



TEST DATA OF PMA60F-15

Regulated DC Power Supply
June 4, 2010

Approved by : Katsumi Ishikawa
Katsumi Ishikawa Design Manager

Prepared by : Shintaro Oki
Shintaro Oki Design Engineer

COSEL CO.,LTD.

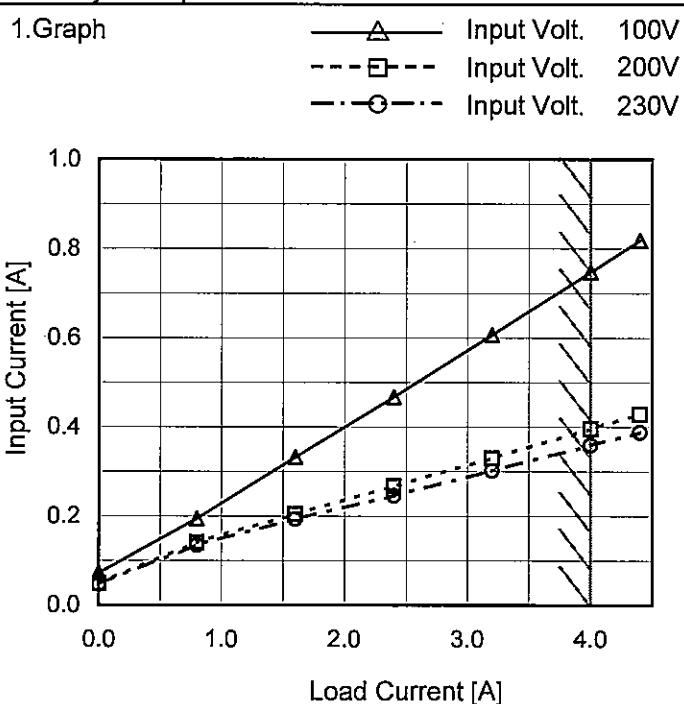
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Model	PMA60F-15
Item	Input Current (by Load Current)
Object	_____



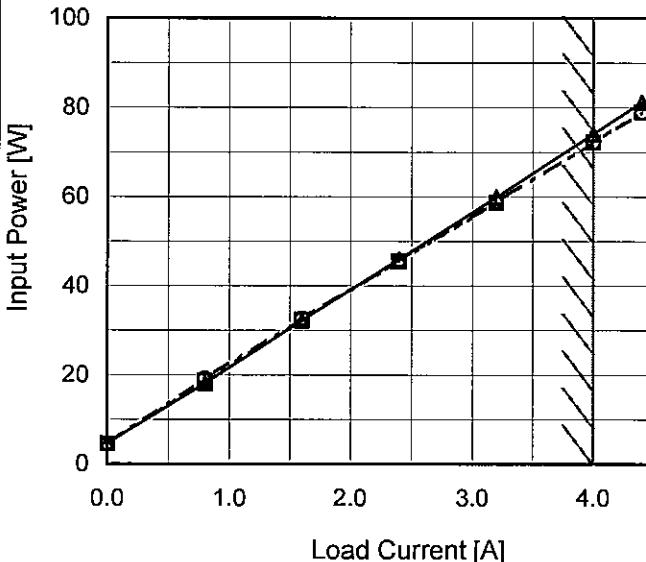
Temperature 25°C
Testing Circuitry Figure A

2. Values

Load Current [A]	Input Current [A]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	0.072	0.048	0.047
0.8	0.194	0.141	0.134
1.6	0.332	0.204	0.193
2.4	0.467	0.267	0.246
3.2	0.606	0.330	0.302
4.0	0.747	0.396	0.359
4.4	0.818	0.429	0.388
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--	-	-	-

