

TEST DATA OF PCA600F-15

Regulated DC Power Supply
March 14, 2018

Approved by : Koji Todo
Koji Todo Design Manager

Prepared by : Masanobu Shima
Masanobu Shima Design Engineer

COSEL CO.,LTD.

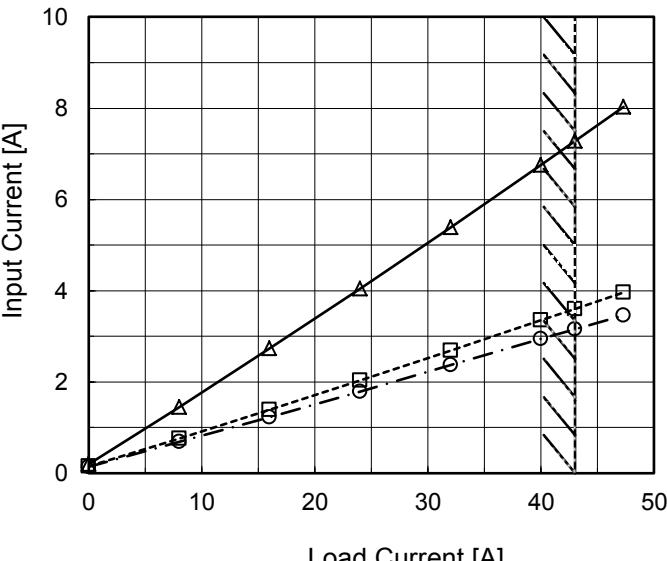


CONTENTS

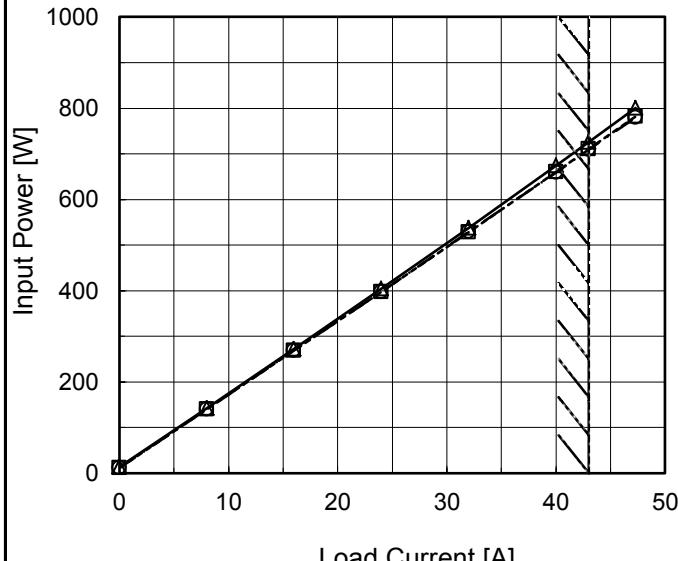
1.Input Current (by Load Current)	1
2.Input Power (by Load Current)	2
3.Efficiency (by Input Voltage)	3
4.Efficiency (by Load Current)	4
5.Power Factor (by Input Voltage)	5
6.Power Factor (by Load Current)	6
7.Inrush Current	7
8.Leakage Current	8
9.Line Regulation	9
10.Load Regulation	10
11.Dynamic Load Response	11
12.Ripple Voltage (by Load Current)	12
13.Ripple-Noise	13
14.Ripple Voltage (by Ambient Temperature)	14
15.Ambient Temperature Drift	15
16.Output Voltage Accuracy	16
17.Time Lapse Drift	17
18.Rise and Fall Time	18
19.Hold-Up Time	19
20.Instantaneous Interruption Compensation	20
21.Minimum Input Voltage for Regulated Output Voltage	21
22.Overcurrent Protection	22
23.Ovvervoltage Protection	23
24.Figure of Testing Circuitry	24

(Final Page 25)

