

TEST DATA OF KHNA60F-12

Regulated DC Power Supply
June 16, 2014

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Yukihiro Takehashi Design Manager

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Seiya Shimada Design Engineer

COSEL CO.,LTD.

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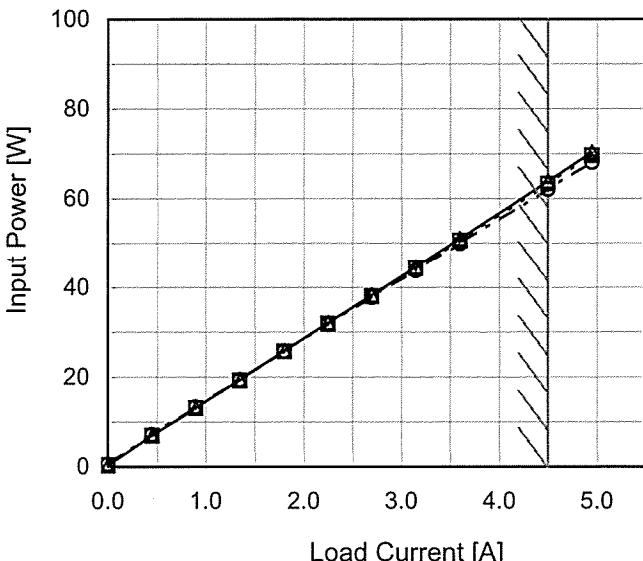
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Model	KHNA60F-12																																																					
Item	Input Current (by Load Current)	Temperature Testing Circuitry	25°C Figure A																																																			
Object	_____																																																					
1.Graph	_____	Input Volt. 100V Input Volt. 115V Input Volt. 230V																																																				
<p>The graph shows three curves representing different input voltages: 100V (solid line with open triangle markers), 115V (dashed line with open square markers), and 230V (dash-dot line with open circle markers). The curves show that as input voltage increases, the required load current to maintain a given input current decreases. A slanted line is drawn across the graph, representing the rated load current range.</p>			2.Values																																																			
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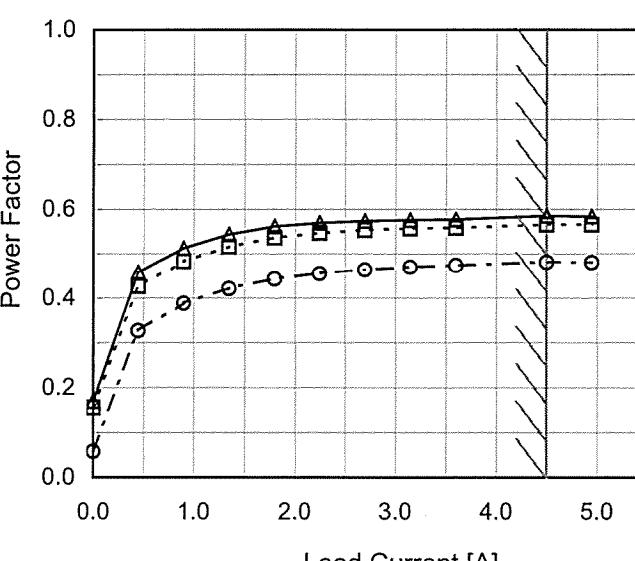
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<p>Graph showing Power Factor vs Input Voltage for KHNA60F-12 at 25°C. The Y-axis is Power Factor (0.0 to 1.0) and the X-axis is Input Voltage [V] (50 to 300). Two data series are shown: Load 50% (dashed line with square markers) and Load 100% (solid line with triangle markers). Both series show a slight decrease in power factor as input voltage increases. A slanted line indicates the rated input voltage range.</p>																																		
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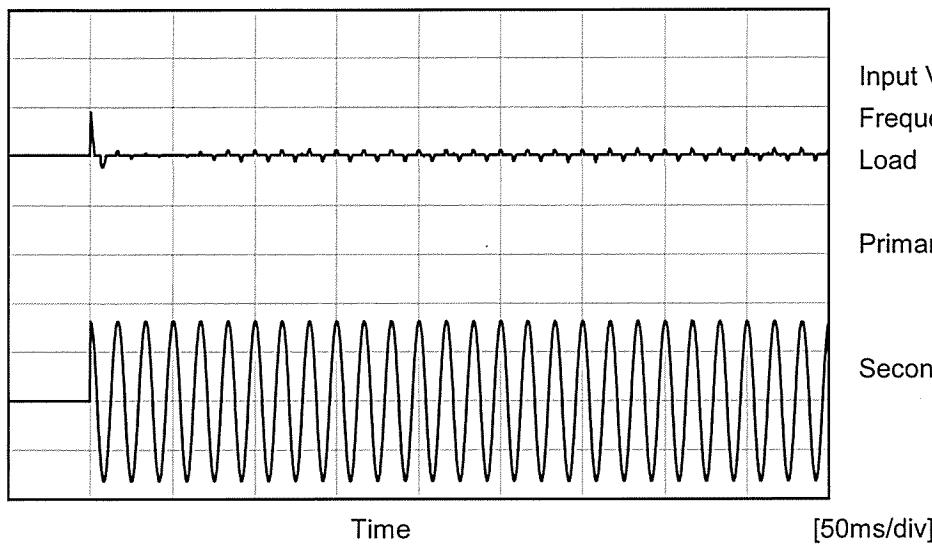
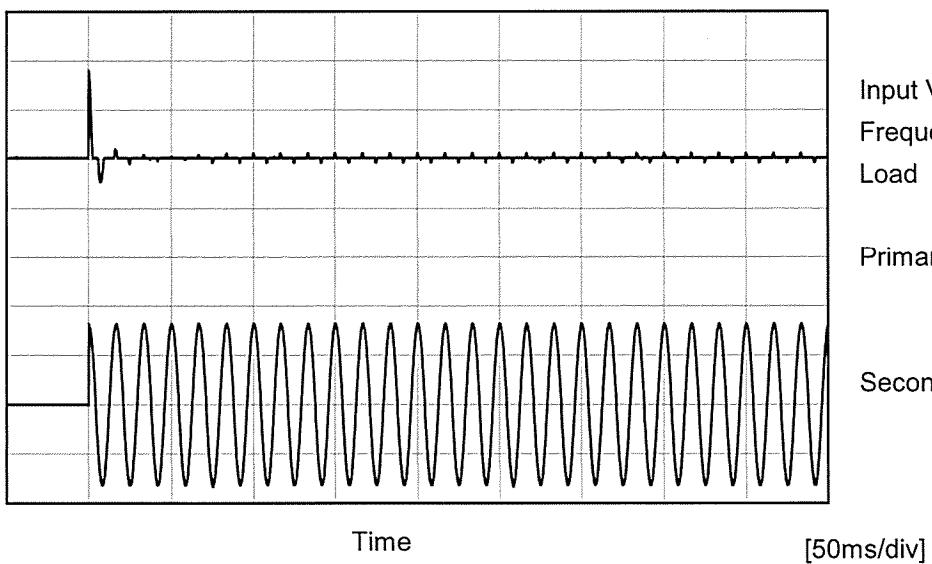
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<p>Note: Slanted line shows the range of the rated load current.</p>																																																						

