

TEST DATA OF KHEA480F-48

Regulated DC Power Supply
October 8, 2015

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COSEL CO.,LTD.

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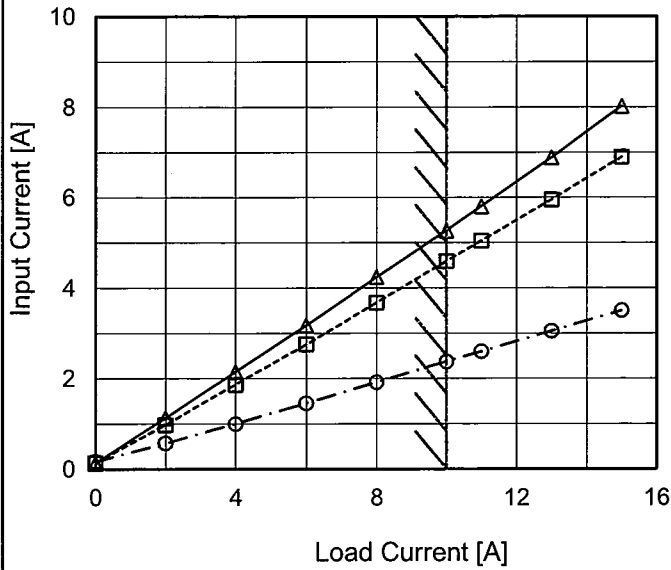


Model	KHEA480F-48
Item	Input Current (by Load Current)
Object	_____

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]	Input Current [A]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
0	0.126	0.137	0.163
2	1.127	0.977	0.570
4	2.147	1.864	0.998
6	3.169	2.749	1.455
8	4.235	3.670	1.915
10	5.263	4.587	2.369
11	5.801	5.040	2.595
13	6.881	5.951	3.045
15	8.020	6.891	3.498
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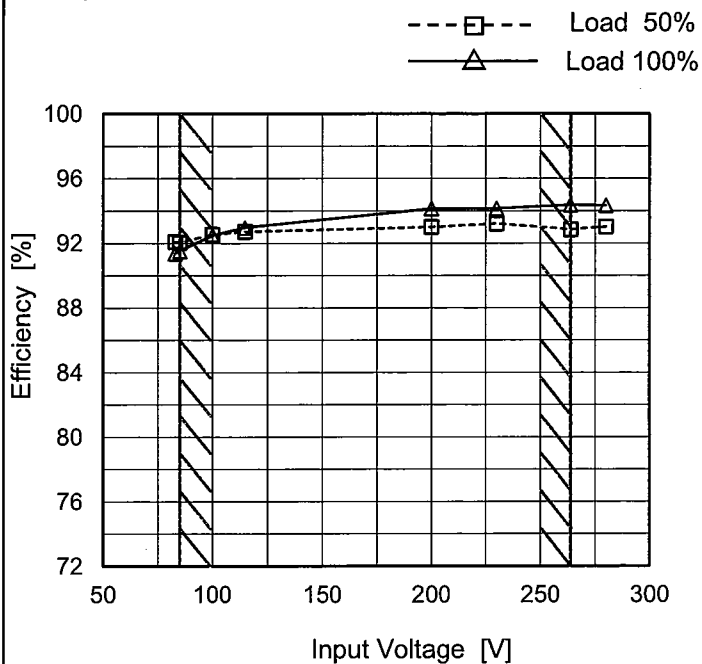


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<p>1.Graph</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>—△— Input Volt. 100V</p> <p>---□--- Input Volt. 115V</p> <p>---○--- Input Volt. 230V</p> </div> <div style="width: 35%;"> <table border="1"> <thead> <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. 115[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>0</td><td>6.6</td><td>7.6</td><td>2.4</td></tr> <tr><td>2</td><td>109.4</td><td>108.9</td><td>110.3</td></tr> <tr><td>4</td><td>209.8</td><td>210.1</td><td>209.3</td></tr> <tr><td>6</td><td>312.1</td><td>310.6</td><td>309.6</td></tr> <tr><td>8</td><td>415.5</td><td>414.0</td><td>410.1</td></tr> <tr><td>10</td><td>520.8</td><td>517.8</td><td>512.0</td></tr> <tr><td>11</td><td>574.9</td><td>570.8</td><td>563.0</td></tr> <tr><td>13</td><td>683.2</td><td>677.8</td><td>666.0</td></tr> <tr><td>15</td><td>797.0</td><td>787.0</td><td>771.0</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>--</td><td>-</td><td>-</td><td>-</td></tr> </tbody> </table> </div> </div> <p style="margin-top: 20px;">Note: Slanted line shows the range of the rated load current.</p>			Load Current [A]	Input Power [W]			Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]	0	6.6	7.6	2.4	2	109.4	108.9	110.3	4	209.8	210.1	209.3	6	312.1	310.6	309.6	8	415.5	414.0	410.1	10	520.8	517.8	512.0	11	574.9	570.8	563.0	13	683.2	677.8	666.0	15	797.0	787.0	771.0	--	-	-	-	--	-	-
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Model	KHEA480F-48	Temperature	25°C
Item	Efficiency (by Input Voltage)	Testing Circuitry	Figure A
Object	_____		

1. Graph



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

2. Values

Input Voltage [V]	Efficiency [%]	
	Load 50%	Load 100%
83	92.1	91.4
85	92.0	91.5
100	92.5	92.5
115	92.7	93.0
200	93.0	94.1
230	93.2	94.1
264	92.8	94.4
280	93.0	94.3
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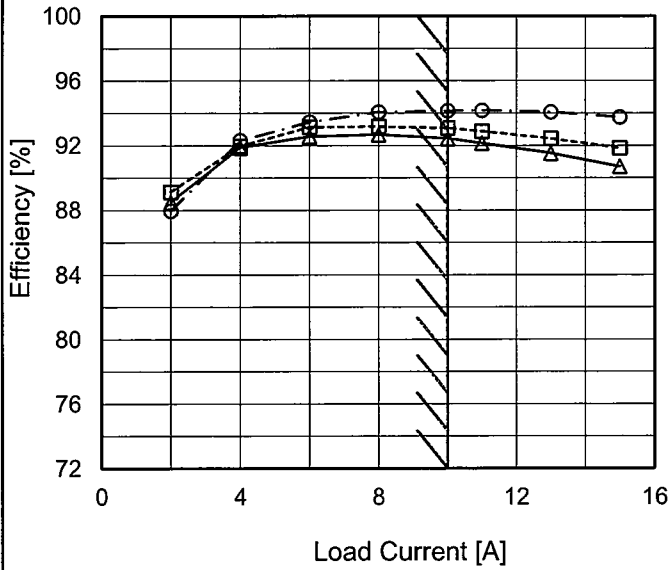