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Model	PCA600F-15																																																						
Item	Input Current (by Load Current)	Temperature 25°C Testing Circuitry Figure A																																																					
Object	_____																																																						
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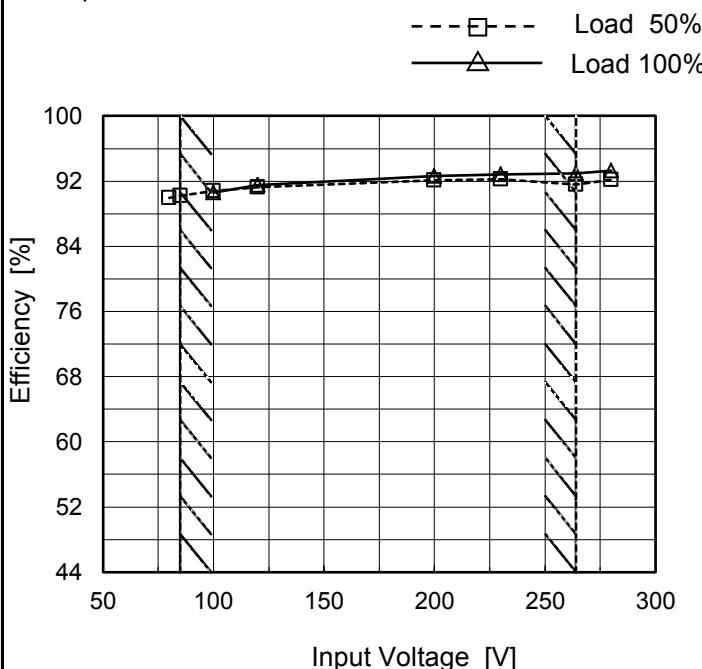
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Model	PCA600F-15
Item	Efficiency (by Input Voltage)
Object	—

Temperature 25°C
 Testing Circuitry Figure A

1.Graph



2.Values

Input Voltage [V]	Efficiency [%]	
	Load 50%	Load 100%
80	89.9	-
85	90.2	-
100	90.8	90.6
120	91.2	91.5
200	92.1	92.6
230	92.2	92.8
264	91.6	93.0
280	92.2	93.3
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Note: Slanted line shows the range of the rated input voltage.

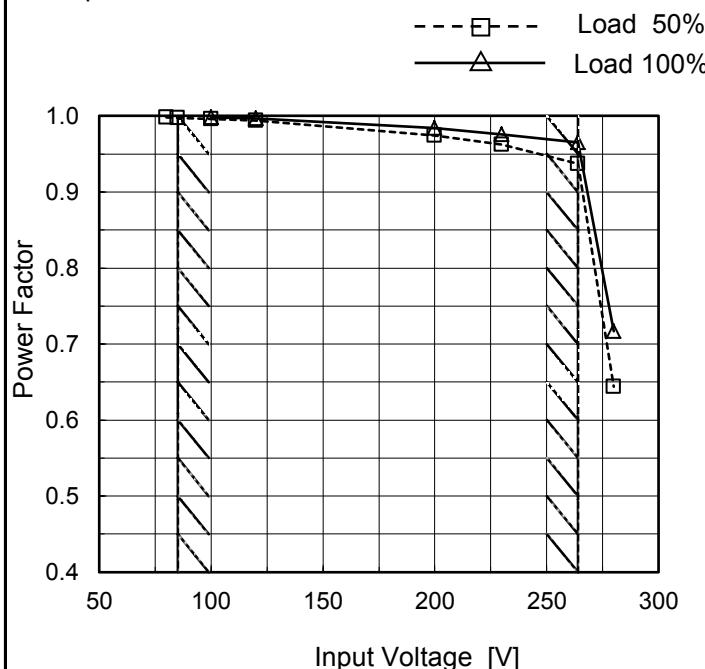
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Model	PCA600F-15	Temperature Testing Circuitry	25°C Figure A																																																			
Item	Efficiency (by Load Current)																																																					
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Model	PCA600F-15
Item	Power Factor (by Input Voltage)
Object	—