COSEL

Model KHNA60F-12

Item Inrush Current

Object _____

Temperature 25°C
Testing Circuitry Figure AInput
Current
[20A/div]Input
Current
[20A/div]

Primary inrush current

Secondary inrush current



Model	KHNA60F-12	Temperature	25°C
Item	Leakage Current	Testing Circuitry	Figure B
Object	_____		

1. Results

[mA]

Standards		Input Volt.			Note
		100 [V]	115 [V]	240 [V]	
DEN-AN	Both phases	0.07	0.08	0.21	Operation
	One of phases	0.13	0.14	0.35	Stand by
IEC60950-1	Both phases	0.07	0.07	0.22	Operation
	One of phases	0.12	0.13	0.33	Stand by

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

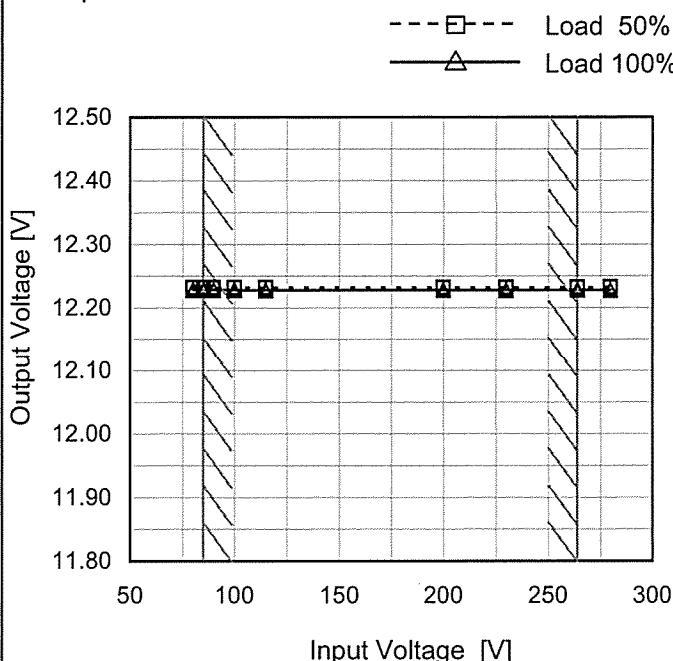
2. Condition

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



Model	KHNA60F-12
Item	Line Regulation
Object	+12V4.5A

1.Graph



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

Temperature 25°C
Testing Circuitry Figure A

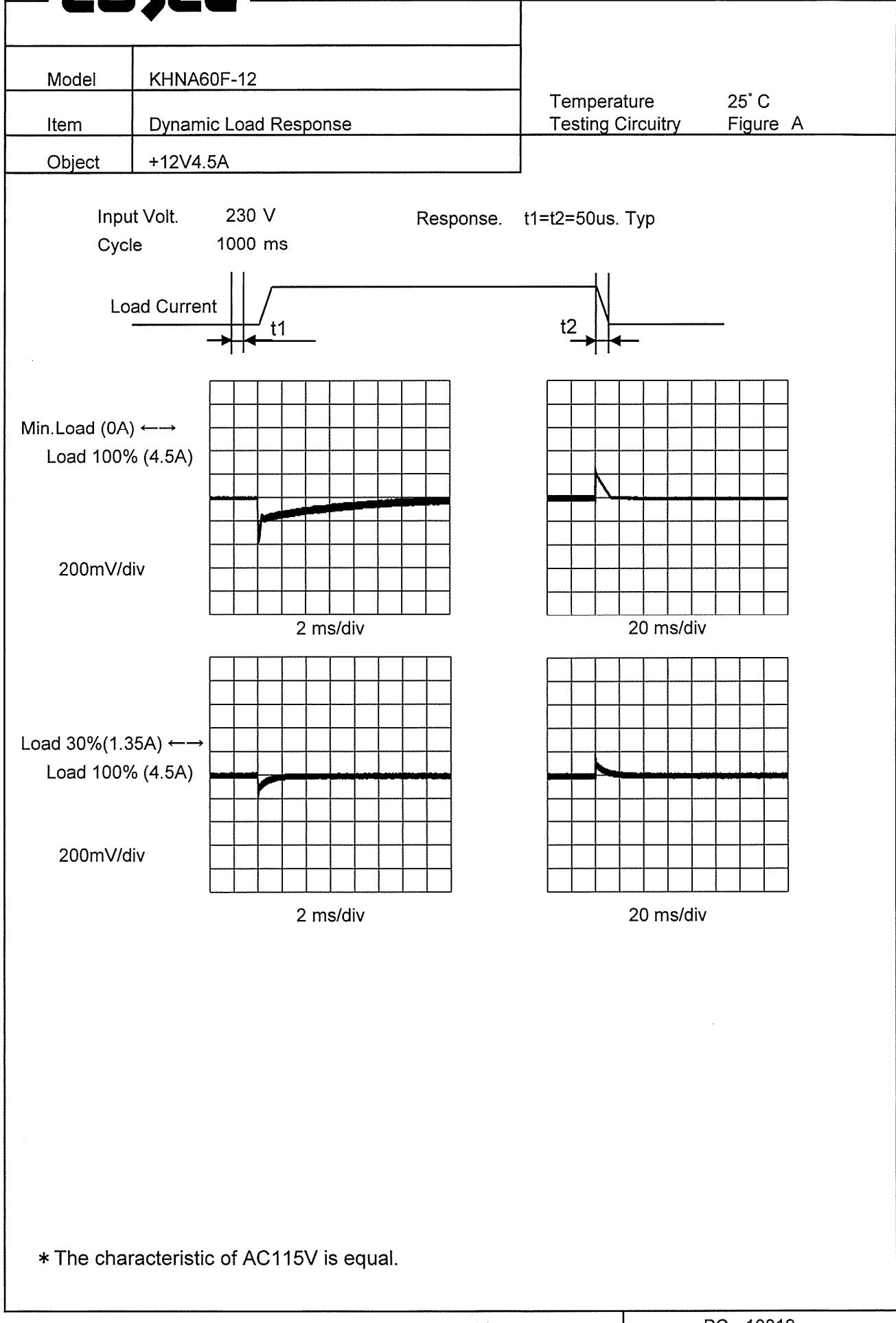
2.Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
80	12.232	12.228
85	12.232	12.228
90	12.232	12.228
100	12.232	12.228
115	12.232	12.228
200	12.232	12.228
230	12.232	12.228
264	12.232	12.228
280	12.232	12.228