Model	KHEA480F-48
Item	Efficiency (by Load Current)
Object	_____

Temperature 25°C
Testing Circuitry Figure A

1.Graph

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



2.Values

Load Current [A]	Efficiency [%]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
0	-	-	-
2	88.5	89.1	87.9
4	91.9	91.9	92.3
6	92.5	93.1	93.4
8	92.7	93.2	94.1
10	92.4	93.1	94.1
11	92.1	92.9	94.2
13	91.5	92.4	94.1
15	90.7	91.8	93.7
--	-	-	-
--	-	-	-

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



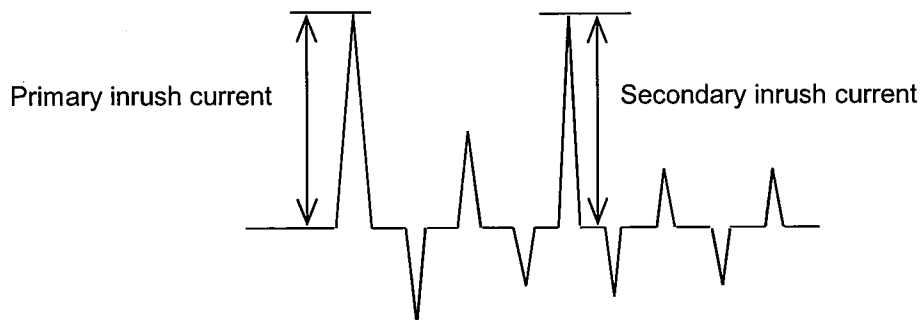
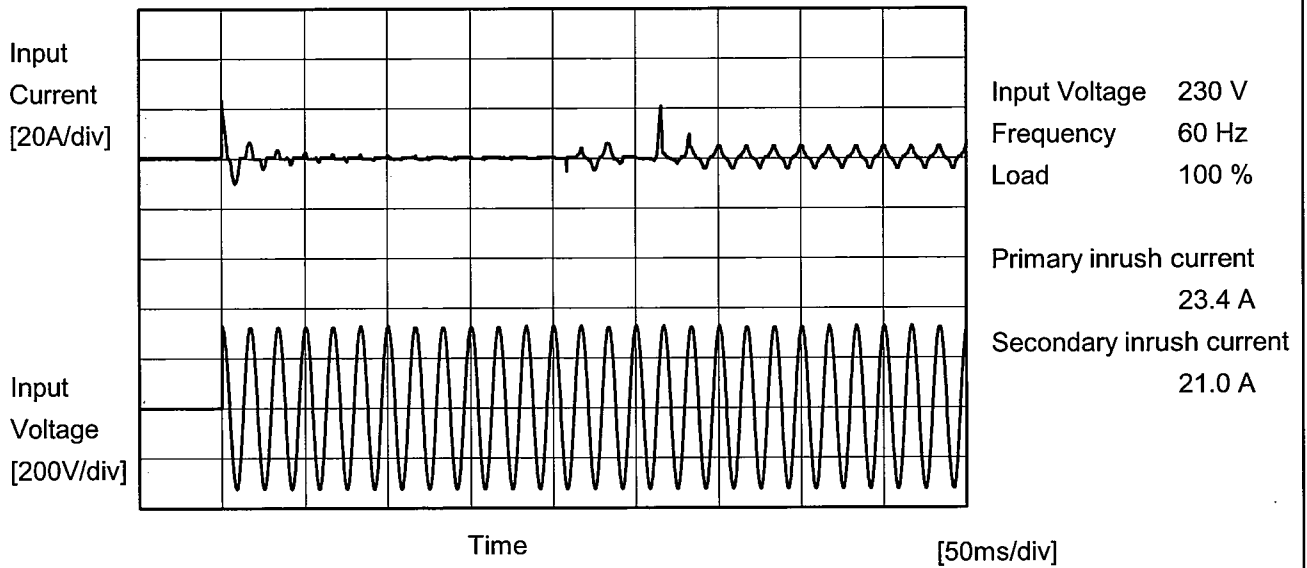
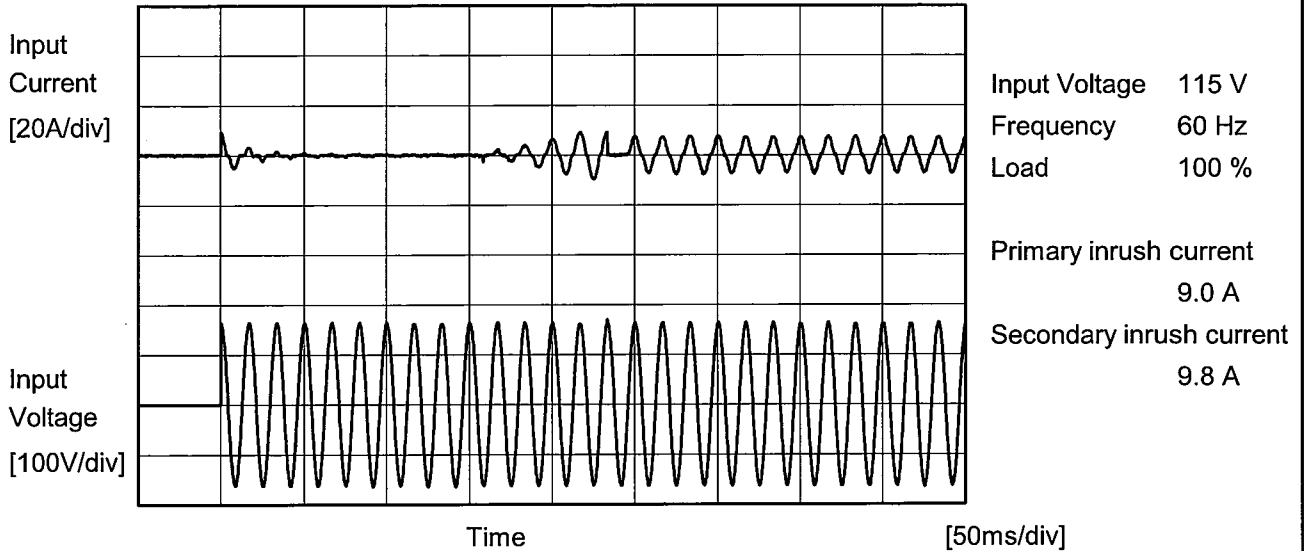
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Model		KHEA480F-48	Temperature 25°C Testing Circuitry Figure A
Item		Inrush Current	
Object		_____	





