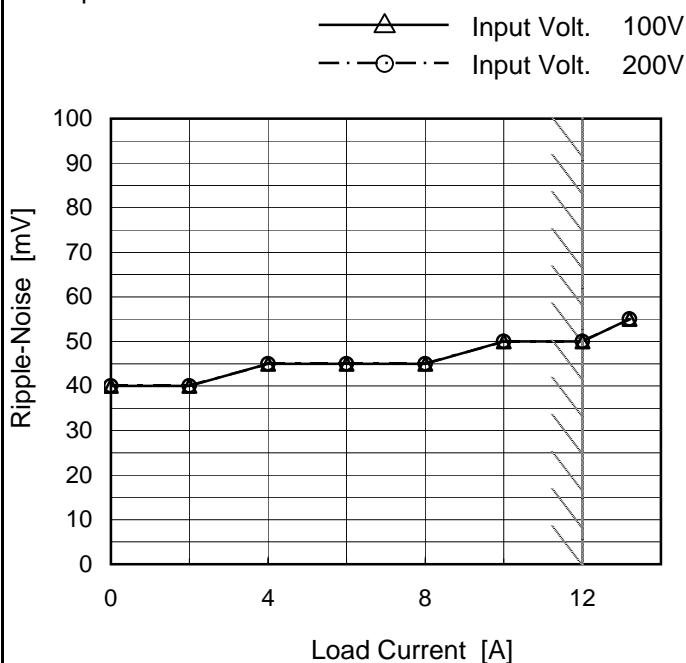
Fig. Complex Ripple Wave Form

COSEL

Model	PMA60F-5
Item	Ripple-Noise
Object	+5V12A

Temperature 25°C
Testing Circuitry Figure A

1. Graph



Measured by 20 MHz Oscilloscope.

Ripple-Noise is shown as p-p in the figure below.

Note: Slanted line shows the range of the rated load current.

2. Values

Load Current [A]	Ripple-Noise [mV]	
	Input Volt. 100 [V]	Input Volt. 200 [V]
0.0	40	40
2.0	40	40
4.0	45	45
6.0	45	45
8.0	45	45
10.0	50	50
12.0	50	50
13.2	55	55
--	-	-
--	-	-
--	-	-

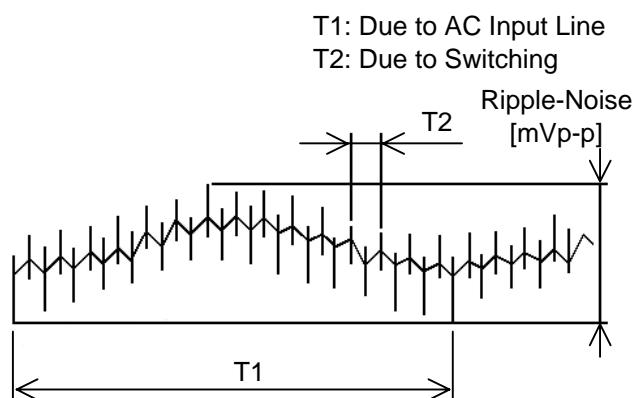
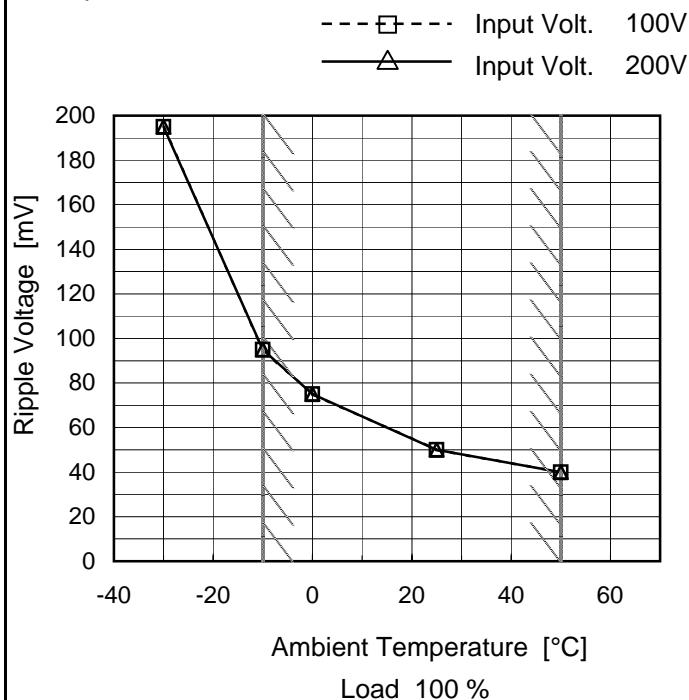