COSEL

Model	KHNA60F-12		Temperature Testing Circuitry 25°C Figure A																																																		
Item	Load Regulation																																																				
Object	+12V4.5A																																																				
1.Graph	<p>Output Voltage [V]</p> <p>Load Current [A]</p> <p>Legend:</p> <ul style="list-style-type: none"> Input Volt. 100V Input Volt. 115V Input Volt. 230V 																																																				
2.Values																																																					
<table border="1"> <thead> <tr> <th rowspan="2">Load Current [A]</th> <th colspan="3">Output Voltage [V]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 115[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>0.00</td><td>12.235</td><td>12.235</td><td>12.235</td></tr> <tr><td>0.45</td><td>12.235</td><td>12.234</td><td>12.234</td></tr> <tr><td>0.90</td><td>12.234</td><td>12.234</td><td>12.234</td></tr> <tr><td>1.35</td><td>12.233</td><td>12.233</td><td>12.233</td></tr> <tr><td>1.80</td><td>12.233</td><td>12.233</td><td>12.233</td></tr> <tr><td>2.25</td><td>12.232</td><td>12.232</td><td>12.232</td></tr> <tr><td>2.70</td><td>12.231</td><td>12.231</td><td>12.231</td></tr> <tr><td>3.15</td><td>12.230</td><td>12.231</td><td>12.230</td></tr> <tr><td>3.60</td><td>12.230</td><td>12.230</td><td>12.230</td></tr> <tr><td>4.50</td><td>12.228</td><td>12.228</td><td>12.228</td></tr> <tr><td>4.95</td><td>12.227</td><td>12.227</td><td>12.227</td></tr> </tbody> </table>			Load Current [A]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]	0.00	12.235	12.235	12.235	0.45	12.235	12.234	12.234	0.90	12.234	12.234	12.234	1.35	12.233	12.233	12.233	1.80	12.233	12.233	12.233	2.25	12.232	12.232	12.232	2.70	12.231	12.231	12.231	3.15	12.230	12.231	12.230	3.60	12.230	12.230	12.230	4.50	12.228	12.228	12.228	4.95	12.227	12.227	12.227
Load Current [A]	Output Voltage [V]																																																				
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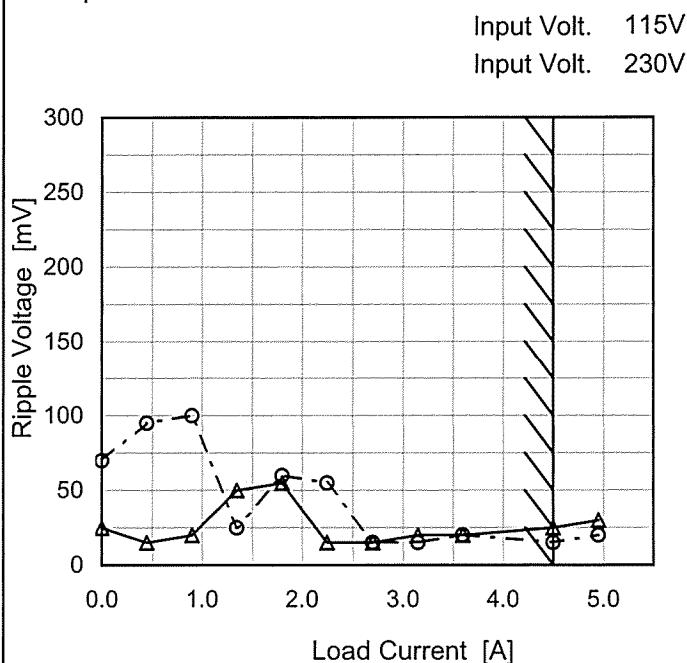
Note: Slanted line shows the range of the rated load current.

COSEL

COSEL

Model	KHNA60F-12
Item	Ripple Voltage (by Load Current)
Object	+12V4.5A

1. Graph



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.

Temperature 25°C
Testing Circuitry Figure C

2. Values

Load Current [A]	Ripple Voltage [mV]	
	Input Volt. 115 [V]	Input Volt. 230 [V]
0.00	25	70
0.45	15	95
0.90	20	100
1.35	50	25
1.80	55	60
2.25	15	55
2.70	15	15
3.15	20	15
3.60	20	20
4.50	25	15
4.95	30	20

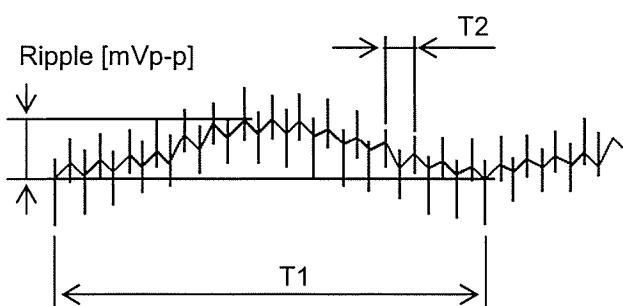
T1: Due to AC Input Line
T2: Due to Switching