COSEL		
Model	KHEA480F-48	Temperature 25°C Testing Circuitry Figure B
Item	Leakage Current	
Object	_____	

1.Results

Standards		Input Volt.			Note
		100 [V]	115 [V]	240 [V]	
DEN-AN	Both phases	0.31	0.35	0.76	Operation
	One of phases	0.45	0.52	1.20	Stand by
IEC60950-1	Both phases	0.30	0.34	0.72	Operation
	One of phases	0.43	0.50	1.09	Stand by

[mA]

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.



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Model	KHEA480F-48	Temperature	25°C																																
Item	Line Regulation	Testing Circuitry	Figure A																																
Object	+48V10A																																		
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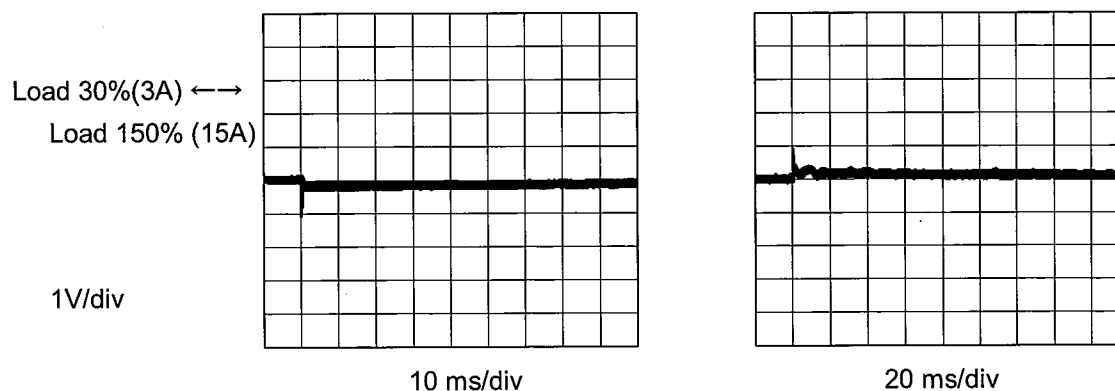
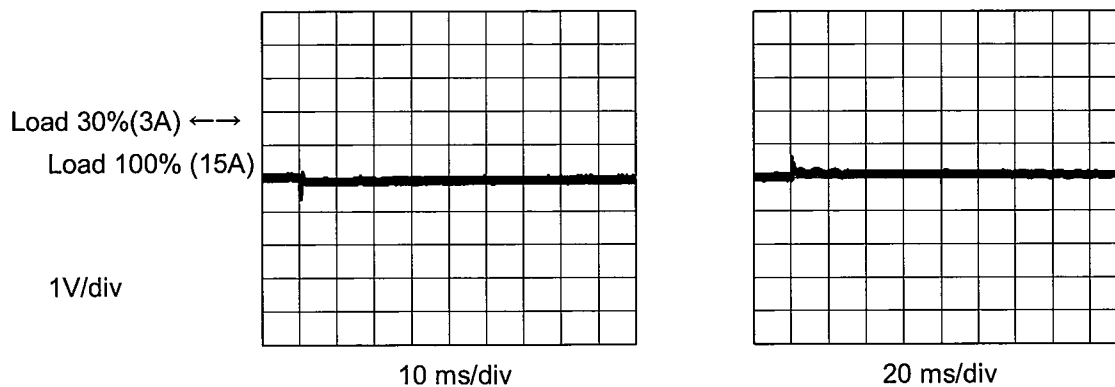
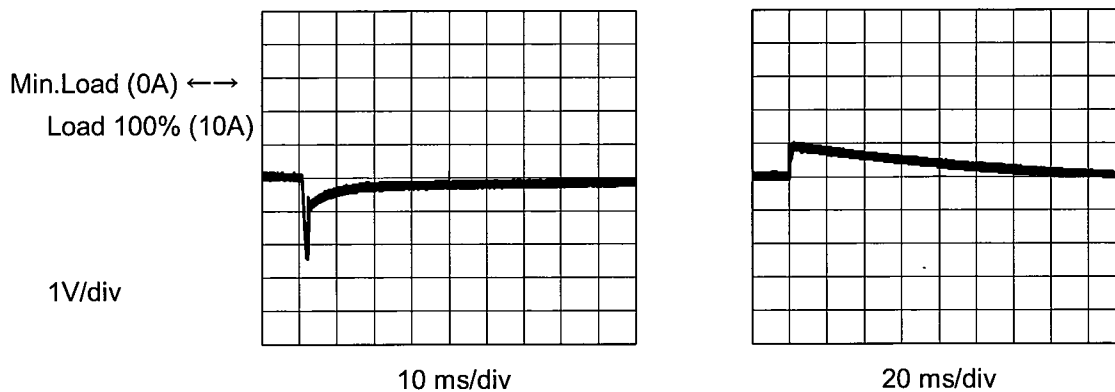
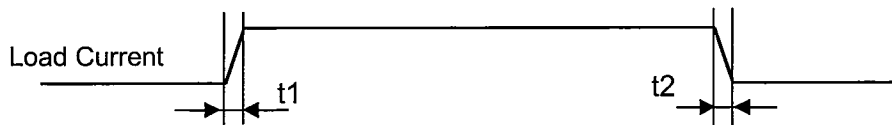
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COSEL

Model	KHEA480F-48	Temperature	25° C
Item	Dynamic Load Response	Testing Circuitry	Figure A
Object	+48V10A		