1.Graph



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

 Temperature 25°C
 Testing Circuitry Figure A

2.Values

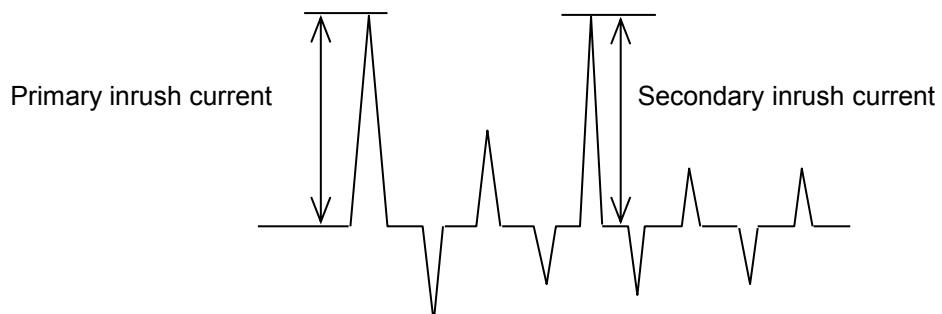
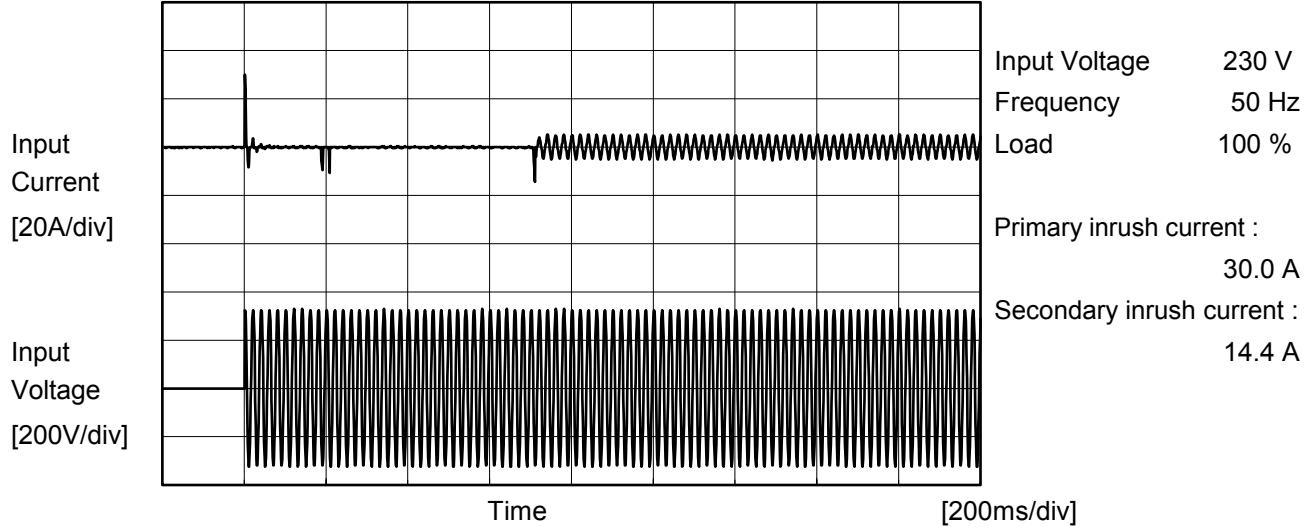
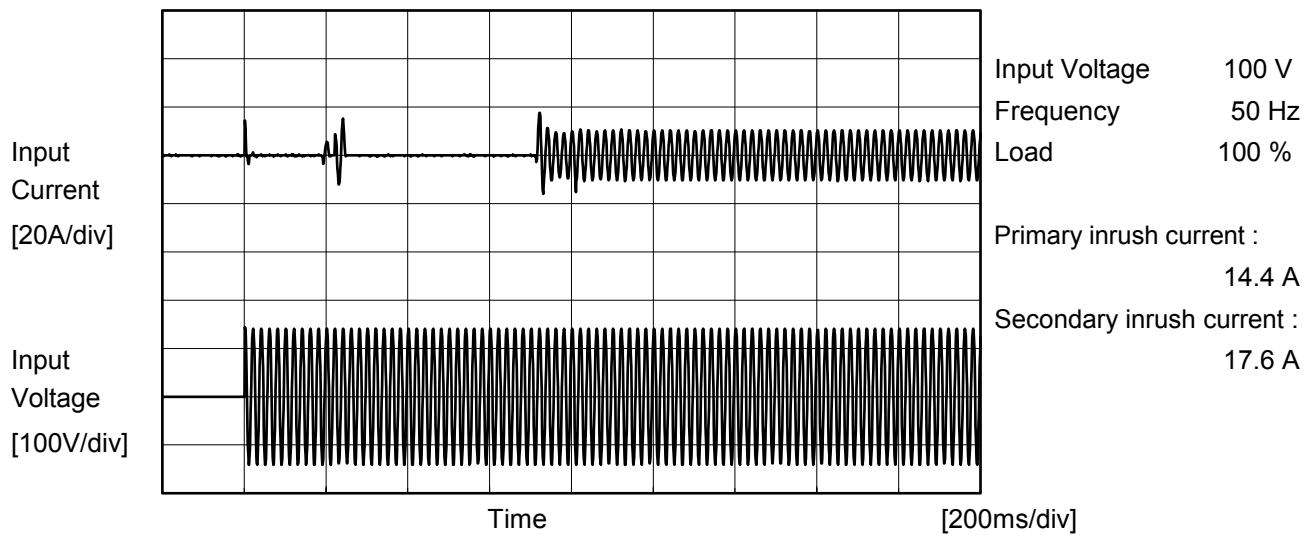
Input Voltage [V]	Power Factor	
	Load 50%	Load 100%
80	0.998	-
85	0.998	-
100	0.996	0.998
120	0.994	0.997
200	0.975	0.984
230	0.963	0.976
264	0.937	0.965
280	0.644	0.717
--	-	-

