

TEST DATA OF KHEA60F-12

Regulated DC Power Supply
June 16, 2014

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Yukihiro Takehashi Design Manager

Prepared by : Seiya Shimada
Seiya Shimada Design Engineer

COSEL CO.,LTD.

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Model	KHEA60F-12	Temperature 25°C Testing Circuitry Figure A																																																				
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Object	_____																																																					
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<div><div><div>—△—</div><div>---□---</div><div>---○---</div></div><div>Input Volt. 100V Input Volt. 115V Input Volt. 230V</div></div> <p>Note: Slanted line shows the range of the rated load current.</p>		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="3">Input Current [A]</th></tr><tr><th>Input Volt. 100[V]</th><th>Input Volt. 115[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>0.00</td><td>0.021</td><td>0.024</td><td>0.040</td></tr><tr><td>0.45</td><td>0.152</td><td>0.142</td><td>0.095</td></tr><tr><td>0.90</td><td>0.256</td><td>0.235</td><td>0.150</td></tr><tr><td>1.35</td><td>0.357</td><td>0.325</td><td>0.200</td></tr><tr><td>1.80</td><td>0.461</td><td>0.417</td><td>0.253</td></tr><tr><td>2.25</td><td>0.563</td><td>0.507</td><td>0.303</td></tr><tr><td>2.70</td><td>0.667</td><td>0.598</td><td>0.354</td></tr><tr><td>3.15</td><td>0.774</td><td>0.691</td><td>0.405</td></tr><tr><td>3.60</td><td>0.883</td><td>0.787</td><td>0.457</td></tr><tr><td>4.50</td><td>1.092</td><td>0.973</td><td>0.561</td></tr><tr><td>4.95</td><td>1.202</td><td>1.070</td><td>0.616</td></tr></table>		Load Current [A]	Input Current [A]			Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]	0.00	0.021	0.024	0.040	0.45	0.152	0.142	0.095	0.90	0.256	0.235	0.150	1.35	0.357	0.325	0.200	1.80	0.461	0.417	0.253	2.25	0.563	0.507	0.303	2.70	0.667	0.598	0.354	3.15	0.774	0.691	0.405	3.60	0.883	0.787	0.457	4.50	1.092	0.973	0.561	4.95	1.202	1.070	0.616
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COSEL

Model KHEA60F-12

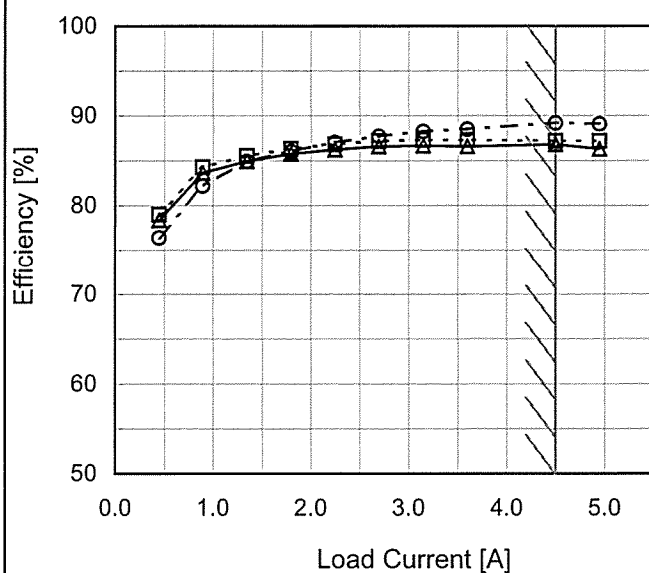
Item Efficiency (by Load Current)

Object

Temperature 25°C
Testing Circuitry Figure A

1.Graph

—△— Input Volt. 100V
 ---□--- Input Volt. 115V
 -·-○-·- Input Volt. 230V



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

2.Values

Load Current [A]	Efficiency [%]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
0.00	-	-	-
0.45	78.4	79.0	76.4
0.90	83.7	84.3	82.2
1.35	84.9	85.5	84.9
1.80	85.8	86.3	86.0
2.25	86.3	86.8	87.0
2.70	86.6	87.2	87.7
3.15	86.7	87.3	88.3
3.60	86.6	87.3	88.5
4.50	86.8	87.2	89.2
4.95	86.3	87.2	89.1