Input Volt. 230 V
Cycle 1000 ms

Response. $t_1=t_2=50\mu\text{s}$. Typ

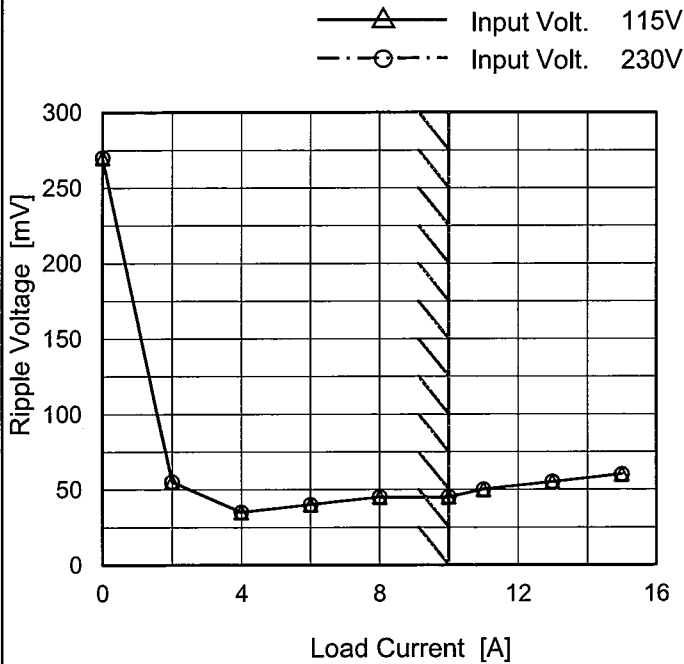


* The characteristic of AC115V is equal.



Model	KHEA480F-48	Temperature	25°C
Item	Ripple Voltage (by Load Current)	Testing Circuitry	Figure C
Object	+48V10A		

1. Graph



2. Values

Load Current [A]	Ripple Voltage [mV]	
	Input Volt. 115 [V]	Input Volt. 230 [V]
0.0	270	270
2.0	55	55
4.0	35	35
6.0	40	40
8.0	45	45
10.0	45	45
11.0	50	50
13.0	55	55
15.0	60	60
--	-	-
--	-	-

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.

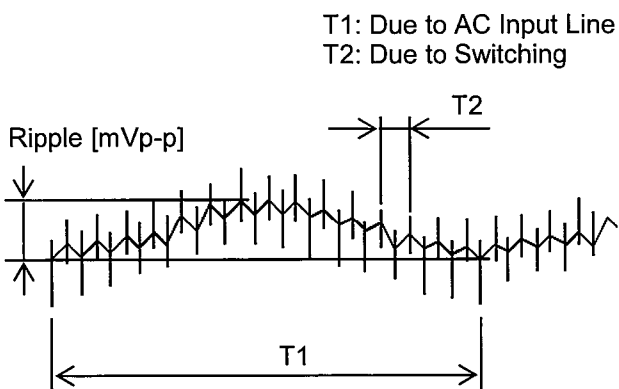
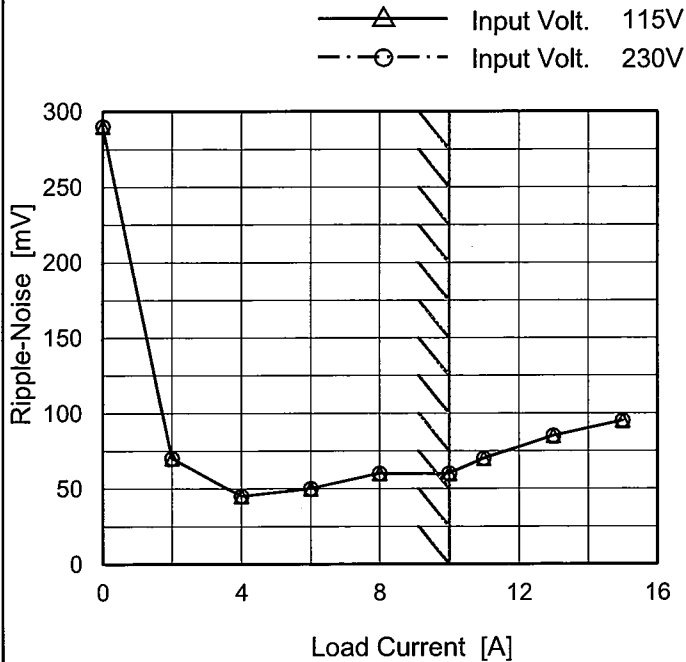


Fig. Complex Ripple Wave Form



Model	KHEA480F-48	Temperature	25°C
Item	Ripple-Noise	Testing Circuitry	Figure C
Object	+48V10A		

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]
0.0	290	290
2.0	70	70
4.0	45	45
6.0	50	50
8.0	60	60
10.0	60	60
11.0	70	70
13.0	85	85
15.0	95	95
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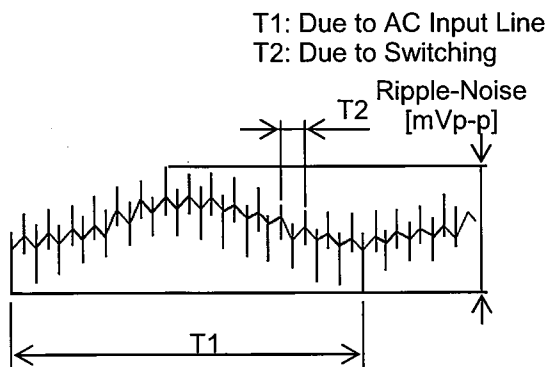


Fig. Complex Ripple Wave Form



Model		KHEA480F-48																																							
Item		Ripple Voltage (by Ambient Temp.)																																							
Object		+48V10A																																							
1.Graph		Testing Circuitry Figure C																																							
<p> ---□--- Input Volt. 115V —△— Input Volt. 230V </p> <p> Ambient Temperature [°C] Load 100 % </p>		2.Values																																							
		<table border="1"> <thead> <tr> <th rowspan="2">Ambient Temperature [°C]</th> <th colspan="2">Ripple Voltage [mV]</th> </tr> <tr> <th>Input Volt. 115 [V]</th> <th>Input Volt. 230 [V]</th> </tr> </thead> <tbody> <tr><td>-30</td><td>170</td><td>170</td></tr> <tr><td>-25</td><td>105</td><td>105</td></tr> <tr><td>-10</td><td>70</td><td>70</td></tr> <tr><td>0</td><td>50</td><td>50</td></tr> <tr><td>10</td><td>45</td><td>45</td></tr> <tr><td>25</td><td>45</td><td>45</td></tr> <tr><td>40</td><td>45</td><td>45</td></tr> <tr><td>50</td><td>45</td><td>45</td></tr> <tr><td>60</td><td>50</td><td>50</td></tr> <tr><td>70</td><td>50</td><td>50</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>		Ambient Temperature [°C]	Ripple Voltage [mV]		Input Volt. 115 [V]	Input Volt. 230 [V]	-30	170	170	-25	105	105	-10	70	70	0	50	50	10	45	45	25	45	45	40	45	45	50	45	45	60	50	50	70	50	50	--	-	-
Ambient Temperature [°C]	Ripple Voltage [mV]																																								
	Input Volt. 115 [V]	Input Volt. 230 [V]																																							
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-25	105	105																																							
-10	70	70																																							
0	50	50																																							
10	45	45																																							
25	45	45																																							
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50	45	45																																							
60	50	50																																							
70	50	50																																							
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<p>Measured by 20 MHz Oscilloscope.</p> <p>Note: Slanted line shows the range of the rated ambient temperature.</p>																																									