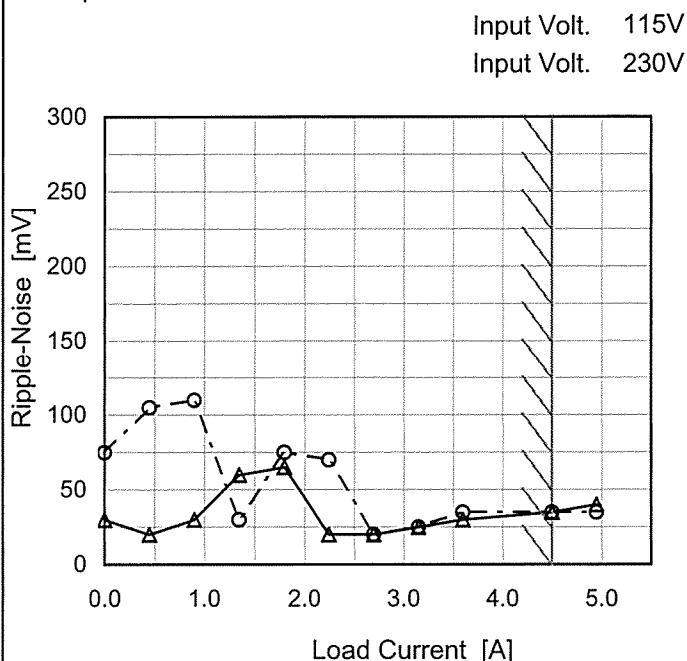
Fig. Complex Ripple Wave Form

COSEL

Model	KHNA60F-12
Item	Ripple-Noise
Object	+12V4.5A

Temperature 25°C
Testing Circuitry Figure C

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. 115 [V]	Input Volt. 230 [V]
0.00	30	75
0.45	20	105
0.90	30	110
1.35	60	30
1.80	65	75
2.25	20	70
2.70	20	20
3.15	25	25
3.60	30	35
4.50	35	35
4.95	40	35

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

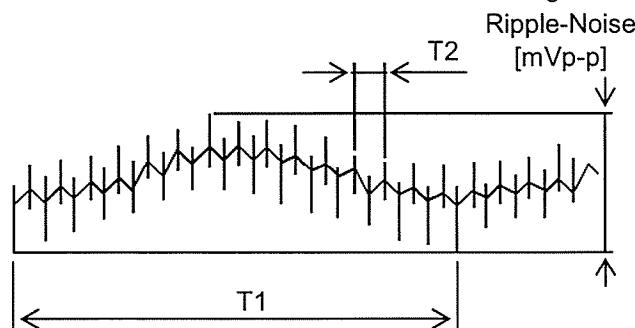


Fig. Complex Ripple Wave Form

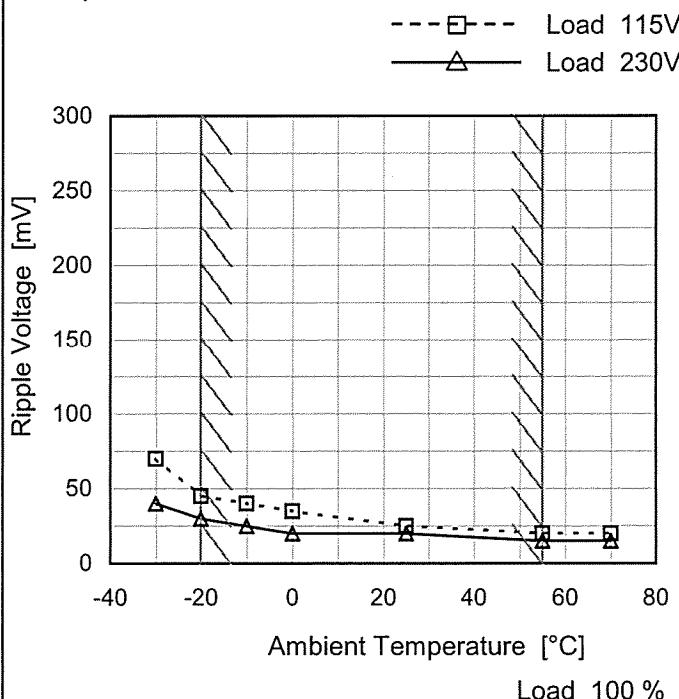
COSEL

Model KHNA60F-12

Item Ripple Voltage (by Ambient Temp.)

Object +12V4.5A

1. Graph



Measured by 20 MHz Oscilloscope.

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

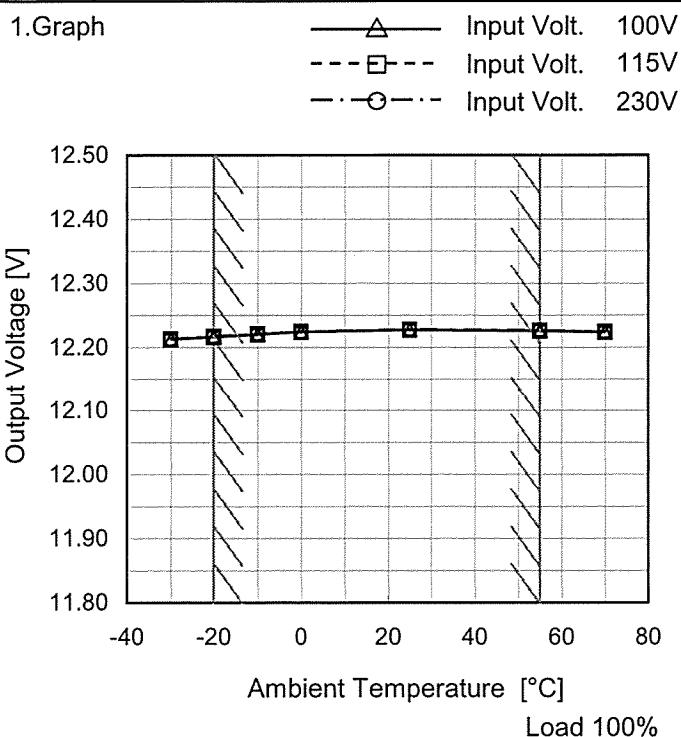
Testing Circuitry Figure C

2. Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 115 [V]	Input Volt. 230 [V]
-30	70	40
-20	45	30
-10	40	25
0	35	20
25	25	20
55	20	15
70	20	15
--	-	-
--	-	-
--	-	-
--	-	-