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

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Model	PMA60F-15																																																					
Item	Input Power (by Load Current)	Temperature	25°C																																																			
Object		Testing Circuitry	Figure A																																																			
1.Graph	<p>—△— Input Volt. 100V - - -□--- Input Volt. 200V - - -○--- Input Volt. 230V</p>  <p>The graph plots Input Power [W] on the Y-axis (0 to 100) against Load Current [A] on the X-axis (0.0 to 4.0). 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). A slanted line from the top right corner of the graph area indicates the rated load current range.</p>	2.Values																																																				
			<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>4.60</td><td>4.50</td><td>4.50</td></tr> <tr><td>0.8</td><td>18.10</td><td>18.70</td><td>19.20</td></tr> <tr><td>1.6</td><td>32.20</td><td>32.40</td><td>32.60</td></tr> <tr><td>2.4</td><td>46.00</td><td>45.50</td><td>45.70</td></tr> <tr><td>3.2</td><td>59.90</td><td>58.80</td><td>58.90</td></tr> <tr><td>4.0</td><td>74.10</td><td>72.20</td><td>72.20</td></tr> <tr><td>4.4</td><td>81.20</td><td>79.00</td><td>78.90</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> <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	4.60	4.50	4.50	0.8	18.10	18.70	19.20	1.6	32.20	32.40	32.60	2.4	46.00	45.50	45.70	3.2	59.90	58.80	58.90	4.0	74.10	72.20	72.20	4.4	81.20	79.00	78.90	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-
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Item	Efficiency (by Input Voltage)	Testing Circuitry	Figure A																														
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<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 on the graph 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>76.4</td><td>79.3</td></tr> <tr><td>85</td><td>77.0</td><td>80.5</td></tr> <tr><td>100</td><td>77.4</td><td>81.5</td></tr> <tr><td>120</td><td>77.8</td><td>82.4</td></tr> <tr><td>200</td><td>77.8</td><td>83.7</td></tr> <tr><td>230</td><td>77.2</td><td>83.7</td></tr> <tr><td>264</td><td>76.6</td><td>83.6</td></tr> <tr><td>280</td><td>77.0</td><td>83.7</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>				Input Voltage [V]	Efficiency Load 50% [%]	Efficiency Load 100% [%]	75	76.4	79.3	85	77.0	80.5	100	77.4	81.5	120	77.8	82.4	200	77.8	83.7	230	77.2	83.7	264	76.6	83.6	280	77.0	83.7	--	-	-
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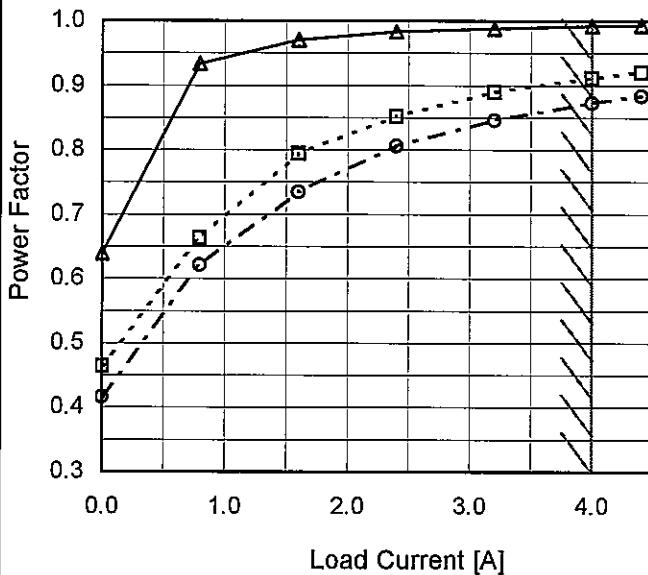
Model PMA60F-15

Item Power Factor (by Load Current)