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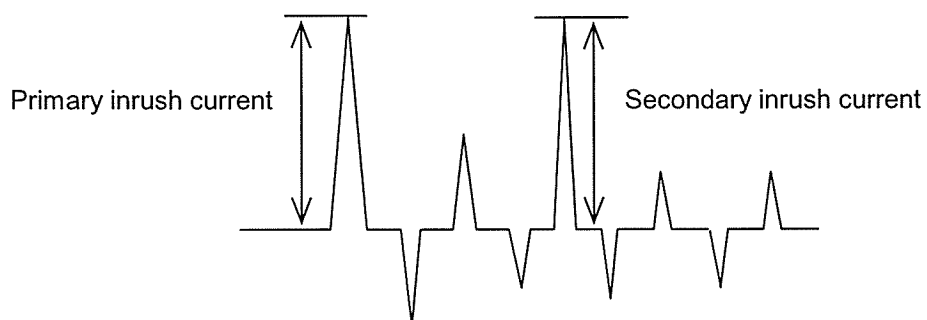
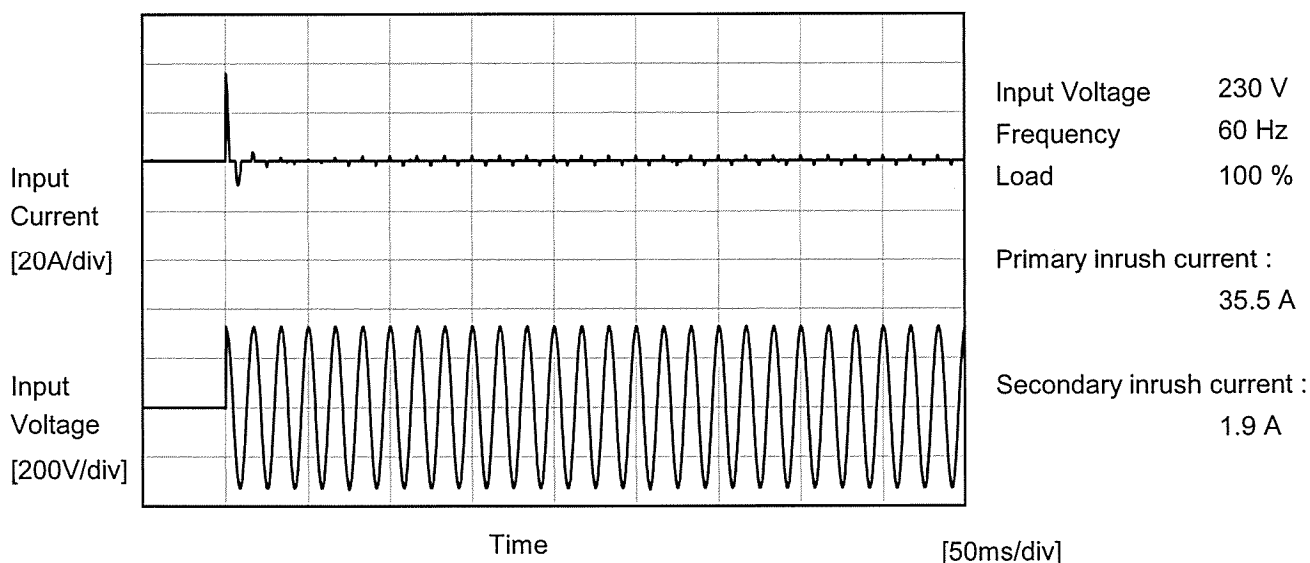
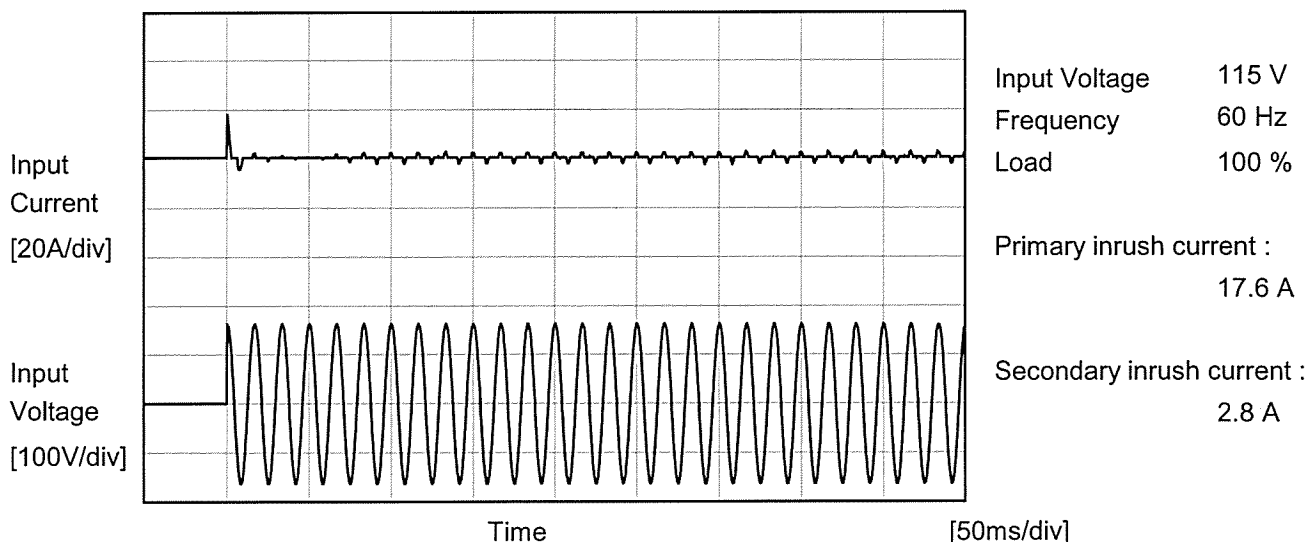
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<div><div><div>---</div><div>□</div><div>---</div></div><div>Load 50%</div></div> <div><div>—</div><div>△</div><div>—</div></div> <div>Load 100%</div> <p>Note: Slanted line shows the range of the rated input voltage.</p>		<table><tr><th rowspan="2">Input Voltage [V]</th><th colspan="2">Power Factor</th></tr><tr><th>Load 50%</th><th>Load 100%</th></tr><tr><td>80</td><td>0.596</td><td>0.614</td></tr><tr><td>85</td><td>0.581</td><td>0.599</td></tr><tr><td>90</td><td>0.572</td><td>0.587</td></tr><tr><td>100</td><td>0.570</td><td>0.585</td></tr><tr><td>115</td><td>0.547</td><td>0.566</td></tr><tr><td>200</td><td>0.460</td><td>0.494</td></tr><tr><td>230</td><td>0.456</td><td>0.481</td></tr><tr><td>264</td><td>0.429</td><td>0.446</td></tr><tr><td>280</td><td>0.423</td><td>0.442</td></tr></table>		Input Voltage [V]	Power Factor		Load 50%	Load 100%	80	0.596	0.614	85	0.581	0.599	90	0.572	0.587	100	0.570	0.585	115	0.547	0.566	200	0.460	0.494	230	0.456	0.481	264	0.429	0.446	280	0.423	0.442
Input Voltage [V]	Power Factor																																		
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COSEL