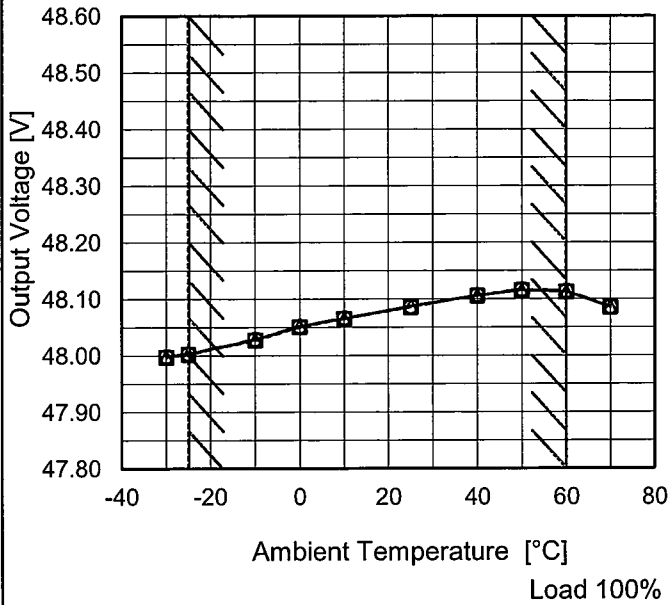


Model	KHEA480F-48
Item	Ambient Temperature Drift
Object	+48V10A

Testing Circuitry Figure A

1.Graph

- △— Input Volt. 85V
- Input Volt. 115V
- Input Volt. 230V



2.Values

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 85[V]	Input Volt. 115[V]	Input Volt. 230[V]
-30	47.998	47.997	47.999
-25	48.003	48.002	48.003
-10	48.028	48.027	48.029
0	48.052	48.050	48.052
10	48.065	48.065	48.066
25	48.087	48.085	48.086
40	48.106	48.106	48.106
50	48.115	48.115	48.116
60	48.112	48.112	48.113
70	48.085	48.085	48.086
--	-	-	-

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



COSEL		
Model	KHEA480F-48	
Item	Output Voltage Accuracy	Testing Circuitry Figure A
Object	+48V10A	

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 : -25 - 60°C

Input Voltage : 85 - 230V

Load Current : 0 - 10A

* 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	60	100	0	48.342	±170	±0.4
Minimum Voltage	-25	115	10	48.002		