Object _____

1. Graph

—△— Input Volt. 100V
 - -□--- Input Volt. 200V
 - -○--- Input Volt. 230V



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

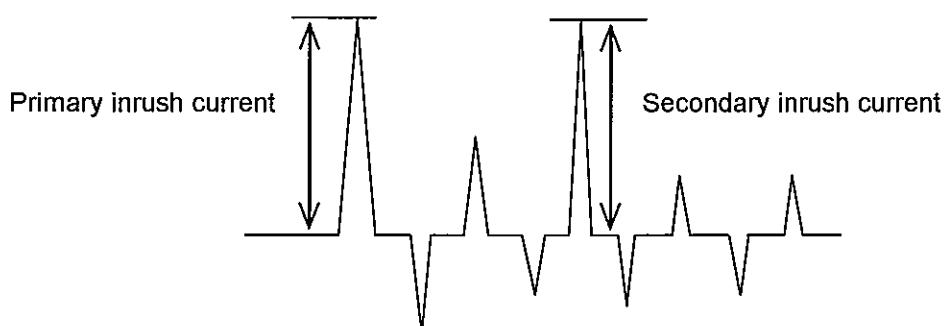
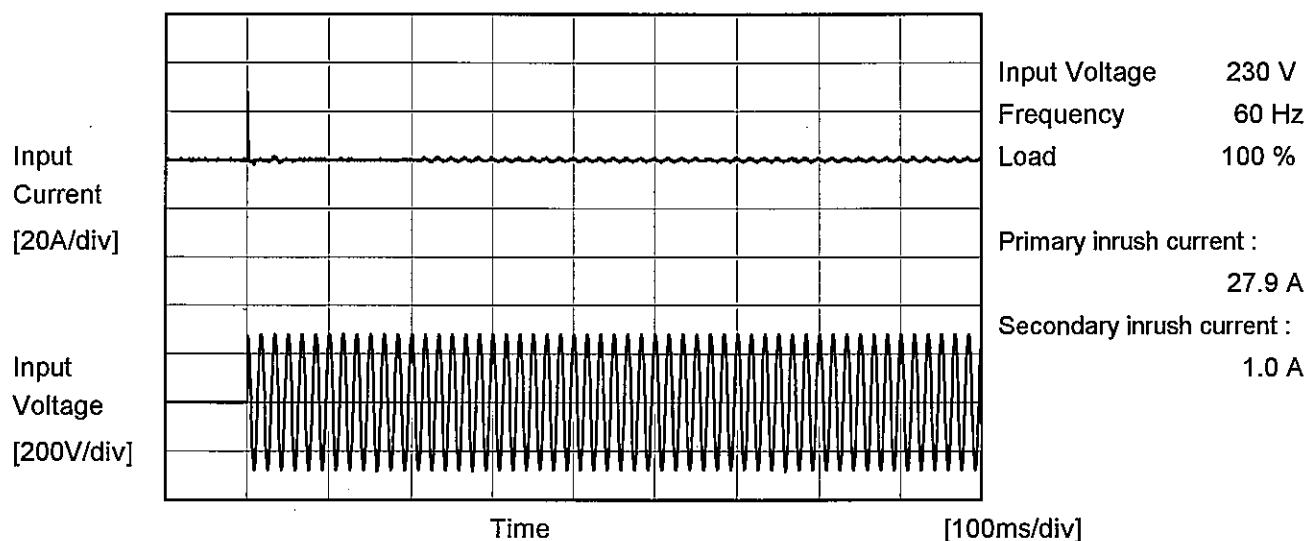
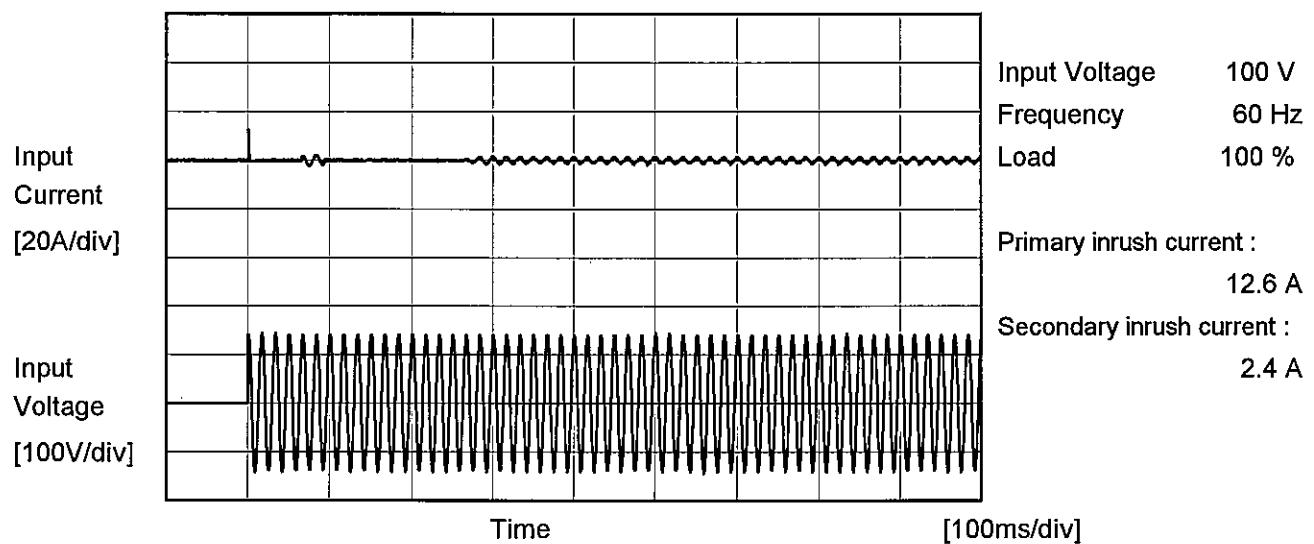
Temperature 25°C
 Testing Circuitry Figure A

2. Values

Load Current [A]	Power Factor		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	0.639	0.464	0.417
0.8	0.933	0.663	0.621
1.6	0.970	0.794	0.734
2.4	0.983	0.852	0.806
3.2	0.988	0.890	0.846
4.0	0.992	0.912	0.873
4.4	0.993	0.921	0.884
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	PMA60F-15	Temperature	25°C
Item	Inrush Current	Testing Circuitry	Figure A
Object	_____		





Model	PMA60F-15	Temperature Testing Circuitry Figure B
Item	Leakage Current	
Object	_____	

1. Results

[mA]

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-15	Temperature	25°C																																
Item	Line Regulation	Testing Circuitry	Figure A																																
Object	+15V4A																																		
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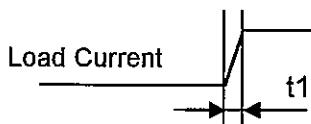
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Note: Slanted line shows the range of the rated load current.																																																							