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Model	PCA600F-15		
Item	Power Factor (by Load Current)		
Object	_____		
1.Graph	—△— Input Volt. 100V - -□--- Input Volt. 200V - -○--- Input Volt. 230V		
<p>Note: Slanted line shows the range of the rated load current.</p>			
Temperature	25°C		
Testing Circuitry	Figure A		
2.Values			
Load Current [A]	Power Factor		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	0.721	0.384	0.329
8.0	0.986	0.922	0.897
16.0	0.995	0.964	0.949
24.0	0.997	0.977	0.966
32.0	0.998	0.984	0.969
40.0	0.998	0.984	0.975
43.0	0.998	0.985	0.976
47.3	0.999	0.985	0.979
--	-	-	-
--	-	-	-
--	-	-	-

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Model	PCA600F-15	Temperature	25°C
Item	Inrush Current	Testing Circuitry	Figure A
Object	_____		





Model	PCA600F-15	Temperature	25°C
Item	Leakage Current	Testing Circuitry	Figure B
Object	_____		

1. Results

[mA]

Standards	Testing Circuitry	Measuring Method	Input Volt.			Note
			100 [V]	230 [V]	240 [V]	
DEN-AN	Figure B-1	Both phases	0.13	0.30	0.31	Operation
		One of phases	0.25	0.56	0.58	Stand by
IEC62368-1	Figure B-2	Both phases	0.12	0.29	0.30	Operation
		One of phases	0.25	0.54	0.56	Stand by
IEC60601-1	Figure B-3	Both phases	0.12	0.29	0.30	Operation
		One of phases	0.25	0.54	0.57	Stand by
	Figure B-4	Both phases	0.12	0.29	0.30	Operation
		One of phases	0.24	0.53	0.55	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.