COSEL

Model	KHNA60F-12
Item	Ambient Temperature Drift
Object	+12V4.5A



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

Testing Circuitry Figure A

2.Values

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
-30	12.213	12.213	12.213
-20	12.217	12.217	12.217
-10	12.221	12.221	12.221
0	12.224	12.225	12.224
25	12.228	12.228	12.228
55	12.226	12.226	12.226
70	12.224	12.224	12.224
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-



Model	KHNA60F-12	Testing Circuitry Figure A
Item	Output Voltage Accuracy	
Object	+12V4.5A	

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 : -20 - 55°C

Input Voltage : 85 - 264V

Load Current : 0 - 4.5A

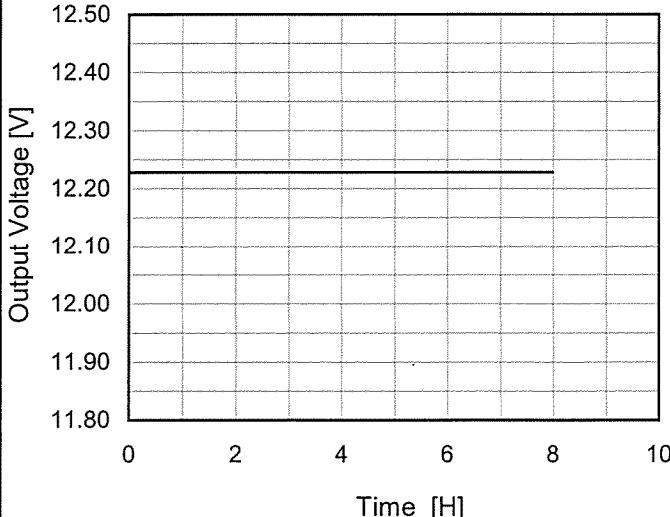
* Output Voltage Accuracy = $\pm(\text{Maximum of Output Voltage} - \text{Minimum of Output Voltage}) / 2$

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

2. Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ration [%]
Maximum Voltage	25	115	0	12.235	± 9	± 0.1
Minimum Voltage	-20	100	4.5	12.217		

COSEL

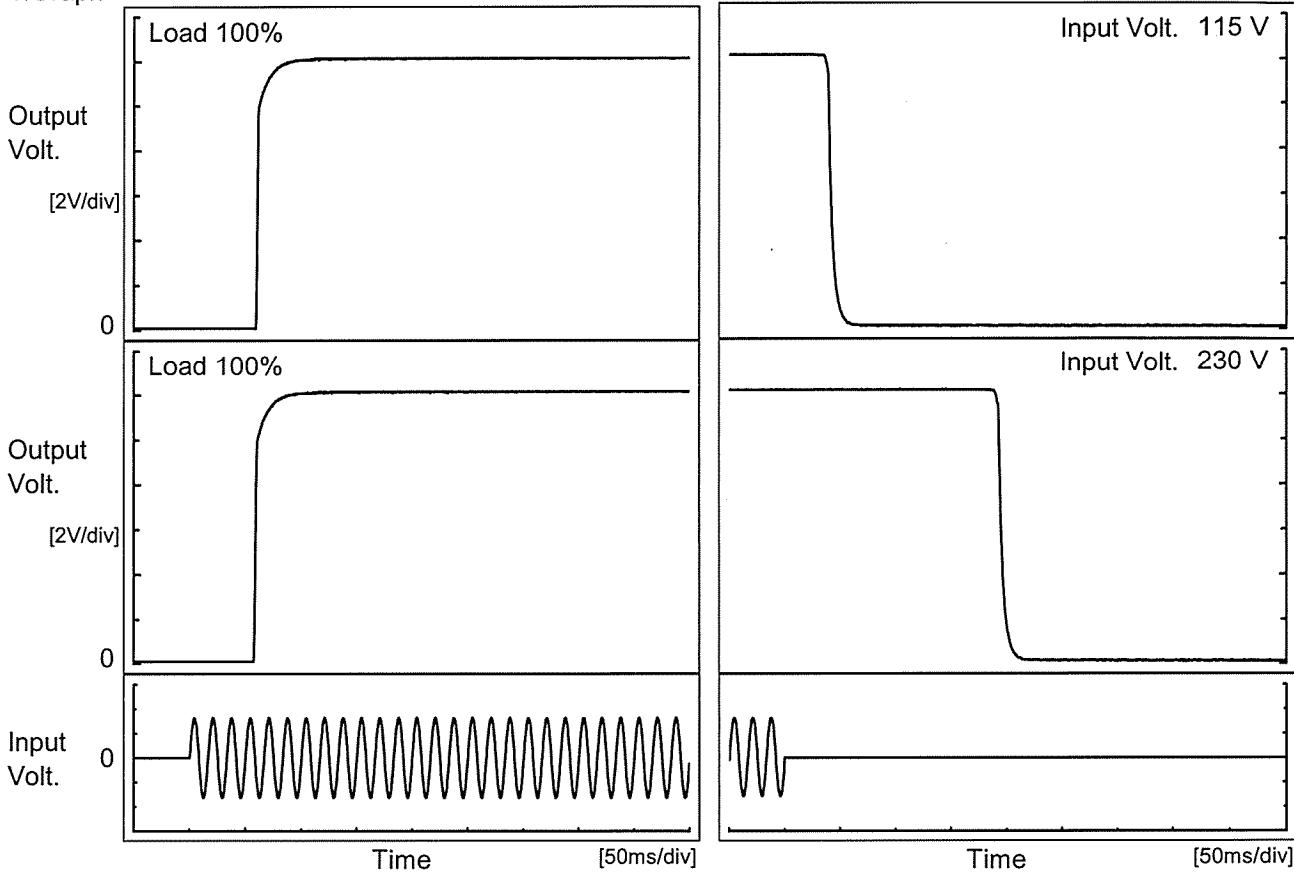
Model	KHNA60F-12	Temperature	25°C																						
Item	Time Lapse Drift	Testing Circuitry	Figure A																						
Object	+12V4.5A	2. Values																							
1. Graph	 <p>Output Voltage [V]</p> <p>Time [H]</p> <p>Input Volt. 230V Load 100%</p>																								
	<table border="1"> <thead> <tr> <th>Time since start [H]</th> <th>Output Voltage [V]</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>12.227</td></tr> <tr><td>0.5</td><td>12.228</td></tr> <tr><td>1.0</td><td>12.228</td></tr> <tr><td>2.0</td><td>12.228</td></tr> <tr><td>3.0</td><td>12.228</td></tr> <tr><td>4.0</td><td>12.228</td></tr> <tr><td>5.0</td><td>12.228</td></tr> <tr><td>6.0</td><td>12.228</td></tr> <tr><td>7.0</td><td>12.228</td></tr> <tr><td>8.0</td><td>12.228</td></tr> </tbody> </table>			Time since start [H]	Output Voltage [V]	0.0	12.227	0.5	12.228	1.0	12.228	2.0	12.228	3.0	12.228	4.0	12.228	5.0	12.228	6.0	12.228	7.0	12.228	8.0	12.228
Time since start [H]	Output Voltage [V]																								
0.0	12.227																								
0.5	12.228																								
1.0	12.228																								
2.0	12.228																								
3.0	12.228																								
4.0	12.228																								
5.0	12.228																								
6.0	12.228																								
7.0	12.228																								
8.0	12.228																								
	<p>* The characteristic of AC115V is equal.</p>																								