COSEL

Model	PMA60F-15	Temperature Testing Circuitry 25°C Figure A
Item	Dynamic Load Response	
Object	+15V4A	

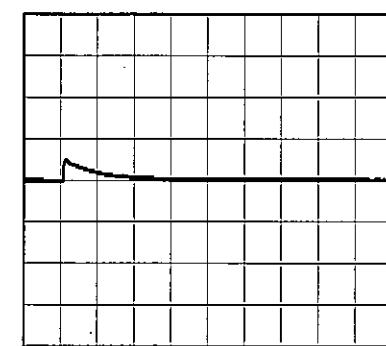
Input Volt. 100 V
Cycle 1000 ms

Response. $t_1=t_2=50\mu s$. Typ

Min. Load (0A) ↔
Load 100% (4A)

100 mV/div

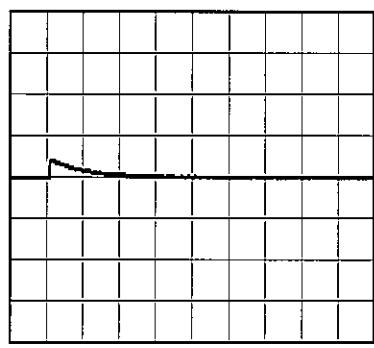
10 ms/div



Min. Load (0A) ↔
Load 50% (2A)

100 mV/div

10 ms/div



COSEL

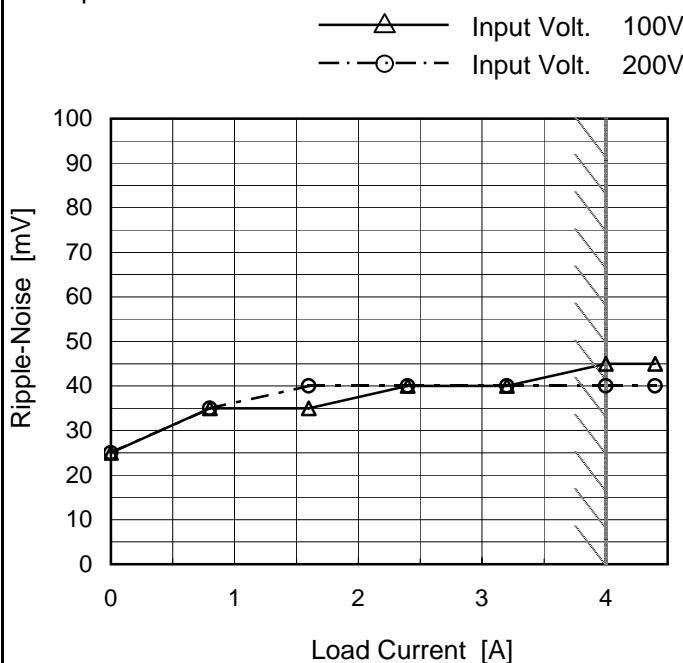
Model	PMA60F-15																																							
Item	Ripple Voltage (by Load Current)	Temperature 25°C Testing Circuitry Figure A																																						
Object	+15V4A																																							
1. Graph																																								
<p>Graph showing Ripple Voltage [mV] vs Load Current [A]. The Y-axis ranges from 0 to 100 mV, and the X-axis ranges from 0 to 4 A. Two curves are plotted: Input Volt. 100V (solid line with open triangles) and Input Volt. 200V (dashed line with open circles). Both curves show a slight increase in ripple voltage as load current increases. A slanted line indicates the rated load current range.</p>																																								
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Load Current [A]	Ripple Voltage [mV]																																							
	Input Volt. 100 [V]	Input Volt. 200 [V]																																						
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<p>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.</p> <p>T1: Due to AC Input Line T2: Due to Switching</p> <p>Fig. Complex Ripple Wave Form</p>																																								

COSEL

Model	PMA60F-15
Item	Ripple-Noise
Object	+15V4A

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	25	25
0.8	35	35
1.6	35	40
2.4	40	40
3.2	40	40
4.0	45	40
4.4	45	40
--	-	-
--	-	-
--	-	-
--	-	-