Model	KHEA60F-12	Temperature 25°C Testing Circuitry Figure A																																																				
Item	Power Factor (by Load Current)																																																					
Object	_____																																																					
1.Graph		2.Values																																																				
<div><div>—△—</div>Input Volt. 100V</div> <div><div>---□---</div>Input Volt. 115V</div> <div><div>---○---</div>Input Volt. 230V</div> <p>Power Factor</p> <p>Load Current [A]</p>		<table><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. 115[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>0.00</td><td>0.170</td><td>0.155</td><td>0.058</td></tr><tr><td>0.45</td><td>0.459</td><td>0.427</td><td>0.328</td></tr><tr><td>0.90</td><td>0.513</td><td>0.483</td><td>0.389</td></tr><tr><td>1.35</td><td>0.544</td><td>0.516</td><td>0.421</td></tr><tr><td>1.80</td><td>0.562</td><td>0.536</td><td>0.443</td></tr><tr><td>2.25</td><td>0.570</td><td>0.547</td><td>0.456</td></tr><tr><td>2.70</td><td>0.574</td><td>0.553</td><td>0.464</td></tr><tr><td>3.15</td><td>0.576</td><td>0.557</td><td>0.470</td></tr><tr><td>3.60</td><td>0.578</td><td>0.558</td><td>0.474</td></tr><tr><td>4.50</td><td>0.585</td><td>0.566</td><td>0.481</td></tr><tr><td>4.95</td><td>0.584</td><td>0.565</td><td>0.481</td></tr></table>		Load Current [A]	Power Factor			Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]	0.00	0.170	0.155	0.058	0.45	0.459	0.427	0.328	0.90	0.513	0.483	0.389	1.35	0.544	0.516	0.421	1.80	0.562	0.536	0.443	2.25	0.570	0.547	0.456	2.70	0.574	0.553	0.464	3.15	0.576	0.557	0.470	3.60	0.578	0.558	0.474	4.50	0.585	0.566	0.481	4.95	0.584	0.565	0.481
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Note: Slanted line shows the range of the rated load current.																																																						

COSEL

Model	KHEA60F-12	Temperature	25°C
Item	Inrush Current	Testing Circuitry	Figure A
Object	_____		



COSEL

		Temperature 25°C Testing Circuitry Figure B
Model	KHEA60F-12	
Item	Leakage Current	
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	KHEA60F-12	Temperature 25°C Testing Circuitry Figure A																															
Item	Line Regulation																																
Object	+12V4.5A																																
1.Graph		2.Values																															
<div><div><div><div>---</div><div>□</div><div>---</div></div><div>Load 50%</div></div><div><div>—</div><div>△</div><div>—</div></div><div>Load 100%</div></div> <table><thead><tr><th>Input Voltage [V]</th><th>Output Voltage [V] Load 50%</th><th>Output Voltage [V] Load 100%</th></tr></thead><tbody><tr><td>80</td><td>12.232</td><td>12.228</td></tr><tr><td>85</td><td>12.232</td><td>12.228</td></tr><tr><td>90</td><td>12.232</td><td>12.228</td></tr><tr><td>100</td><td>12.232</td><td>12.228</td></tr><tr><td>115</td><td>12.232</td><td>12.228</td></tr><tr><td>200</td><td>12.232</td><td>12.228</td></tr><tr><td>230</td><td>12.232</td><td>12.228</td></tr><tr><td>264</td><td>12.232</td><td>12.228</td></tr><tr><td>280</td><td>12.232</td><td>12.228</td></tr></tbody></table> <p>Note: Slanted line shows the range of the rated input voltage.</p>		Input Voltage [V]	Output Voltage [V] Load 50%	Output Voltage [V] 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		
Input Voltage [V]	Output Voltage [V] Load 50%	Output Voltage [V] Load 100%																															
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230	12.232	12.228																															
264	12.232	12.228																															
280	12.232	12.228																															

Output Voltage [V]

12.50

12.40

12.30

12.20

12.10

12.00

11.90

11.80

50

100

150

200

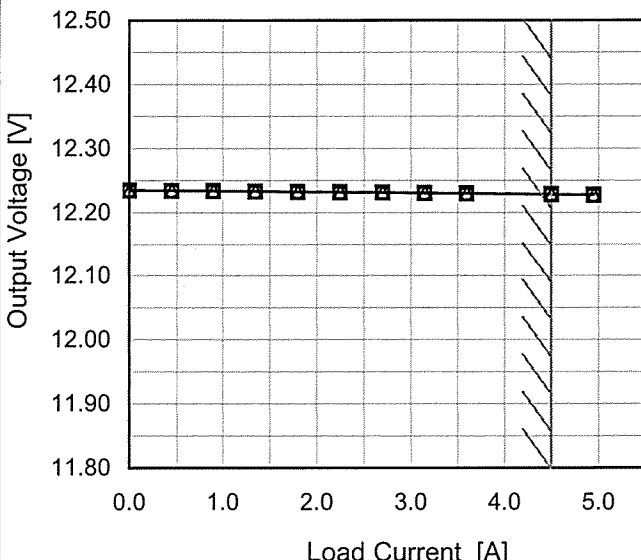
250

300

Input Voltage [V]