Fig. Complex Ripple Wave Form

COSEL

Model	PMA60F-5
Item	Ripple Voltage (by Ambient Temp.)
Object	+5V12A

1. Graph



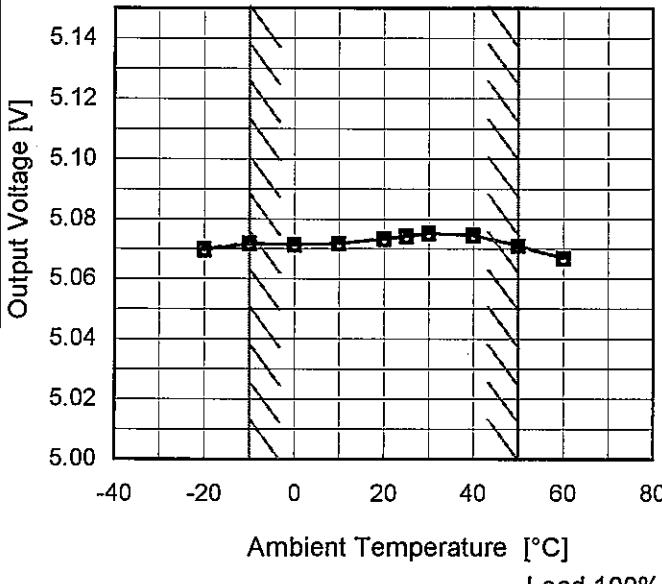
Testing Circuitry Figure A

2. Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 200 [V]
-30	195	195
-10	95	95
0	75	75
25	50	50
50	40	40
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

Measured by 20 MHz Oscilloscope.

Note: Slanted line shows the range of the rated ambient temperature.

Model	PMA60F-5	Testing Circuitry Figure A																																																					
Item	Ambient Temperature Drift																																																						
Object	+5V12A																																																						
1.Graph	<p style="text-align: center;"> Input Volt. 100V Input Volt. 200V Input Volt. 230V </p>  <p style="text-align: center;">Load 100%</p>																																																						
2.Values	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Ambient Temperature [°C]</th> <th colspan="3">Output Voltage [V]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 200[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr> <td>-20</td> <td>5.070</td> <td>5.070</td> <td>5.070</td> </tr> <tr> <td>-10</td> <td>5.072</td> <td>5.072</td> <td>5.072</td> </tr> <tr> <td>0</td> <td>5.071</td> <td>5.071</td> <td>5.071</td> </tr> <tr> <td>10</td> <td>5.072</td> <td>5.072</td> <td>5.072</td> </tr> <tr> <td>20</td> <td>5.073</td> <td>5.073</td> <td>5.073</td> </tr> <tr> <td>25</td> <td>5.074</td> <td>5.074</td> <td>5.074</td> </tr> <tr> <td>30</td> <td>5.075</td> <td>5.075</td> <td>5.075</td> </tr> <tr> <td>40</td> <td>5.075</td> <td>5.075</td> <td>5.075</td> </tr> <tr> <td>50</td> <td>5.071</td> <td>5.071</td> <td>5.071</td> </tr> <tr> <td>60</td> <td>5.067</td> <td>5.067</td> <td>5.067</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table>				Ambient Temperature [°C]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	-20	5.070	5.070	5.070	-10	5.072	5.072	5.072	0	5.071	5.071	5.071	10	5.072	5.072	5.072	20	5.073	5.073	5.073	25	5.074	5.074	5.074	30	5.075	5.075	5.075	40	5.075	5.075	5.075	50	5.071	5.071	5.071	60	5.067	5.067	5.067	--	-	-	-
Ambient Temperature [°C]	Output Voltage [V]																																																						
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10	5.072	5.072	5.072																																																				
20	5.073	5.073	5.073																																																				
25	5.074	5.074	5.074																																																				
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60	5.067	5.067	5.067																																																				
--	-	-	-																																																				
Note:	Slanted line shows the range of the rated ambient temperature.																																																						



Model	PMA60F-5	Testing Circuitry Figure A
Item	Output Voltage Accuracy	
Object	+5V12A	

1. Output Voltage Accuracy

This is defined as the value of the output voltage, regulation load, ambient temperature and input voltage varied at random in the range as specified below.