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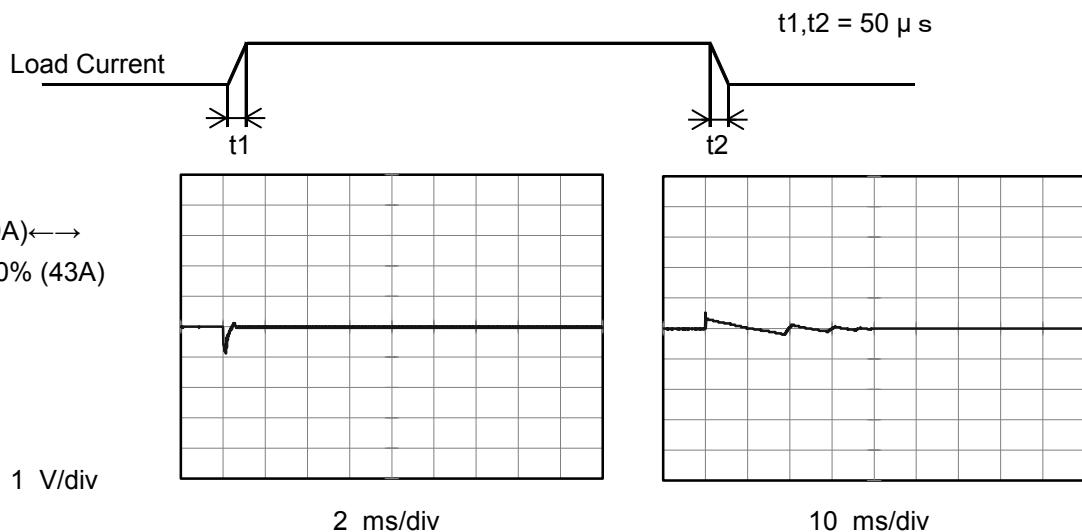
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Load Current [A]	Output Voltage [V] (100V)	Output Voltage [V] (200V)	Output Voltage [V] (230V)																																			
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			24.0	15.314																																		
			32.0	15.313																																		
			40.0	15.309																																		
			43.0	15.307																																		
			47.3	15.306																																		
			--	-																																		
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			--	-																																		

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

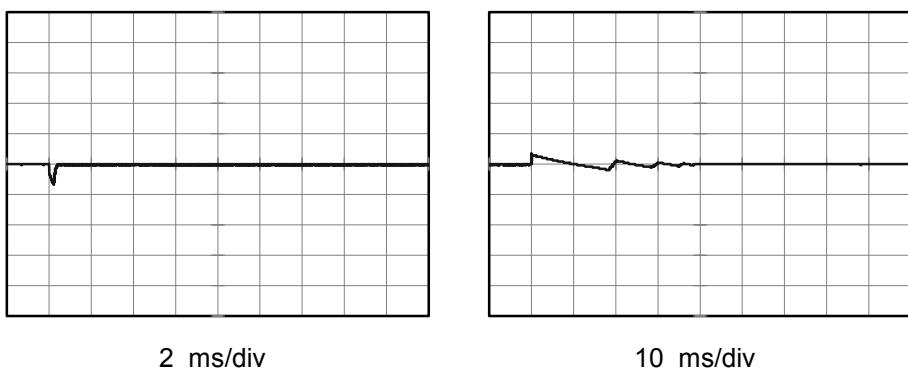
COSEL

Model	PCA600F-15	Temperature	25°C
Item	Dynamic Load Response	Testing Circuitry	Figure A
Object	+15V43A		

Input Volt. 100 V
 Cycle 1000 ms



Min.Load (0A) →
 Load 50% (21.5A)