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

COSEL

Model	KHEA60F-12	Temperature 25°C Testing Circuitry Figure A																																																				
Item	Load Regulation																																																					
Object	+12V4.5A																																																					
1.Graph		2.Values																																																				
<div><div><div>—△— Input Volt. 100V</div><div>---□--- Input Volt. 115V</div><div>-·-○-·- Input Volt. 230V</div></div></div>		<table><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><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></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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4.95	12.227	12.227	12.227																																																			
Note: Slanted line shows the range of the rated load current.																																																						

COSEL

Model	KHEA60F-12	Temperature	25° C
Item	Dynamic Load Response	Testing Circuitry	Figure A
Object	+12V4.5A		

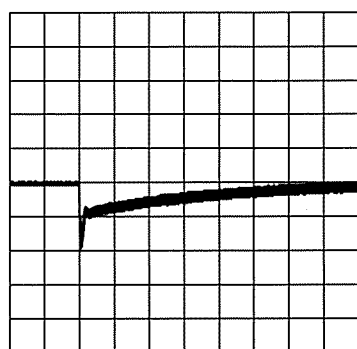
Input Volt. 230 V
Cycle 1000 ms

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

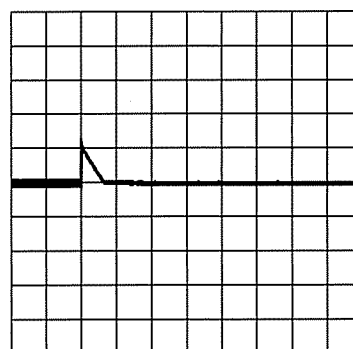


Min. Load (0A) \longleftrightarrow
Load 100% (4.5A)

200mV/div



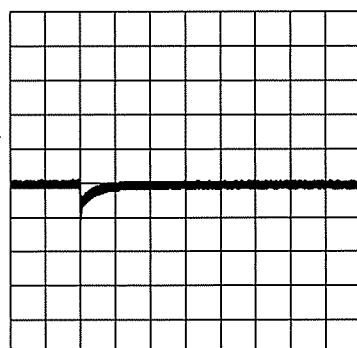
2 ms/div



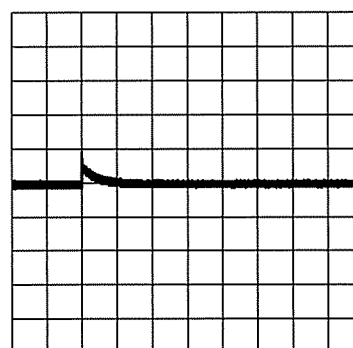
20 ms/div

Load 30%(1.35A) \longleftrightarrow
Load 100% (4.5A)

200mV/div



2 ms/div



20 ms/div

* The characteristic of AC115V is equal.

COSEL

Model	KHEA60F-12	Temperature 25°C Testing Circuitry Figure C																																							
Item	Ripple Voltage (by Load Current)																																								
Object	+12V4.5A																																								
1.Graph		2.Values																																							
<div>Input Volt. 115V Input Volt. 230V</div> <p>Ripple Voltage [mV]</p> <p>Load Current [A]</p>		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="2">Ripple Voltage [mV]</th></tr><tr><th>Input Volt. 115 [V]</th><th>Input Volt. 230 [V]</th></tr><tr><td>0.00</td><td>25</td><td>70</td></tr><tr><td>0.45</td><td>15</td><td>95</td></tr><tr><td>0.90</td><td>20</td><td>100</td></tr><tr><td>1.35</td><td>50</td><td>25</td></tr><tr><td>1.80</td><td>55</td><td>60</td></tr><tr><td>2.25</td><td>15</td><td>55</td></tr><tr><td>2.70</td><td>15</td><td>15</td></tr><tr><td>3.15</td><td>20</td><td>15</td></tr><tr><td>3.60</td><td>20</td><td>20</td></tr><tr><td>4.50</td><td>25</td><td>15</td></tr><tr><td>4.95</td><td>30</td><td>20</td></tr></table>		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
Load Current [A]	Ripple Voltage [mV]																																								
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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>																																									
<div>T1: Due to AC Input Line T2: Due to Switching</div> <p>Ripple [mVp-p]</p> <p>T1</p> <p>T2</p>																																									
Fig. Complex Ripple Wave Form																																									