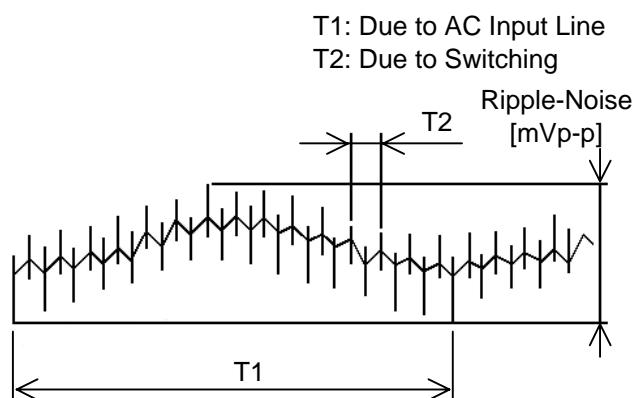
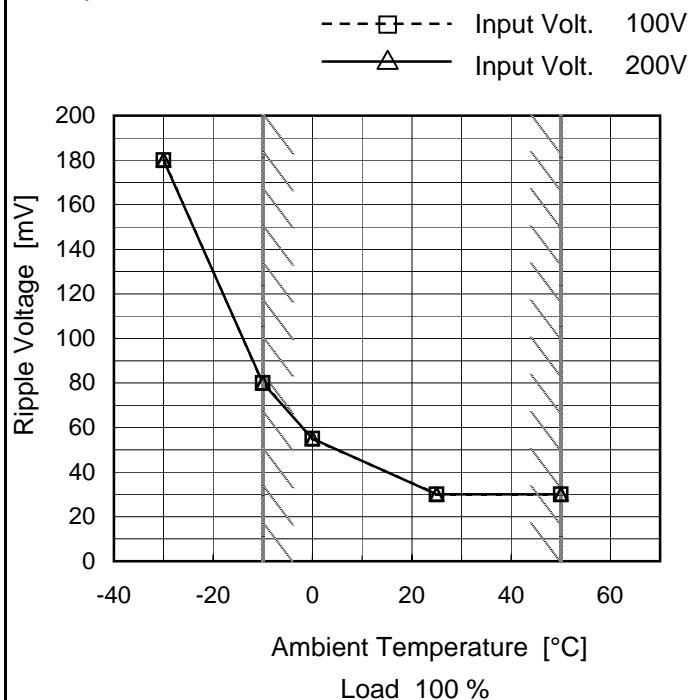


Fig. Complex Ripple Wave Form

COSEL

Model	PMA60F-15
Item	Ripple Voltage (by Ambient Temp.)
Object	+15V4A

1. Graph



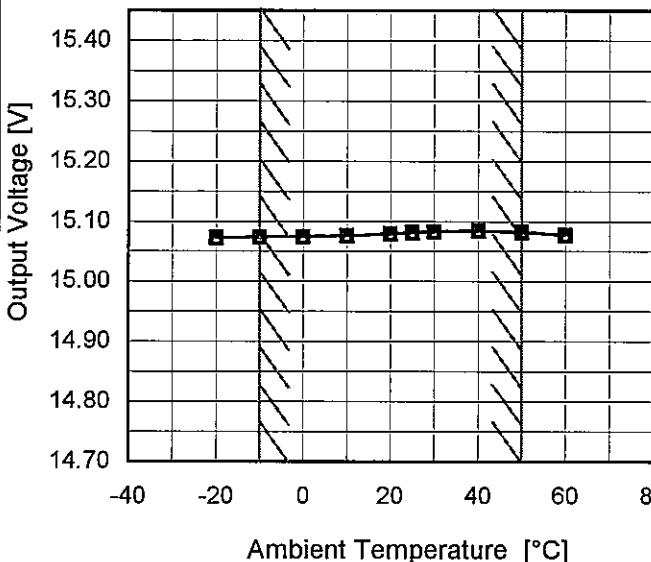
Testing Circuitry Figure A

2. Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 200 [V]
-30	180	180
-10	80	80
0	55	55
25	30	30
50	30	30
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

Measured by 20 MHz Oscilloscope.

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

Model	PMA60F-15	Testing Circuitry Figure A																																																					
Item	Ambient Temperature Drift																																																						
Object	+15V4A	2.Values																																																					
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>																																																						
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Note: Slanted line shows the range of the rated ambient temperature.



Model	PMA60F-15	Testing Circuitry Figure A
Item	Output Voltage Accuracy	
Object	+15V4A	

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 ~ 4A

* 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	40	264	0	15.094	± 10	± 0.1
Minimum Voltage	-10	264	4	15.074		