Temperature : -10 ~ 50°C

Input Voltage : 85 ~ 264V

Load Current : 0 ~ 12A

* Output Voltage Accuracy = $\pm(\text{Maximum of Output Voltage} - \text{Minimum of Output Voltage}) / 2$

$$\text{* Output Voltage Accuracy (Ration)} = \frac{\text{Output Voltage Accuracy}}{\text{Rated Output Voltage}} \times 100$$

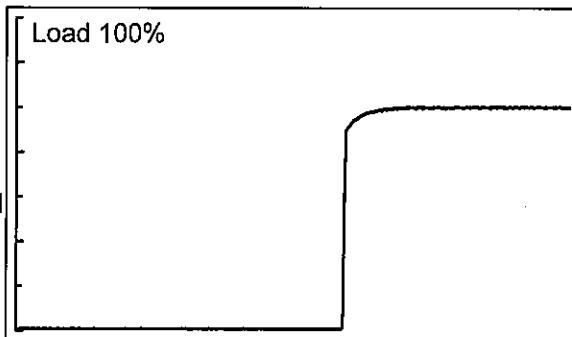
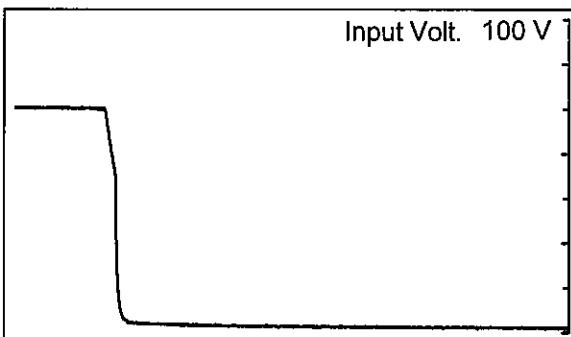
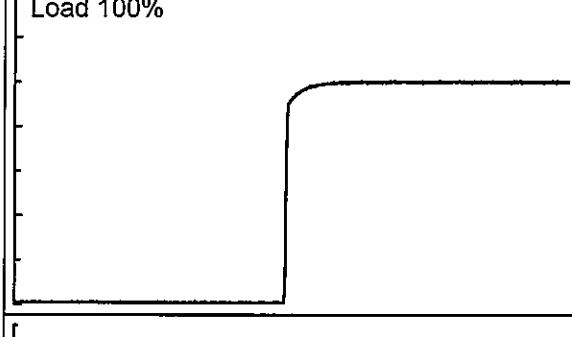
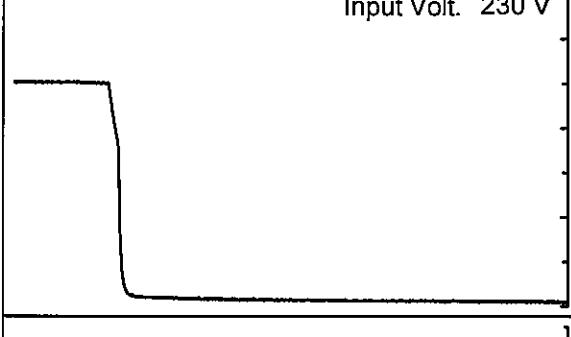
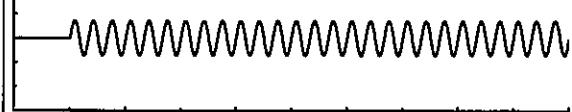
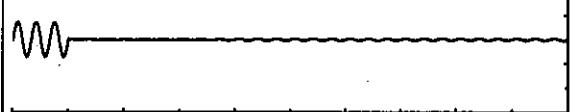
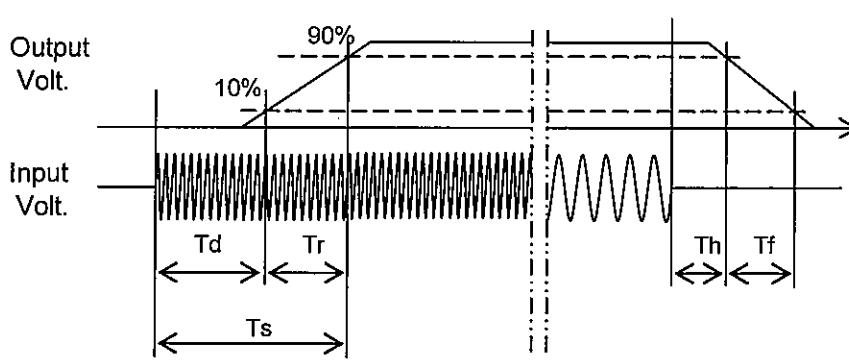
2. Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ration [%]
Maximum Voltage	30	264	0	5.093	±11	±0.2
Minimum Voltage	50	264	12	5.071		