COSEL

Model	KHEA60F-12	Temperature 25°C Testing Circuitry Figure C																																					
Item	Ripple-Noise																																						
Object	+12V4.5A																																						
1.Graph		2.Values																																					
<div><div>Input Volt. 115V Input Volt. 230V</div><table><thead><tr><th>Load Current [A]</th><th>115V [mV]</th><th>230V [mV]</th></tr></thead><tbody><tr><td>0.00</td><td>30</td><td>75</td></tr><tr><td>0.45</td><td>20</td><td>105</td></tr><tr><td>0.90</td><td>30</td><td>110</td></tr><tr><td>1.35</td><td>60</td><td>30</td></tr><tr><td>1.80</td><td>65</td><td>75</td></tr><tr><td>2.25</td><td>20</td><td>70</td></tr><tr><td>2.70</td><td>20</td><td>20</td></tr><tr><td>3.15</td><td>25</td><td>25</td></tr><tr><td>3.60</td><td>30</td><td>35</td></tr><tr><td>4.50</td><td>35</td><td>35</td></tr><tr><td>4.95</td><td>40</td><td>35</td></tr></tbody></table><p>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.</p></div>		Load Current [A]		115V [mV]	230V [mV]	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	
Load Current [A]	115V [mV]	230V [mV]																																					
0.00	30	75																																					
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<div><div>T1: Due to AC Input Line T2: Due to Switching</div><p>Fig. Complex Ripple Wave Form</p></div>																																							

Model

KHEA60F-12

Item

Ripple Voltage (by Ambient Temp.)

Object

+12V4.5A

1.Graph

---□---

Load 115V

—△—

Load 230V

Ripple Voltage [mV]

300

250

200

150

100

50

0

-40

-20

0

20

40

60

80

Ambient Temperature [°C]

Load 100 %

Measured by 20 MHz Oscilloscope.

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

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
--	-	-
--	-	-
--	-	-
--	-	-

Testing Circuitry

Figure C

BC - 10818

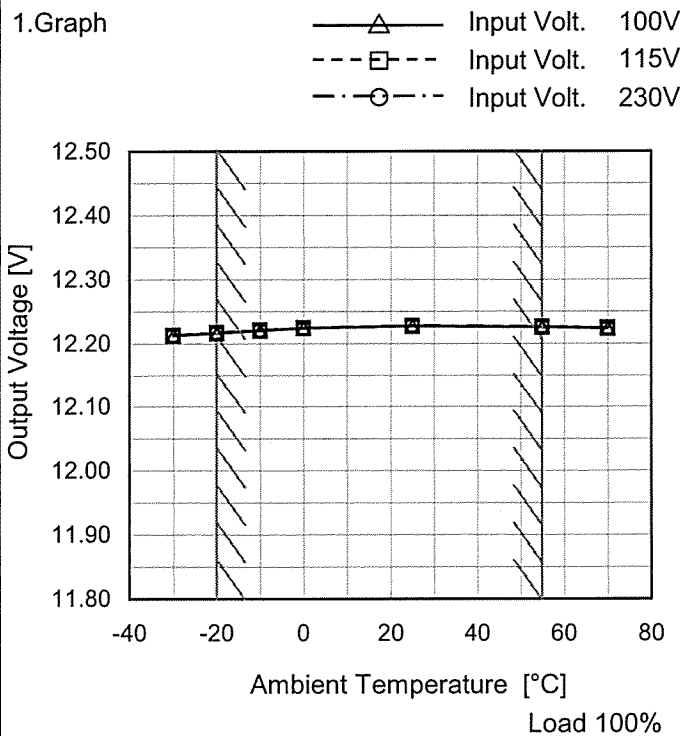
COSEL

Model KHEA60F-12

Item Ambient Temperature Drift

Object +12V4.5A

Testing Circuitry Figure A



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

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
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

COSEL

		Testing Circuitry Figure A
Model	KHEA60F-12	
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 = $\pm(\text{Maximum of Output Voltage} - \text{Minimum of Output Voltage}) / 2$