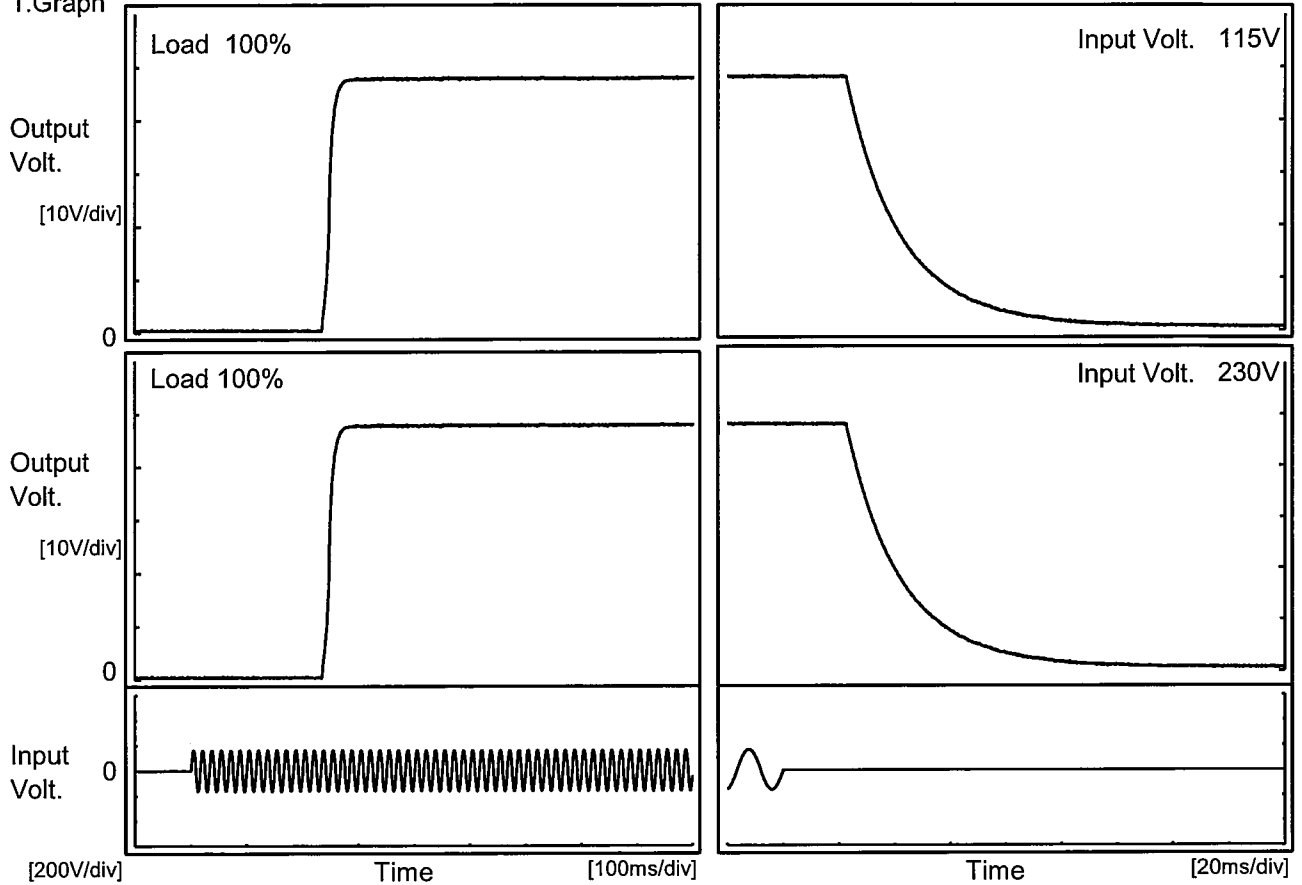


COSEL																								
Model	KHEA480F-48																							
Item	Time Lapse Drift	Temperature 25°C Testing Circuitry Figure A																						
Object	+48V10A																							
<p>1. Graph</p> <p style="text-align: center;">Time [H]</p> <p style="text-align: center;">Input Volt. 230V Load 100%</p>		<p>2. Values</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>48.102</td></tr> <tr><td>0.5</td><td>48.101</td></tr> <tr><td>1.0</td><td>48.101</td></tr> <tr><td>2.0</td><td>48.101</td></tr> <tr><td>3.0</td><td>48.101</td></tr> <tr><td>4.0</td><td>48.101</td></tr> <tr><td>5.0</td><td>48.101</td></tr> <tr><td>6.0</td><td>48.101</td></tr> <tr><td>7.0</td><td>48.101</td></tr> <tr><td>8.0</td><td>48.101</td></tr> </tbody> </table>	Time since start [H]	Output Voltage [V]	0.0	48.102	0.5	48.101	1.0	48.101	2.0	48.101	3.0	48.101	4.0	48.101	5.0	48.101	6.0	48.101	7.0	48.101	8.0	48.101
Time since start [H]	Output Voltage [V]																							
0.0	48.102																							
0.5	48.101																							
1.0	48.101																							
2.0	48.101																							
3.0	48.101																							
4.0	48.101																							
5.0	48.101																							
6.0	48.101																							
7.0	48.101																							
8.0	48.101																							
<p>* The characteristic of AC115V is equal.</p>																								



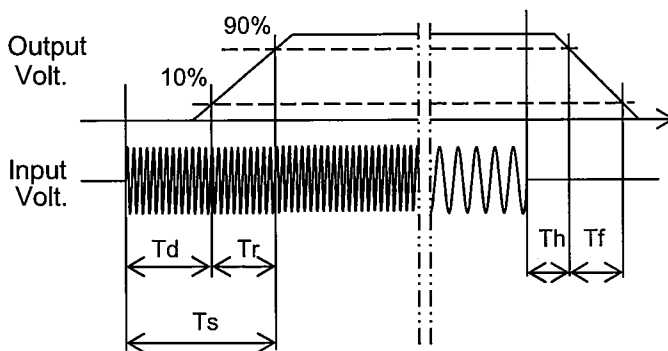
Model		KHEA480F-48	Temperature 25°C Testing Circuitry Figure A
Item		Rise and Fall Time	
Object		+48V10A	

1. Graph



2. Values

		[ms]				
Input \ Time		Td	Tr	Ts	Th	Tf
	115V	240.0	19.5	261.4	25.2	45.2
	230V	240.0	20.0	260.0	24.4	45.1

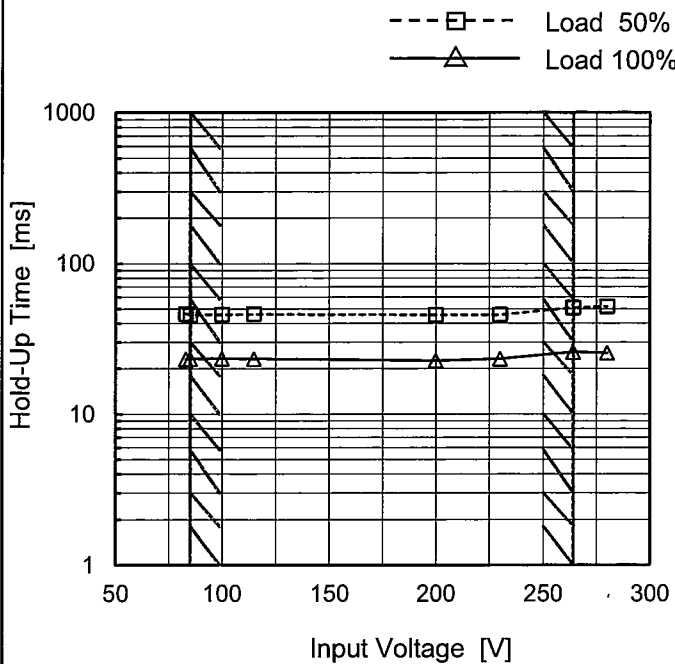




Model	KHEA480F-48
Item	Hold-Up Time
Object	+48V10A

Temperature 25°C
Testing Circuitry Figure A

1. Graph



2. Values

Input Voltage [V]	Hold-Up Time [ms]	
	Load 50%	Load 100%
83	46	23
85	46	23
100	46	23
115	46	23
200	46	23
230	46	23
264	51	26
280	52	25
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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.