<table border="1"> <tr><td>Model</td><td>PMA60F-5</td></tr> <tr><td>Item</td><td>Time Lapse Drift</td></tr> <tr><td>Object</td><td>+5V12A</td></tr> </table>	Model	PMA60F-5	Item	Time Lapse Drift	Object	+5V12A	Temperature 25°C																
Model	PMA60F-5																						
Item	Time Lapse Drift																						
Object	+5V12A																						
Testing Circuitry Figure A																							
1.Graph	2.Values																						
<p>Output Voltage [V]</p> <p>Time [H]</p> <p>Input Volt. 100V Load 100%</p>	<table border="1"> <thead> <tr> <th>Time since start [H]</th> <th>Output Voltage [V]</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>5.071</td></tr> <tr><td>0.5</td><td>5.070</td></tr> <tr><td>1.0</td><td>5.070</td></tr> <tr><td>2.0</td><td>5.070</td></tr> <tr><td>3.0</td><td>5.070</td></tr> <tr><td>4.0</td><td>5.070</td></tr> <tr><td>5.0</td><td>5.070</td></tr> <tr><td>6.0</td><td>5.070</td></tr> <tr><td>7.0</td><td>5.070</td></tr> <tr><td>8.0</td><td>5.070</td></tr> </tbody> </table>	Time since start [H]	Output Voltage [V]	0.0	5.071	0.5	5.070	1.0	5.070	2.0	5.070	3.0	5.070	4.0	5.070	5.0	5.070	6.0	5.070	7.0	5.070	8.0	5.070
Time since start [H]	Output Voltage [V]																						
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3.0	5.070																						
4.0	5.070																						
5.0	5.070																						
6.0	5.070																						
7.0	5.070																						
8.0	5.070																						
* The characteristic of AC200V is equal.																							

COSEL

Model	PMA60F-5	Temperature 25°C			
Item	Rise and Fall Time	Testing Circuitry Figure A			
Object	+5V12A				
1. Graph					
Output Volt. [1V/div]	Load 100% 	Input Volt. 100 V 			
Output Volt. [1V/div]	Load 100% 	Input Volt. 230 V 			
Input Volt.					
Time [50ms/div]					
2. Values [ms]					
Input Volt. \ Time	Td	Tr	Ts	Th	Tf
100 V	245.0	4.0	249.0	34.3	11.0
230 V	194.0	3.8	197.8	38.5	11.3
					

Model	PMA60F-5	Temperature	25°C																																
Item	Hold-Up Time	Testing Circuitry	Figure A																																
Object	+5V12A																																		
1. Graph																																			
2. Values																																			
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Input Voltage [V]	Hold-Up Time [ms]																																		
	Load 50%	Load 100%																																	
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100	70	33																																	
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200	76	37																																	
230	77	38																																	
264	78	38																																	
280	77	38																																	
--	-	-																																	
<p>This duration covers from Shut-off of input voltage to the moment when output voltage descends to the rated range of voltage accuracy. Note: Slanted line shows the range of the rated input voltage.</p>																																			