COSEL

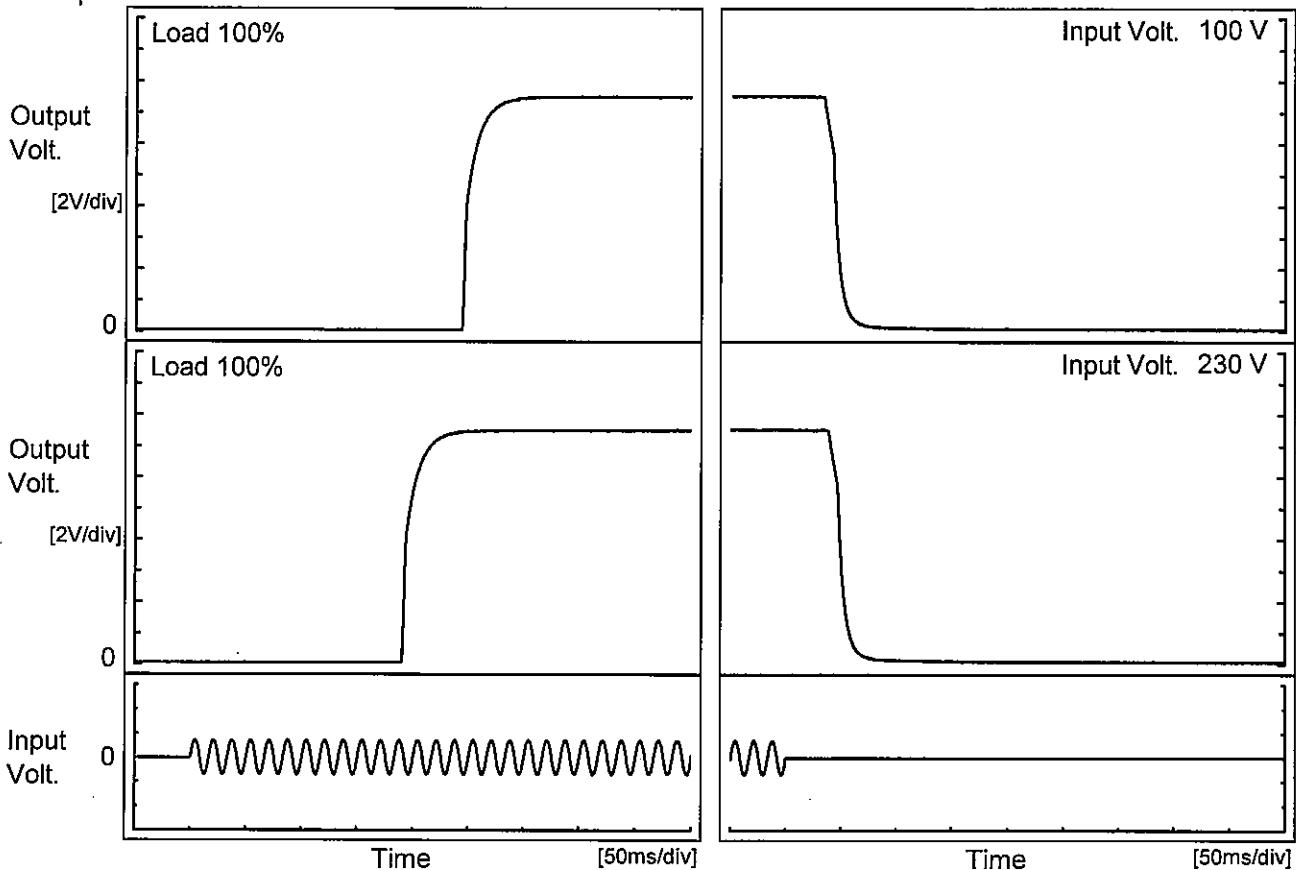
Model	PMA60F-15	Temperature	25°C																						
Item	Time Lapse Drift	Testing Circuitry	Figure A																						
Object	+15V4A																								
1.Graph			2.Values																						
<p>Output Voltage [V]</p> <p>Time [H]</p> <p>Input Volt. 100V Load 100%</p>			<table border="1"> <thead> <tr> <th>Time since start [H]</th> <th>Output Voltage [V]</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>15.080</td></tr> <tr><td>0.5</td><td>15.077</td></tr> <tr><td>1.0</td><td>15.078</td></tr> <tr><td>2.0</td><td>15.078</td></tr> <tr><td>3.0</td><td>15.078</td></tr> <tr><td>4.0</td><td>15.078</td></tr> <tr><td>5.0</td><td>15.078</td></tr> <tr><td>6.0</td><td>15.078</td></tr> <tr><td>7.0</td><td>15.078</td></tr> <tr><td>8.0</td><td>15.078</td></tr> </tbody> </table>	Time since start [H]	Output Voltage [V]	0.0	15.080	0.5	15.077	1.0	15.078	2.0	15.078	3.0	15.078	4.0	15.078	5.0	15.078	6.0	15.078	7.0	15.078	8.0	15.078
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8.0	15.078																								

* The characteristic of AC200V is equal.