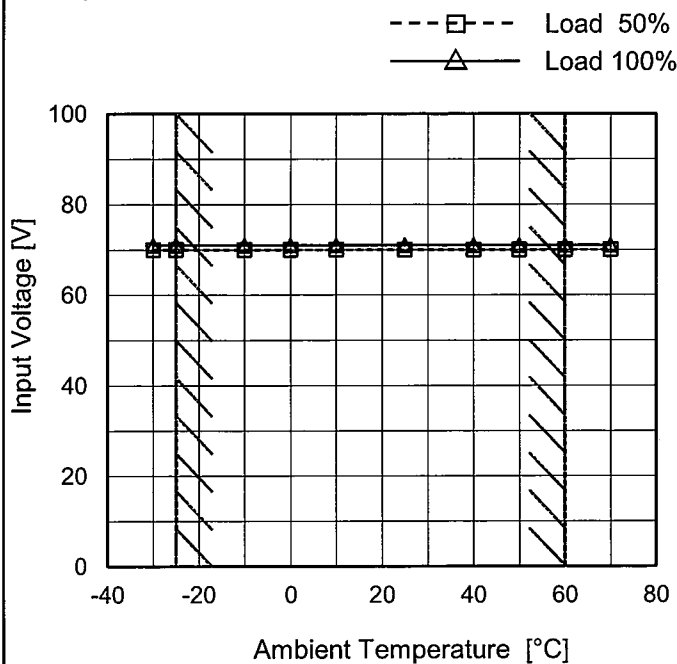
COSEL																																																						
Model	KHEA480F-48	Temperature	25°C																																																			
Item	Instantaneous Interruption Compensation	Testing Circuitry	Figure A																																																			
Object	+48V10A																																																					
<p>1.Graph</p> <p style="text-align: right;"> —△— Input Volt. 100V - - -□- - Input Volt. 115V - · -○- · - Input Volt. 230V </p> <p style="text-align: center;">Load Current [A]</p>		<p>2.Values</p> <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</td><td>-</td><td>-</td><td>-</td></tr> <tr><td>2</td><td>110</td><td>111</td><td>110</td></tr> <tr><td>4</td><td>56</td><td>56</td><td>55</td></tr> <tr><td>6</td><td>37</td><td>37</td><td>37</td></tr> <tr><td>8</td><td>28</td><td>28</td><td>28</td></tr> <tr><td>10</td><td>22</td><td>22</td><td>22</td></tr> <tr><td>11</td><td>20</td><td>20</td><td>20</td></tr> <tr><td>13</td><td>15</td><td>15</td><td>16</td></tr> <tr><td>15</td><td>14</td><td>14</td><td>14</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. 115[V]	Input Volt. 230[V]	0	-	-	-	2	110	111	110	4	56	56	55	6	37	37	37	8	28	28	28	10	22	22	22	11	20	20	20	13	15	15	16	15	14	14	14	--	-	-	-	--	-	-	-
Load Current [A]	Time [ms]																																																					
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]																																																			
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4	56	56	55																																																			
6	37	37	37																																																			
8	28	28	28																																																			
10	22	22	22																																																			
11	20	20	20																																																			
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<p>Note: Slanted line shows the range of the rated load current.</p>																																																						



Model	KHEA480F-48
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+48V10A

Testing Circuitry Figure A

1. Graph



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

2. Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-30	70	71
-25	70	71
-10	70	71
0	70	71
10	70	71
25	70	71
40	70	71
50	70	71
60	70	71
70	70	71
--	-	-



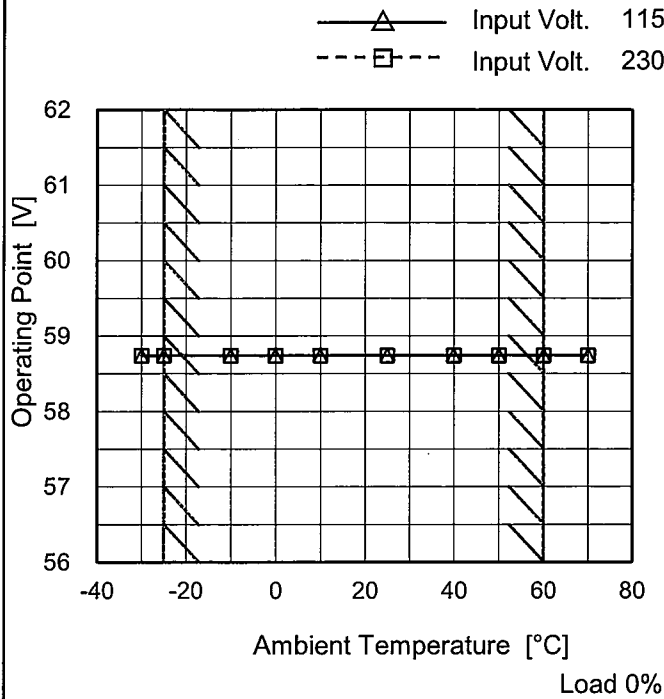
COSEL																																																														
Model	KHEA480F-48	Temperature	25°C																																																											
Item	Overcurrent Protection	Testing Circuitry	Figure A																																																											
Object	+48V10A																																																													
<p>1.Graph</p> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <p>————— Input Volt. 100V</p> <p>————— Input Volt. 115V</p> <p>————— Input Volt. 230V</p> </div> </div> <p>Note: Slanted line shows the range of the rated load current.</p> <p>Intermittent operation occurs when the output voltage is from 24V to 0V.</p>		<p>2.Values</p> <table border="1"> <thead> <tr> <th rowspan="2">Output Voltage [V]</th> <th colspan="3">Load Current [A]</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>45.6</td><td>17.06</td><td>17.10</td><td>17.11</td></tr> <tr><td>43.2</td><td>17.21</td><td>17.25</td><td>17.27</td></tr> <tr><td>38.4</td><td>17.41</td><td>17.44</td><td>17.45</td></tr> <tr><td>33.6</td><td>17.67</td><td>17.70</td><td>17.70</td></tr> <tr><td>28.8</td><td>17.96</td><td>17.99</td><td>17.99</td></tr> <tr><td>24.0</td><td>18.20</td><td>18.22</td><td>18.22</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> <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>		Output Voltage [V]	Load Current [A]			Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]	45.6	17.06	17.10	17.11	43.2	17.21	17.25	17.27	38.4	17.41	17.44	17.45	33.6	17.67	17.70	17.70	28.8	17.96	17.99	17.99	24.0	18.20	18.22	18.22	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-	--	-	-	-
Output Voltage [V]	Load Current [A]																																																													
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]																																																											
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Model	KHEA480F-48
Item	Overvoltage Protection
Object	+48V10A