<p>Model PMA60F-5</p> <p>Item Instantaneous Interruption Compensation</p> <p>Object +5V12A</p>	<p>Temperature 25°C Testing Circuitry Figure A</p>																																																				
	2.Values																																																				
	<table border="1"> <thead> <tr> <th rowspan="2">Load Current [A]</th><th colspan="3">Time [ms]</th></tr> <tr> <th>Input Volt. 100[V]</th><th>Input Volt. 200[V]</th><th>Input Volt. 230[V]</th></tr> </thead> <tbody> <tr><td>0.0</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>2.0</td><td>147</td><td>204</td><td>221</td></tr> <tr><td>4.0</td><td>106</td><td>112</td><td>115</td></tr> <tr><td>6.0</td><td>72</td><td>79</td><td>80</td></tr> <tr><td>8.0</td><td>52</td><td>60</td><td>60</td></tr> <tr><td>10.0</td><td>42</td><td>47</td><td>46</td></tr> <tr><td>12.0</td><td>35</td><td>36</td><td>40</td></tr> <tr><td>13.2</td><td>28</td><td>35</td><td>35</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> </tbody> </table>			Load Current [A]	Time [ms]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.0	-	-	-	2.0	147	204	221	4.0	106	112	115	6.0	72	79	80	8.0	52	60	60	10.0	42	47	46	12.0	35	36	40	13.2	28	35	35	--	-	-	-	--	-	-	-	--	-	-
Load Current [A]	Time [ms]																																																				
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--	-	-	-																																																		
--	-	-	-																																																		
--	-	-	-																																																		
<p>1.Graph</p> <p>Instantaneous Compensation Time [ms]</p> <p>Load Current [A]</p> <p>—▲— Input Volt. 100V ---■--- Input Volt. 200V ---○--- Input Volt. 230V</p>																																																					
<p>Note: Slanted line shows the range of the rated load current.</p>																																																					

<p>Model PMA60F-5</p> <p>Item Minimum Input Voltage for Regulated Output Voltage</p> <p>Object +5V12A</p>	Testing Circuitry Figure A																																						
	2.Values																																						
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Ambient Temperature [°C]	Input Voltage [V]																																						
	Load 50%	Load 100%																																					
-20	40	54																																					
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--	-	-																																					
1.Graph	<p>---□--- Load 50%</p> <p>—△— Load 100%</p>																																						

Note: Slanted line shows the range of the rated ambient temperature.

COSEL

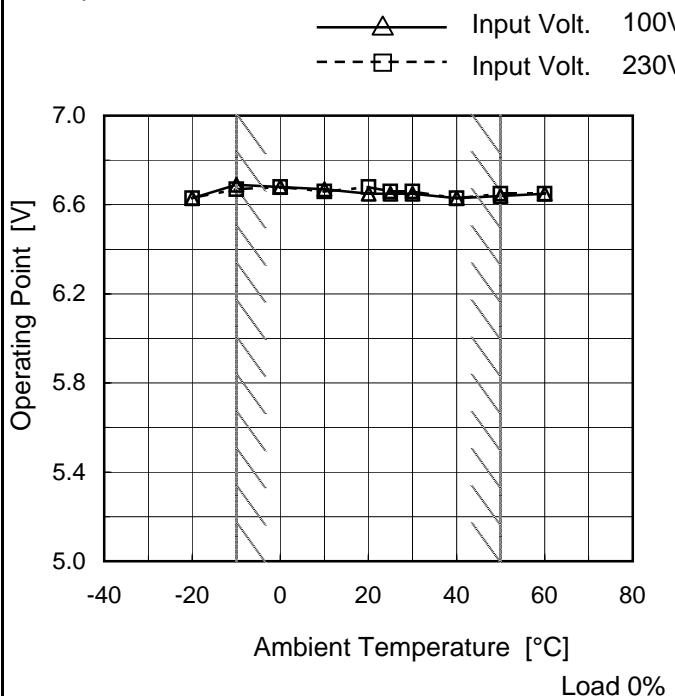
Model	PMA60F-5	Temperature	25°C																																												
Item	Overcurrent Protection	Testing Circuitry	Figure A																																												
Object	+5V12A																																														
1. Graph																																															
<p>Output Voltage [V]</p> <p>Load Current [A]</p> <p>Input Volt. 100V</p> <p>Input Volt. 230V</p> <p>Note: Slanted line shows the range of the rated load current.</p>																																															
2. Values																																															
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Output Voltage [V]	Load Current [A]																																														
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--	-	-																																													

COSEL

Model	PMA60F-5
Item	Overvoltage Protection
Object	+5V12A

Testing Circuitry Figure A

1.Graph



2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 230[V]
-20	6.63	6.63
-10	6.69	6.67
0	6.68	6.68
10	6.67	6.66
20	6.65	6.68
25	6.65	6.66
30	6.65	6.66
40	6.63	6.63
50	6.64	6.65
60	6.65	6.65
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Note: Slanted line shows the range of the rated ambient temperature.