Model	PMA60F-15
Item	Rise and Fall Time
Object	+15V4A

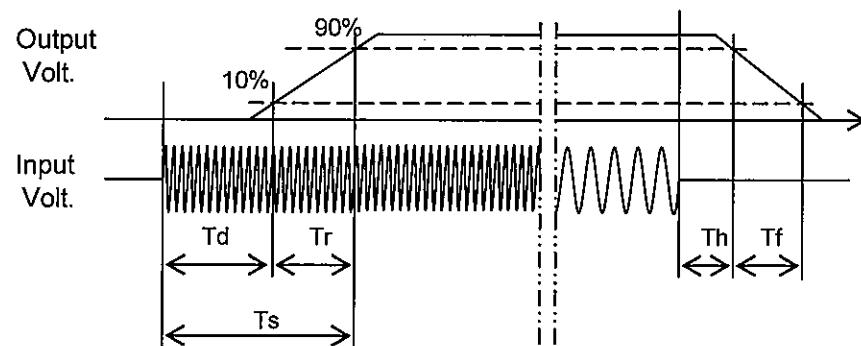
Temperature 25°C
Testing Circuitry Figure A

1. Graph



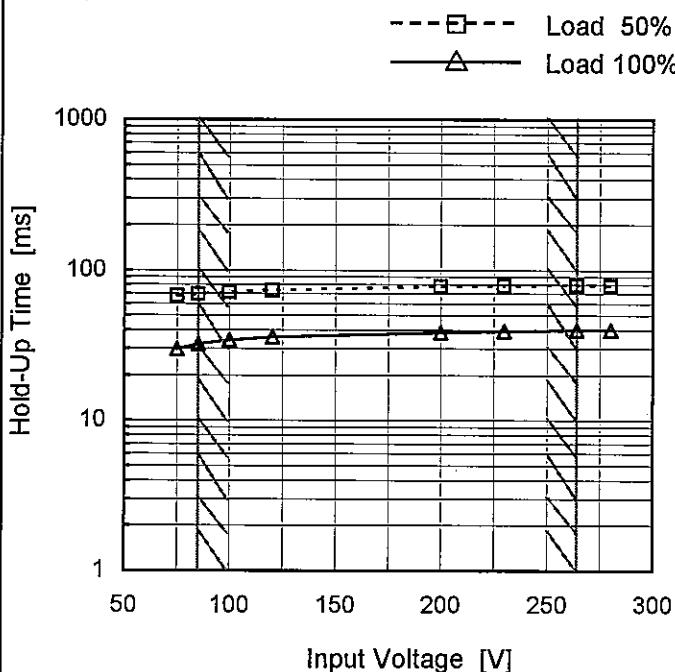
2. Values

Input Volt.	Time	Td	Tr	Ts	Th	Tf
100 V		245.5	21.0	266.5	37.3	17.3
230 V		191.5	21.0	212.5	41.8	17.5



Model	PMA60F-15
Item	Hold-Up Time
Object	+15V4A

1. Graph



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.

Temperature 25°C
Testing Circuitry Figure A

2. Values

Input Voltage [V]	Hold-Up Time [ms]	
	Load 50%	Load 100%
75	67	30
85	69	32
100	72	34
120	74	36
200	78	39
230	79	39
264	80	40
280	79	40
--	-	-

Model	PMA60F-15	Temperature Testing Circuitry 25°C Figure A																																																			
Item	Instantaneous Interruption Compensation																																																				
Object	+15V4A																																																				
1.Graph	<p>—△— Input Volt. 100V - -□--- Input Volt. 200V - -○--- Input Volt. 230V</p> <p>Instantaneous Compensation Time [ms]</p> <p>Load Current [A]</p>																																																				
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Note:	Slanted line shows the range of the rated load current.																																																				

<p>Model PMA60F-15</p> <p>Item Minimum Input Voltage for Regulated Output Voltage</p> <p>Object +15V4A</p>	Testing Circuitry Figure A																																						
	1. Graph	2. Values																																					
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<p>Note: Slanted line shows the range of the rated ambient temperature.</p>																																							

COSEL

Model	PMA60F-15																																										
Item	Overcurrent Protection	Temperature 25°C Testing Circuitry Figure A																																									
Object	+15V4A																																										
1.Graph																																											
<p>Input Volt. 100V Input Volt. 230V</p> <p>Output Voltage [V]</p> <p>Load Current [A]</p>																																											
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Model PMA60F-15 Item Overvoltage Protection Object +15V4A	Testing Circuitry Figure A																																						
	1. Graph	2. Values																																					
	<p style="text-align: center;"> —△— Input Volt. 100V - -□-- Input Volt. 230V </p> <p style="text-align: center;">Operating Point [V]</p> <p style="text-align: center;">Ambient Temperature [°C]</p> <p style="text-align: center;">Load 0%</p>	<table border="1"> <thead> <tr> <th rowspan="2">Ambient Temperature [°C]</th> <th colspan="2">Operating Point [V]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>-20</td><td>22.97</td><td>22.90</td></tr> <tr><td>-10</td><td>23.04</td><td>23.11</td></tr> <tr><td>0</td><td>23.25</td><td>23.18</td></tr> <tr><td>10</td><td>23.32</td><td>23.32</td></tr> <tr><td>20</td><td>23.46</td><td>23.46</td></tr> <tr><td>25</td><td>23.53</td><td>23.53</td></tr> <tr><td>30</td><td>23.60</td><td>23.60</td></tr> <tr><td>40</td><td>23.74</td><td>23.74</td></tr> <tr><td>50</td><td>23.88</td><td>23.88</td></tr> <tr><td>60</td><td>24.02</td><td>24.02</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>	Ambient Temperature [°C]	Operating Point [V]		Input Volt. 100[V]	Input Volt. 230[V]	-20	22.97	22.90	-10	23.04	23.11	0	23.25	23.18	10	23.32	23.32	20	23.46	23.46	25	23.53	23.53	30	23.60	23.60	40	23.74	23.74	50	23.88	23.88	60	24.02	24.02	--	-
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<p>Note: Slanted line shows the range of the rated ambient temperature.</p>																																							