* 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		

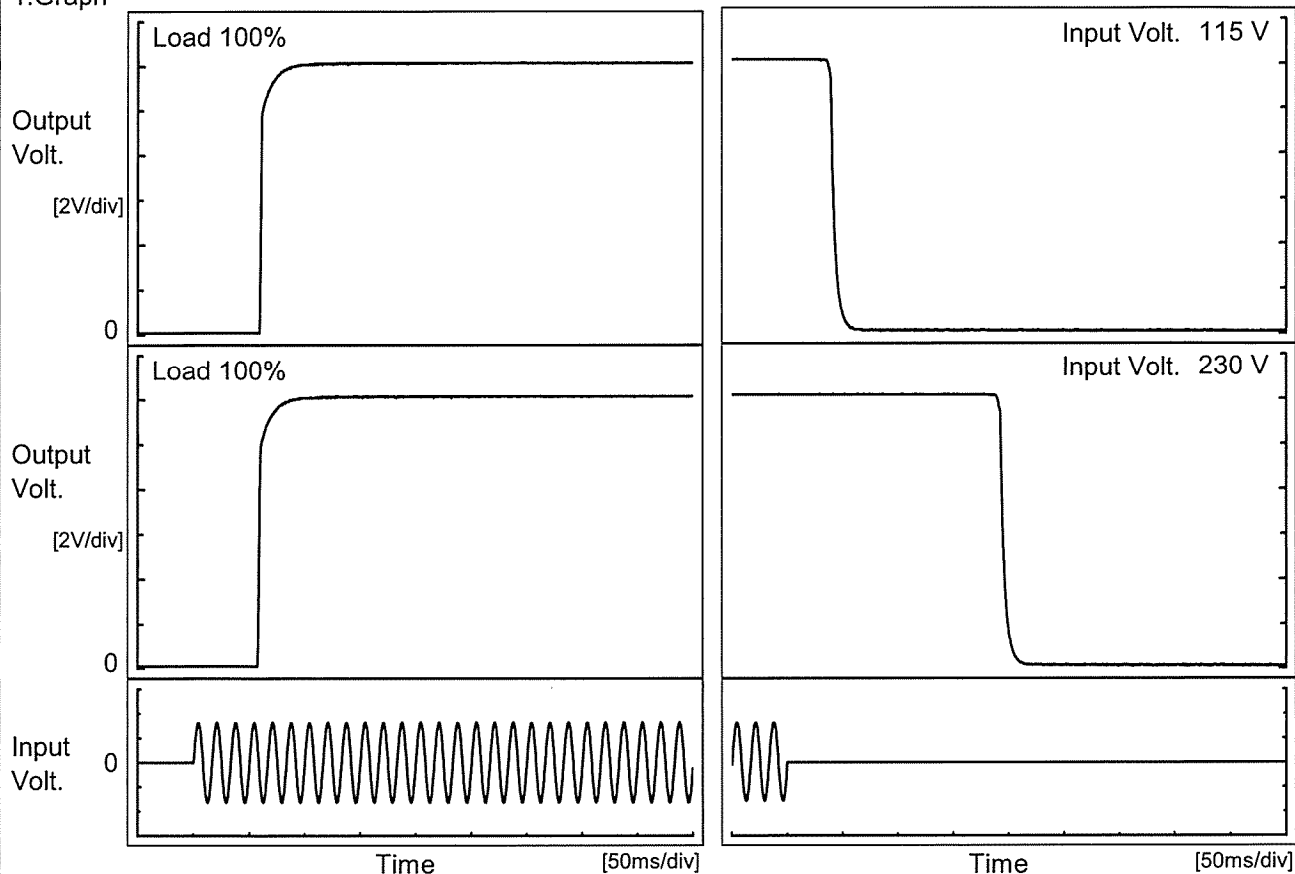
COSEL

Model	KHEA60F-12		
Item	Time Lapse Drift	Temperature	25°C
Object	+12V4.5A	Testing Circuitry	Figure A
1.Graph		2.Values	
<div><div><div>Output Voltage [V]</div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></di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COSEL

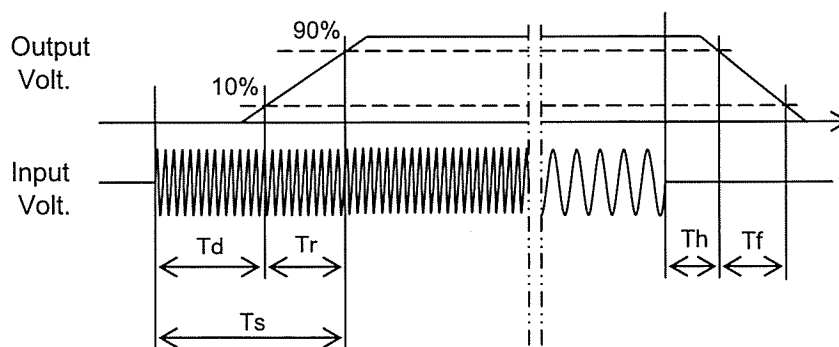
Model	KHEA60F-12	Temperature 25°C Testing Circuitry Figure A
Item	Rise and Fall Time	
Object	+12V4.5A	

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



COSEL

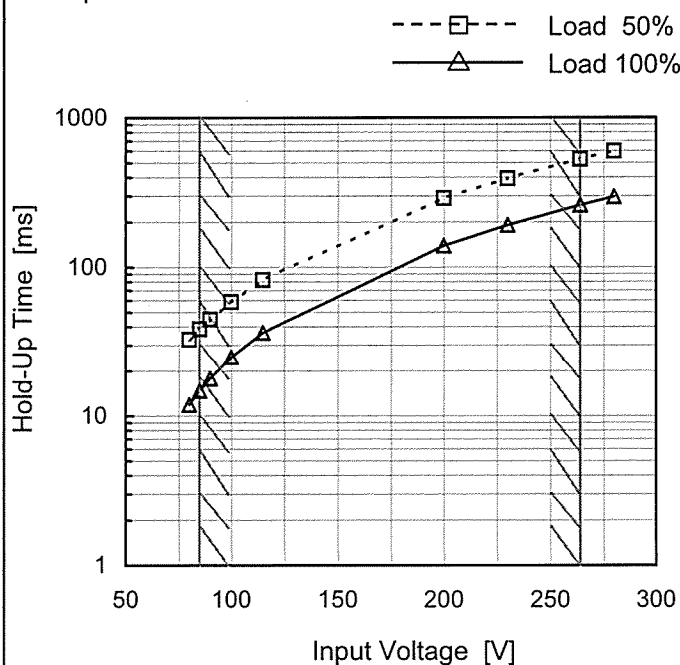
Model KHEA60F-12

Item Hold-Up Time

Object +12V4.5A

 Temperature 25°C
 Testing Circuitry Figure A

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.