COSEL

Model	KHNA60F-12
Item	Rise and Fall Time
Object	+12V4.5A

Temperature 25°C
Testing Circuitry Figure A

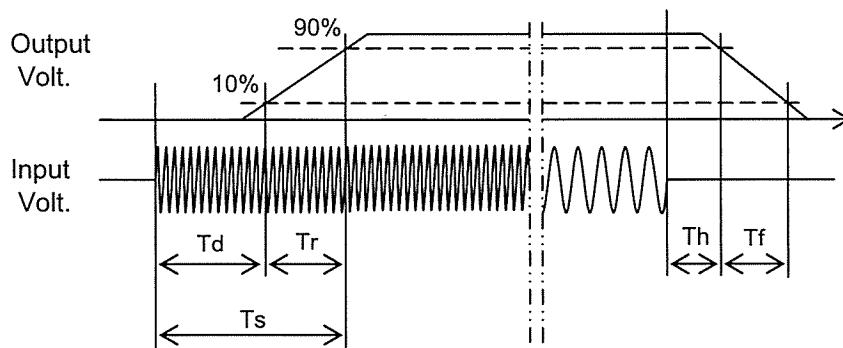
1. Graph



2. Values

[ms]

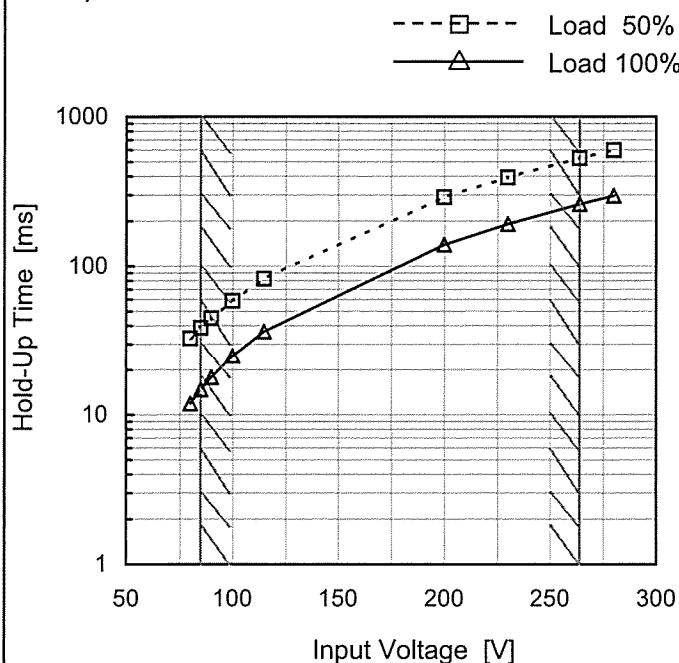
Input Volt.	Time	Td	Tr	Ts	Th	Tf
115 V		60.5	7.8	68.3	39.5	8.8
230 V		58.5	7.5	66.0	192.8	8.5





Model	KHNA60F-12
Item	Hold-Up Time
Object	+12V4.5A

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%
80	33	12
85	39	15
90	45	18
100	59	25
115	82	37
200	289	139
230	391	192
264	528	260
280	597	296