Testing Circuitry Figure A

1. Graph



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

2. Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 115[V]	Input Volt. 230[V]
-30	58.74	58.74
-25	58.74	58.74
-10	58.74	58.74
0	58.74	58.74
10	58.74	58.74
25	58.74	58.74
40	58.74	58.74
50	58.74	58.74
60	58.74	58.74
70	58.74	58.74
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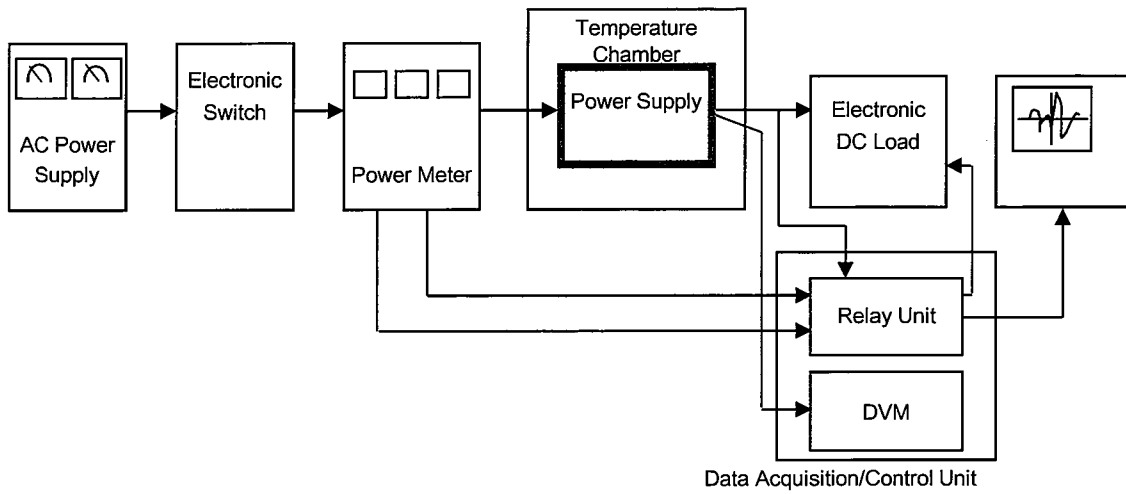


Figure A

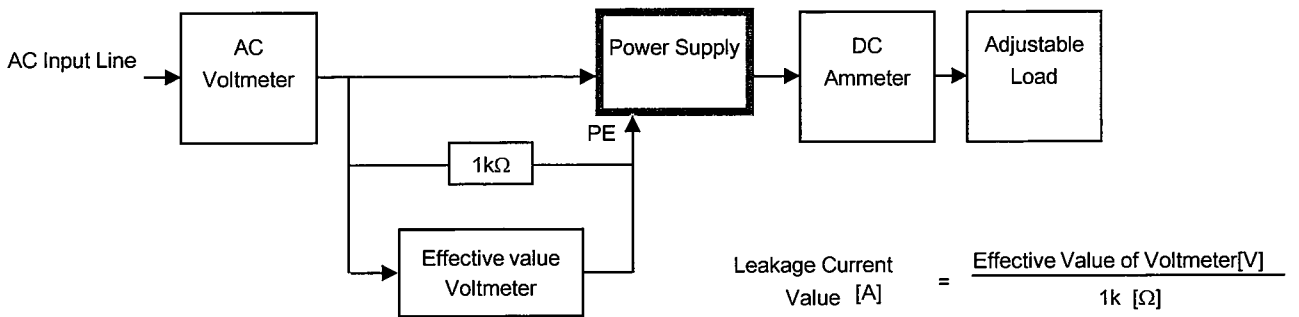


Figure B (DEN-AN)

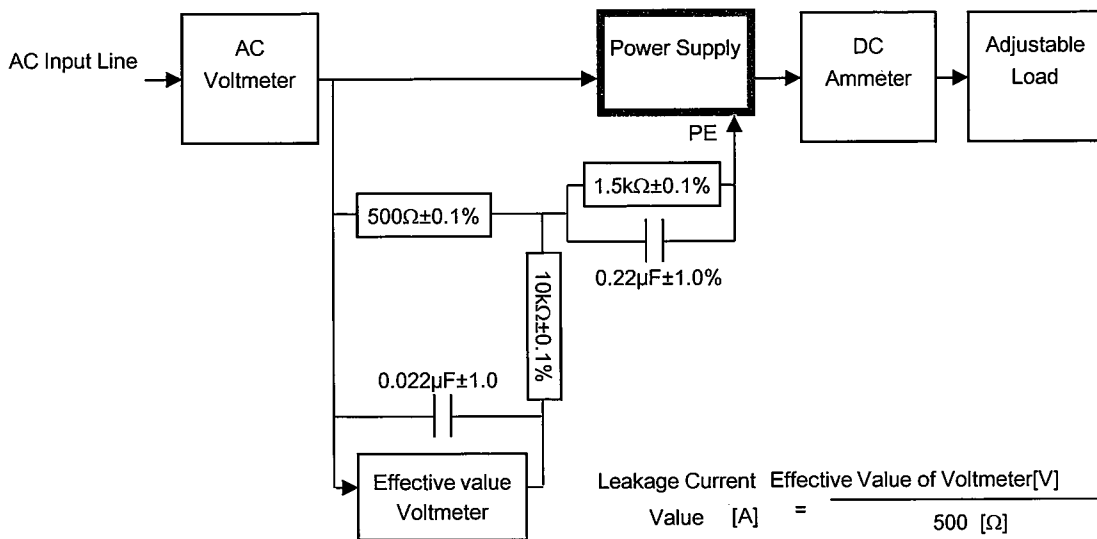
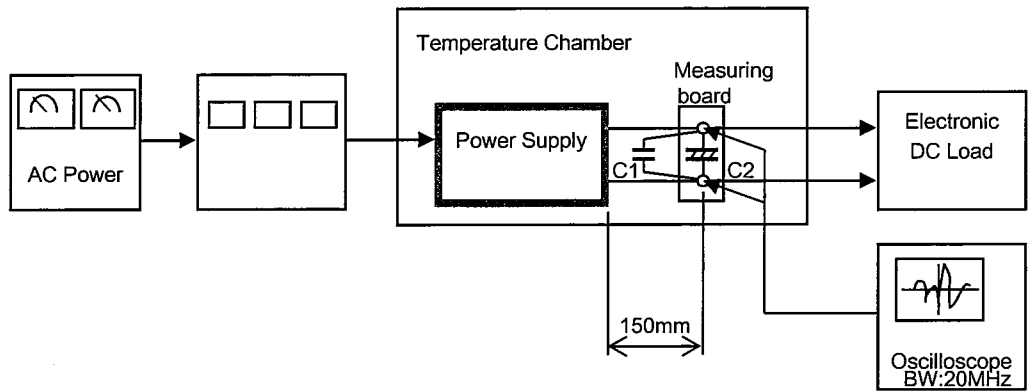


Figure B (IEC60950-1)



C1= 0.1 μ F
 (Ceramic capacitor)
 C2= 22 μ F
 (Electrolytic capacitor)

Figure C