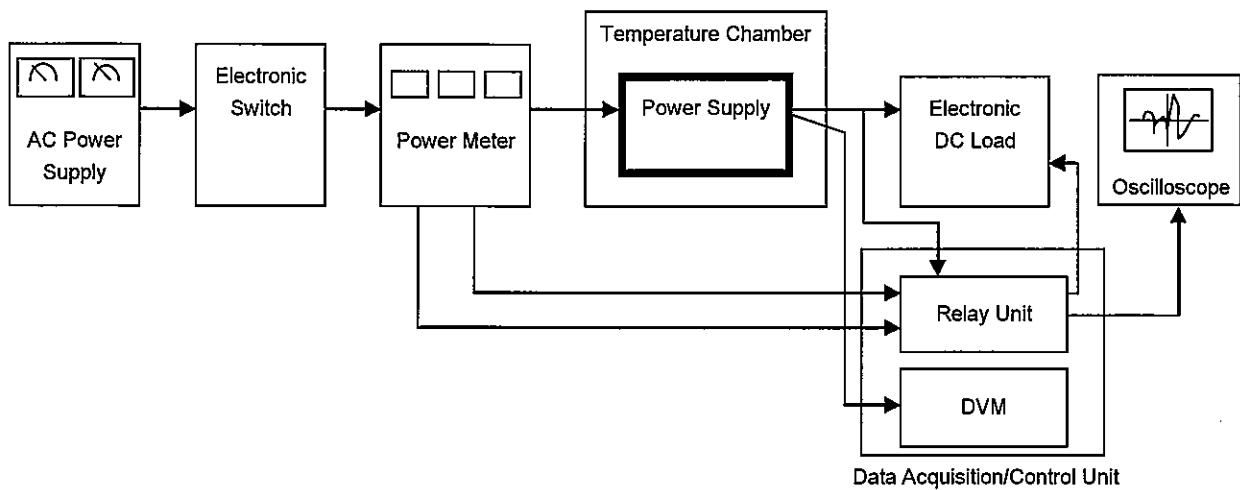


Figure A

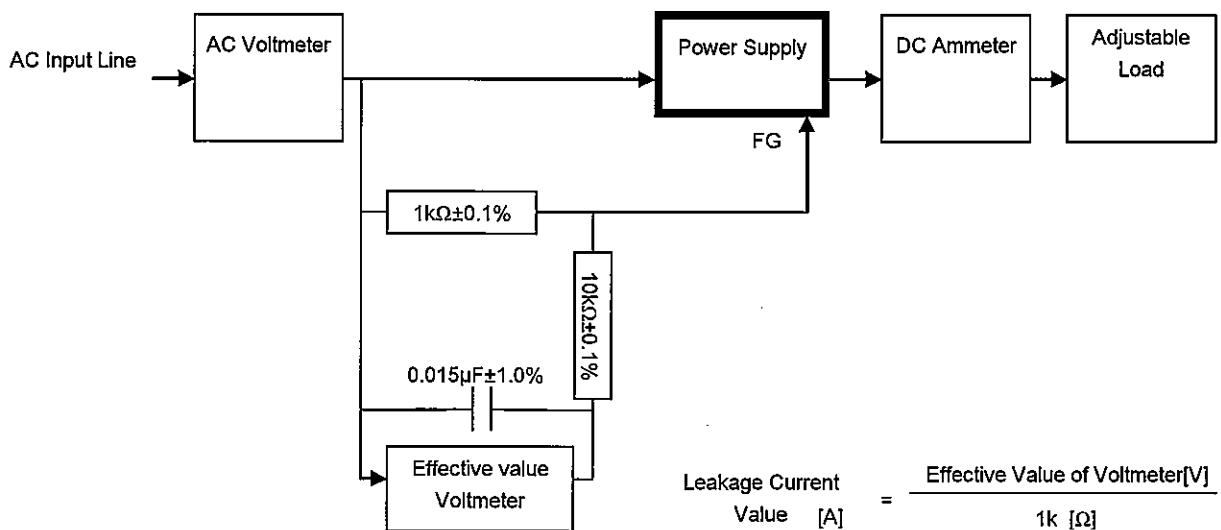


Figure B (IEC60601-1)