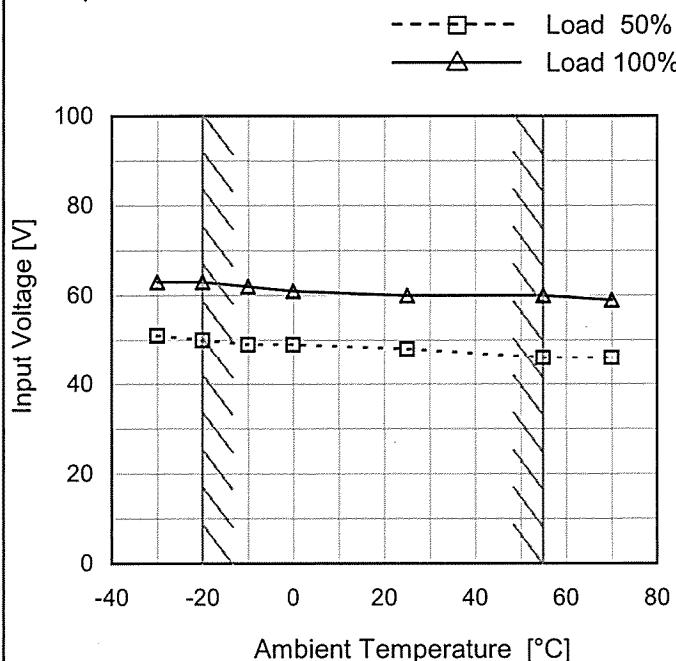
COSEL

Model	KHNA60F-12																																																					
Item	Instantaneous Interruption Compensation																																																					
Object	+12V4.5A																																																					
1.Graph																																																						
<p style="text-align: center;"> —△— Input Volt. 100V ---□--- Input Volt. 115V ---○--- Input Volt. 230V </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. 115[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>0.00</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>0.45</td><td>282</td><td>390</td><td>1770</td></tr> <tr><td>0.90</td><td>147</td><td>205</td><td>945</td></tr> <tr><td>1.35</td><td>98</td><td>139</td><td>647</td></tr> <tr><td>1.80</td><td>73</td><td>104</td><td>488</td></tr> <tr><td>2.25</td><td>57</td><td>82</td><td>392</td></tr> <tr><td>2.70</td><td>48</td><td>68</td><td>329</td></tr> <tr><td>3.15</td><td>40</td><td>57</td><td>281</td></tr> <tr><td>3.60</td><td>35</td><td>48</td><td>246</td></tr> <tr><td>4.50</td><td>26</td><td>37</td><td>193</td></tr> <tr><td>4.95</td><td>20</td><td>31</td><td>173</td></tr> </tbody> </table>				Load Current [A]	Time [ms]			Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]	0.00	-	-	-	0.45	282	390	1770	0.90	147	205	945	1.35	98	139	647	1.80	73	104	488	2.25	57	82	392	2.70	48	68	329	3.15	40	57	281	3.60	35	48	246	4.50	26	37	193	4.95	20	31	173
Load Current [A]	Time [ms]																																																					
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]																																																			
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4.50	26	37	193																																																			
4.95	20	31	173																																																			
<p>Note: Slanted line shows the range of the rated load current.</p>																																																						

COSEL

Model	KHNA60F-12
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+12V4.5A

1. Graph



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

Testing Circuitry Figure A

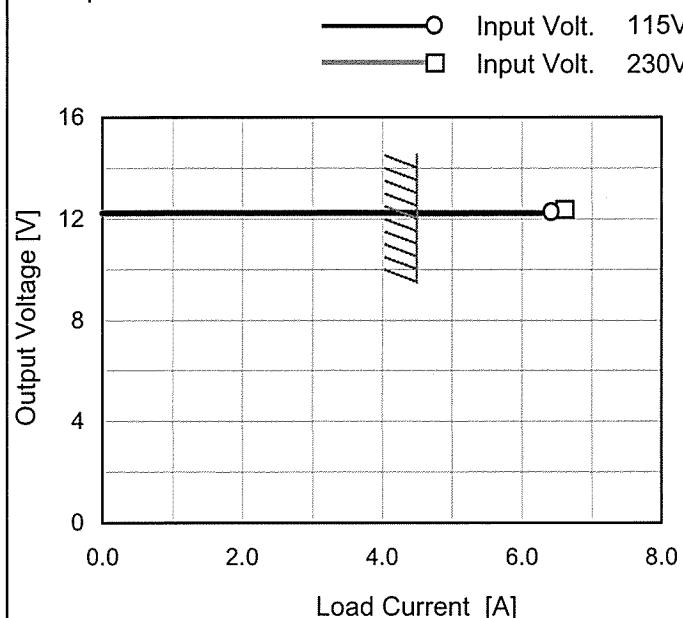
2. Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-30	51	63
-20	50	63
-10	49	62
0	49	61
25	48	60
55	46	60
70	46	59
--	-	-
--	-	-
--	-	-
--	-	-

COSEL

Model	KHNA60F-12
Item	Overcurrent Protection
Object	+12V4.5A

1.Graph



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

Intermittent operation occurs when overcurrent protection is activated.

Temperature 25°C
Testing Circuitry Figure A

2.Values

Output Voltage [V]	Load Current [A]	
	Input Volt. 115[V]	Input Volt. 230[V]
12.2	6.27	6.39
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-



		Testing Circuitry Figure A																																							
Model	KHNA60F-12																																								
Item	Overvoltage Protection																																								
Object	+12V4.5A																																								
1.Graph		2.Values																																							
<p>Operating Point [V]</p> <p>Ambient Temperature [°C]</p> <p>Load 0%</p> <p>Legend:</p> <ul style="list-style-type: none"> Input Volt. 115V (Solid Line with open triangle) Input Volt. 230V (Dashed Line with open square) 		<table border="1"> <thead> <tr> <th rowspan="2">Ambient Temperature [°C]</th> <th colspan="2">Operating Point [V]</th> </tr> <tr> <th>Input Volt. 115[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr> <td>-30</td><td>15.76</td><td>15.70</td> </tr> <tr> <td>-20</td><td>15.80</td><td>15.76</td> </tr> <tr> <td>-10</td><td>15.88</td><td>15.86</td> </tr> <tr> <td>0</td><td>15.93</td><td>15.91</td> </tr> <tr> <td>25</td><td>16.02</td><td>15.99</td> </tr> <tr> <td>55</td><td>16.33</td><td>16.27</td> </tr> <tr> <td>70</td><td>16.44</td><td>16.40</td> </tr> <tr> <td>--</td><td>-</td><td>-</td> </tr> <tr> <td>--</td><td>-</td><td>-</td> </tr> <tr> <td>--</td><td>-</td><td>-</td> </tr> <tr> <td>--</td><td>-</td><td>-</td> </tr> </tbody> </table>		Ambient Temperature [°C]	Operating Point [V]		Input Volt. 115[V]	Input Volt. 230[V]	-30	15.76	15.70	-20	15.80	15.76	-10	15.88	15.86	0	15.93	15.91	25	16.02	15.99	55	16.33	16.27	70	16.44	16.40	--	-	-	--	-	-	--	-	-	--	-	-
Ambient Temperature [°C]	Operating Point [V]																																								
	Input Volt. 115[V]	Input Volt. 230[V]																																							
-30	15.76	15.70																																							
-20	15.80	15.76																																							
-10	15.88	15.86																																							
0	15.93	15.91																																							
25	16.02	15.99																																							
55	16.33	16.27																																							
70	16.44	16.40																																							
--	-	-																																							
--	-	-																																							
--	-	-																																							
--	-	-																																							
<p>Note: Slanted line shows the range of the rated ambient temperature.</p>																																									