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	KHEA60F-12																																																					
Item	Instantaneous Interruption Compensation	Temperature	25°C																																																			
Object	+12V4.5A	Testing Circuitry	Figure A																																																			
1.Graph		2.Values																																																				
<div><div>—△— Input Volt. 100V</div><div>---□--- Input Volt. 115V</div><div>-○- Input Volt. 230V</div></div> <p>Instantaneous Compensation Time [ms]</p> <p>Load Current [A]</p> <p>Note: Slanted line shows the range of the rated load current.</p>		<table><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><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></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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3.60	35	48	246																																																			
4.50	26	37	193																																																			
4.95	20	31	173																																																			



Model	KHEA60F-12	Testing Circuitry Figure A																																					
Item	Minimum Input Voltage for Regulated Output Voltage																																						
Object	+12V4.5A																																						
1.Graph		2.Values																																					
<div><div><div>---□---</div><div>Load 50%</div></div><div><div>—△—</div><div>Load 100%</div></div></div> <table><thead><tr><th>Ambient Temperature [°C]</th><th>Load 50% [V]</th><th>Load 100% [V]</th></tr></thead><tbody><tr><td>-30</td><td>51</td><td>63</td></tr><tr><td>-20</td><td>50</td><td>63</td></tr><tr><td>-10</td><td>49</td><td>62</td></tr><tr><td>0</td><td>49</td><td>61</td></tr><tr><td>25</td><td>48</td><td>60</td></tr><tr><td>55</td><td>46</td><td>60</td></tr><tr><td>70</td><td>46</td><td>59</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]	Load 50% [V]	Load 100% [V]	-30	51	63	-20	50	63	-10	49	62	0	49	61	25	48	60	55	46	60	70	46	59	--	-	-	--	-	-	--	-	-	--	-	-		
Ambient Temperature [°C]	Load 50% [V]	Load 100% [V]																																					
-30	51	63																																					
-20	50	63																																					
-10	49	62																																					
0	49	61																																					
25	48	60																																					
55	46	60																																					
70	46	59																																					
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--	-	-																																					
Note: Slanted line shows the range of the rated ambient temperature.																																							

Model	KHEA60F-12																																																	
Item	Overcurrent Protection	Temperature	25°C																																															
Object	+12V4.5A	Testing Circuitry	Figure A																																															
1.Graph		2.Values																																																
<div><div><div></div><div>Input Volt. 115V</div></div><div><div></div><div>Input Volt. 230V</div></div></div> <p>Note: Slanted line shows the range of the rated load current.</p> <p>Intermittent operation occurs when overcurrent protection is activated.</p>		<table><tr><th rowspan="2">Output Voltage [V]</th><th colspan="2">Load Current [A]</th></tr><tr><th>Input Volt. 115[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>12.2</td><td>6.27</td><td>6.39</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><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><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><tr><td>--</td><td>-</td><td>-</td></tr></table>		Output Voltage [V]	Load Current [A]		Input Volt. 115[V]	Input Volt. 230[V]	12.2	6.27	6.39	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-
Output Voltage [V]	Load Current [A]																																																	
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Model	KHEA60F-12																																								
Item	Overvoltage Protection	Testing Circuitry Figure A																																							
Object	+12V4.5A																																								
1.Graph		2.Values																																							
<div><div><div>—△—</div><div>Input Volt. 115V</div></div><div><div>---□---</div><div>Input Volt. 230V</div></div></div> <p>Operating Point [V]</p> <p>Ambient Temperature [°C]</p> <p>Load 0%</p> <p>Note: Slanted line shows the range of the rated ambient temperature.</p>		<table><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><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></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	--	-	-	--	-	-	--	-	-	--	-	-
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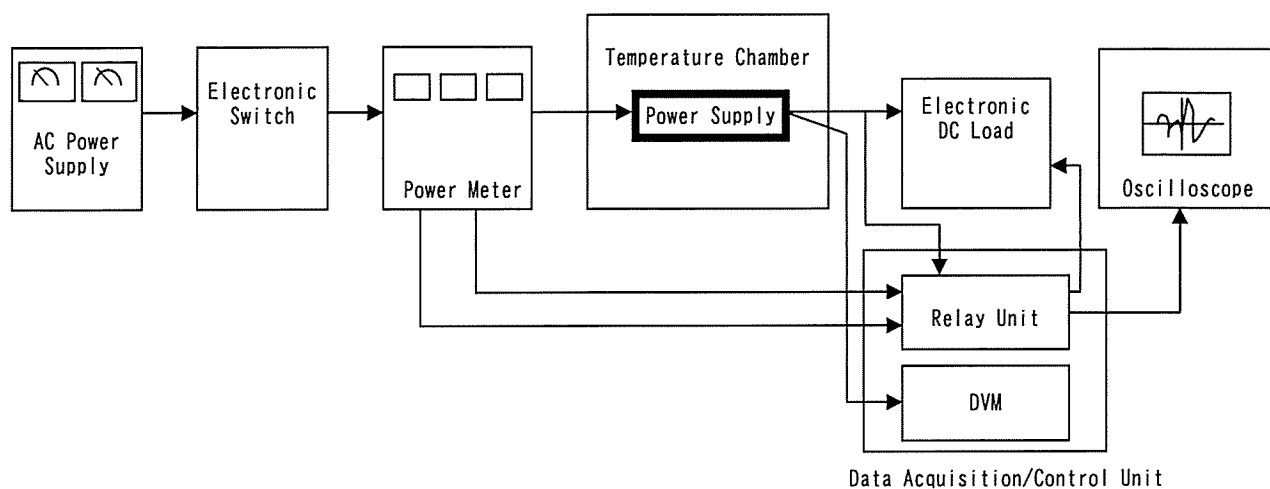