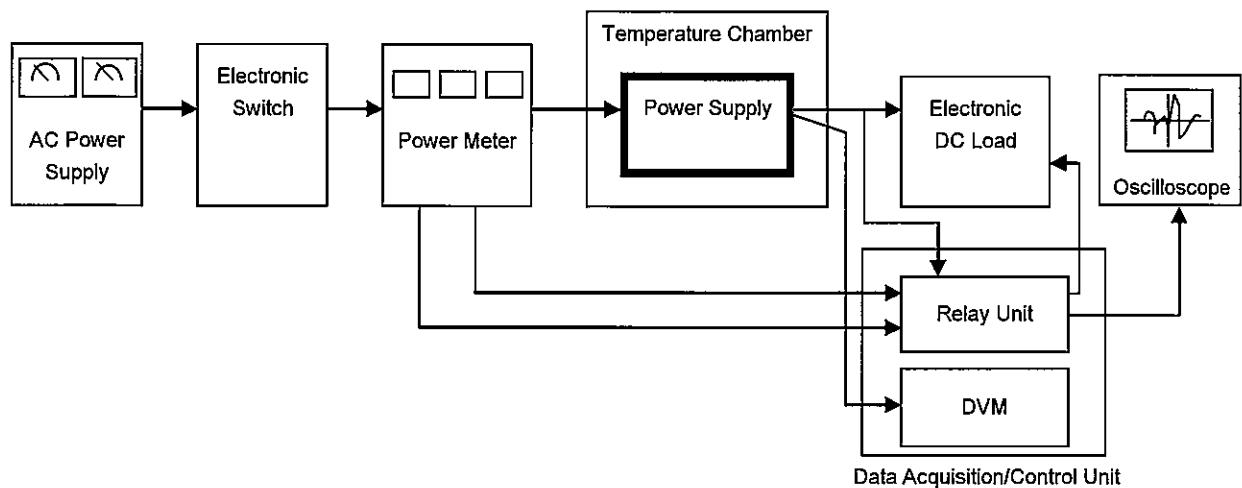


Figure A

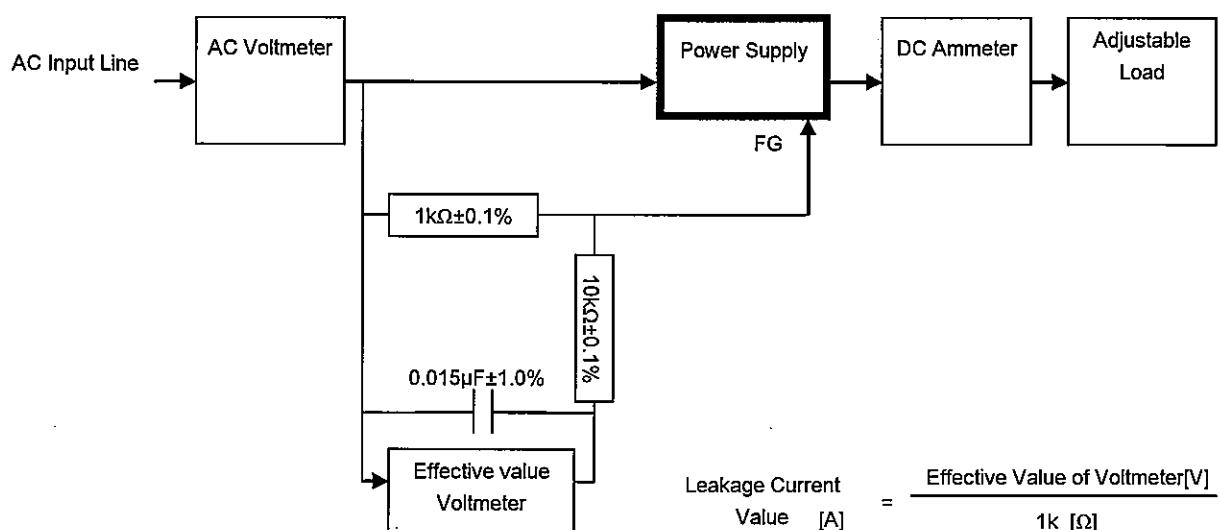


Figure B (IEC60601-1)