COSEL

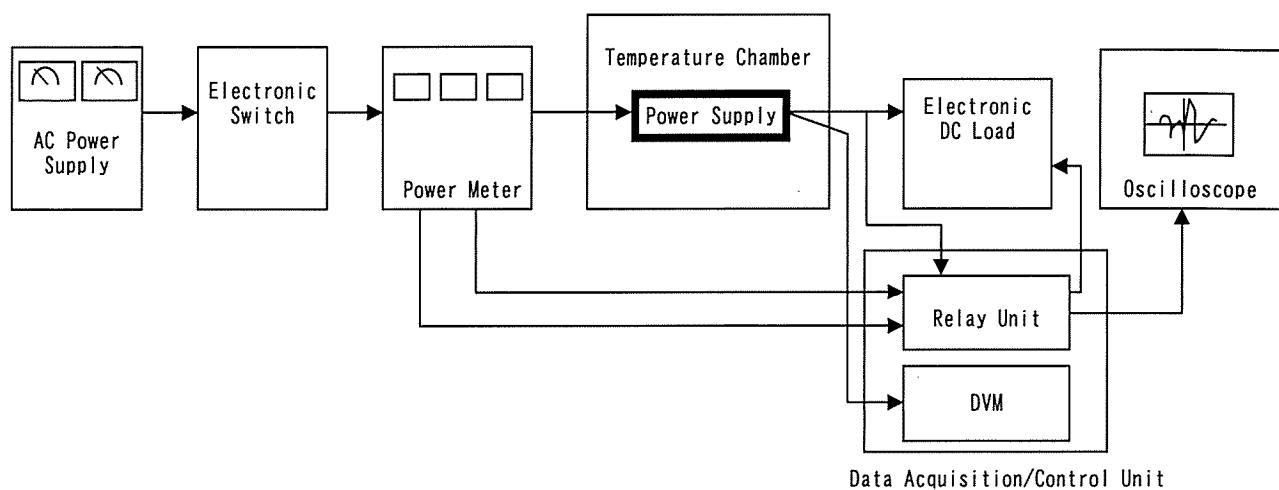


Figure A

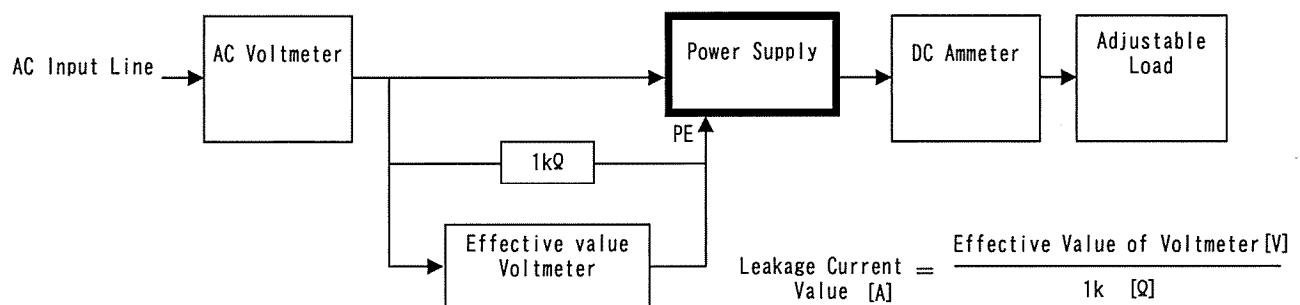


Figure B (DEN-AN)

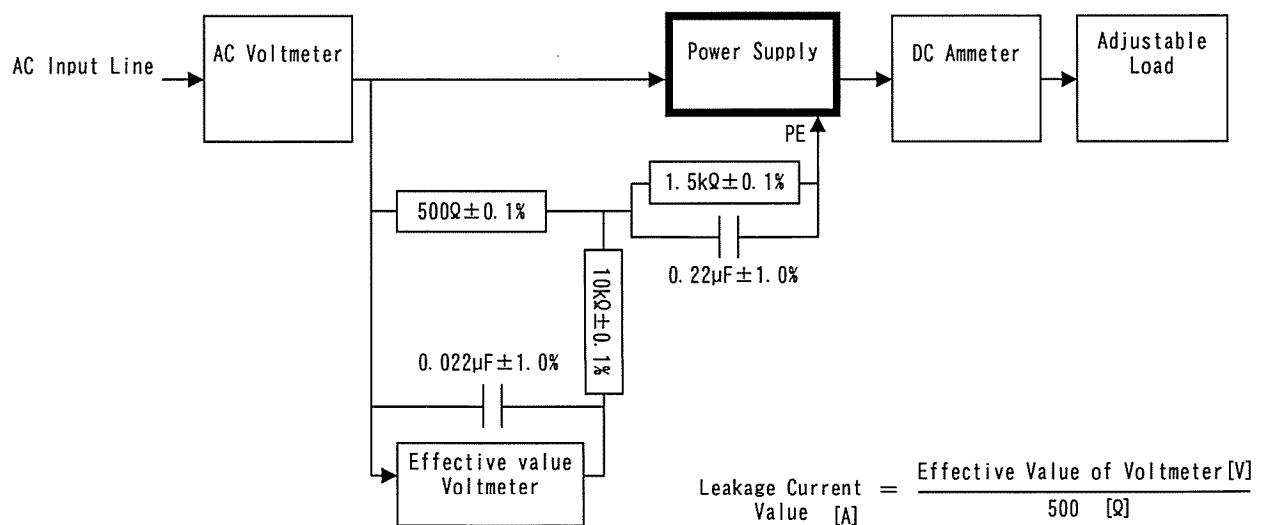
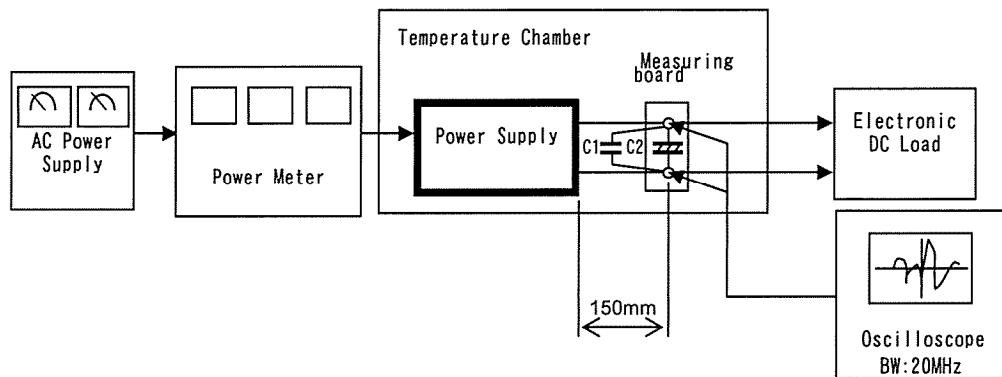


Figure B (IEC60950-1)

COSSEL

C1= $0.1 \mu F$
(Ceramic capacitor)

C2= $22 \mu F$
(Electrolytic capacitor)

Figure C