Figure A

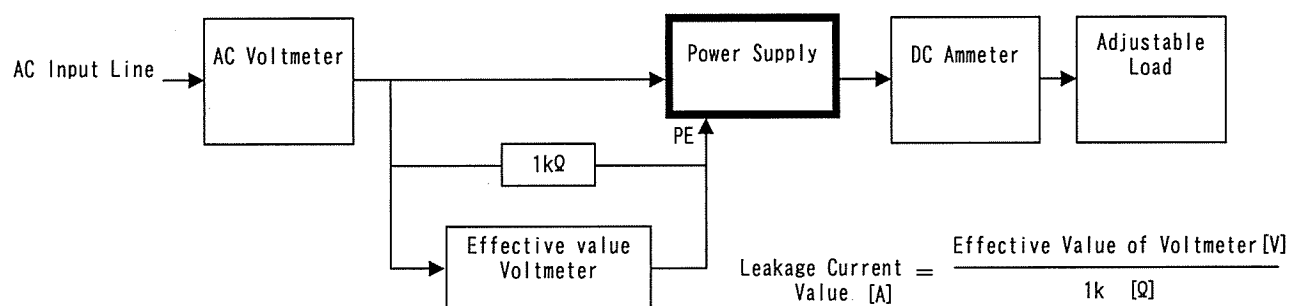


Figure B (DEN-AN)

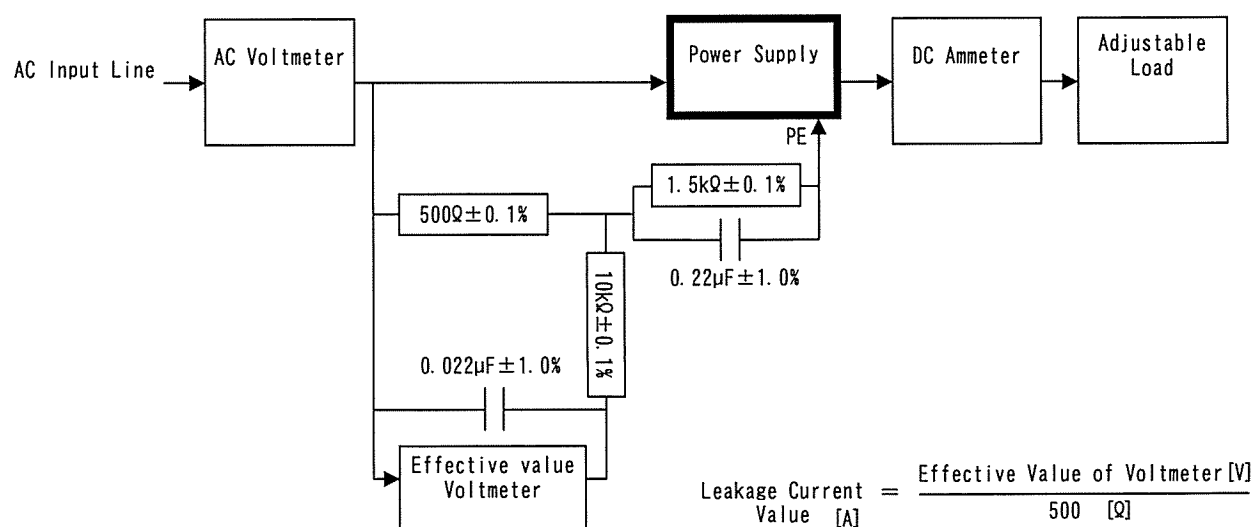


Figure B (IEC60950-1)

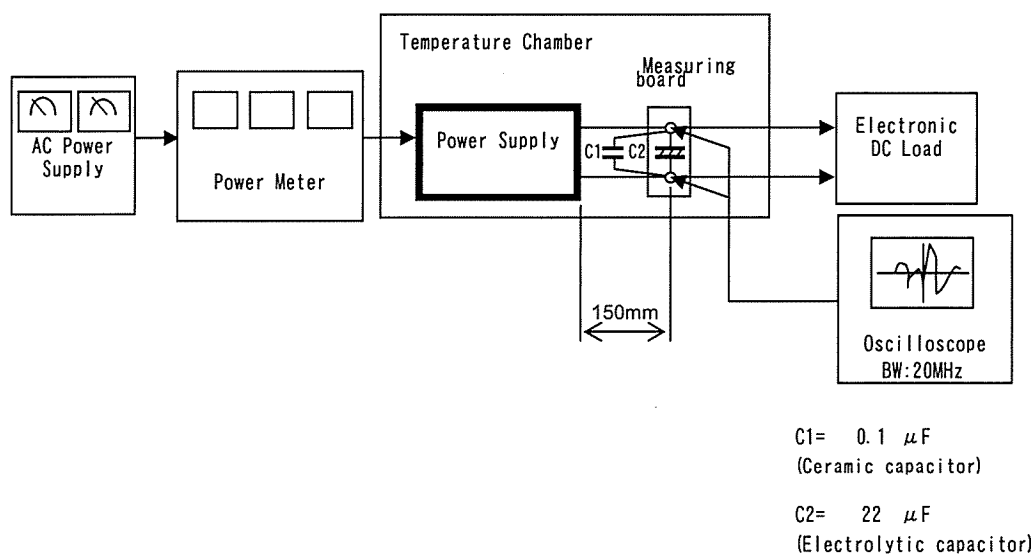


Figure C