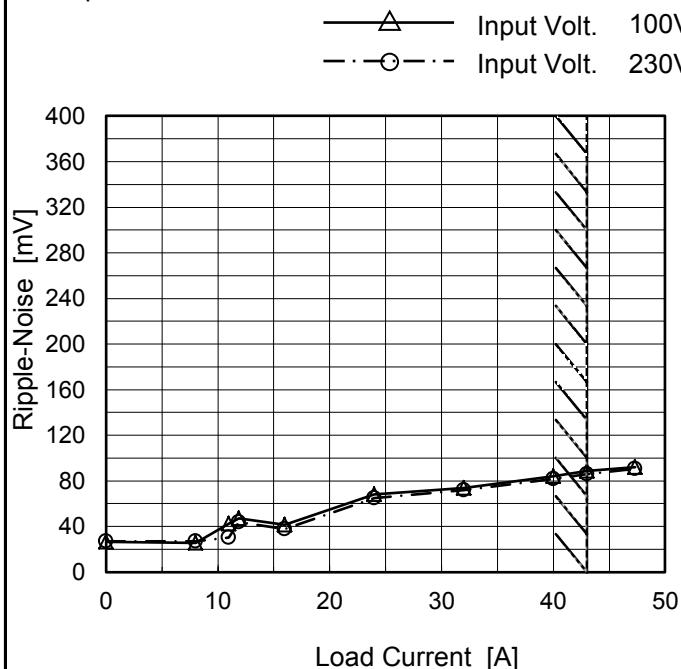
COSEL

Model	PCA600F-15	Temperature Testing Circuitry	25°C Figure C																																				
Item	Ripple Voltage (by Load Current)																																						
Object	+15V43A																																						
1. Graph			2. Values																																				
<p>Graph showing Ripple Voltage [mV] vs Load Current [A]. The Y-axis ranges from 0 to 400 mV, and the X-axis ranges from 0 to 50 A. Two curves are plotted: Input Volt. 100V (solid line with open circles) and Input Volt. 230V (dashed line with open circles). A slanted line indicates the rated load current range.</p> <table border="1"> <thead> <tr> <th>Load Current [A]</th> <th>Ripple Voltage [mV] (Input Volt. 100V)</th> <th>Ripple Voltage [mV] (Input Volt. 230V)</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>26</td><td>26</td></tr> <tr><td>8.0</td><td>26</td><td>27</td></tr> <tr><td>11.0</td><td>42</td><td>30</td></tr> <tr><td>11.9</td><td>46</td><td>44</td></tr> <tr><td>16.0</td><td>41</td><td>38</td></tr> <tr><td>24.0</td><td>68</td><td>65</td></tr> <tr><td>32.0</td><td>74</td><td>72</td></tr> <tr><td>40.0</td><td>84</td><td>82</td></tr> <tr><td>43.0</td><td>88</td><td>86</td></tr> <tr><td>47.3</td><td>92</td><td>89</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>				Load Current [A]	Ripple Voltage [mV] (Input Volt. 100V)	Ripple Voltage [mV] (Input Volt. 230V)	0.0	26	26	8.0	26	27	11.0	42	30	11.9	46	44	16.0	41	38	24.0	68	65	32.0	74	72	40.0	84	82	43.0	88	86	47.3	92	89	--	-	-
Load Current [A]	Ripple Voltage [mV] (Input Volt. 100V)	Ripple Voltage [mV] (Input Volt. 230V)																																					
0.0	26	26																																					
8.0	26	27																																					
11.0	42	30																																					
11.9	46	44																																					
16.0	41	38																																					
24.0	68	65																																					
32.0	74	72																																					
40.0	84	82																																					
43.0	88	86																																					
47.3	92	89																																					
--	-	-																																					
<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>Diagram illustrating a complex ripple wave form. The Y-axis is labeled "Ripple [mVp-p]". Two time intervals are indicated: T1, which spans the entire period of the low-frequency ripple, and T2, which is a much smaller interval within one cycle of T1, representing the switching component.</p>																																							
Fig. Complex Ripple Wave Form																																							

COSEL

Model	PCA600F-15	Temperature Testing Circuitry	25°C
Item	Ripple-Noise		Figure C
Object	+15V43A		

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. 230 [V]
0.0	26	27
8.0	26	27
11.0	42	30
11.9	47	44
16.0	42	38
24.0	68	65
32.0	74	72
40.0	84	82
43.0	89	86
47.3	92	90
--	-	-

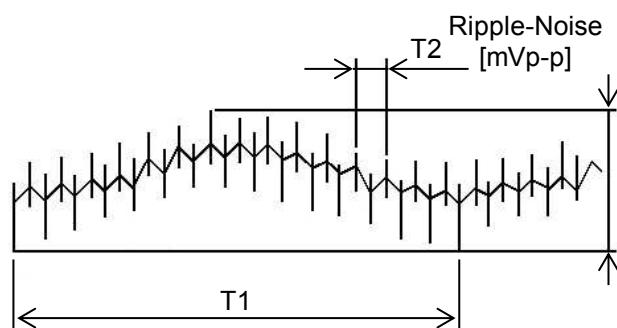
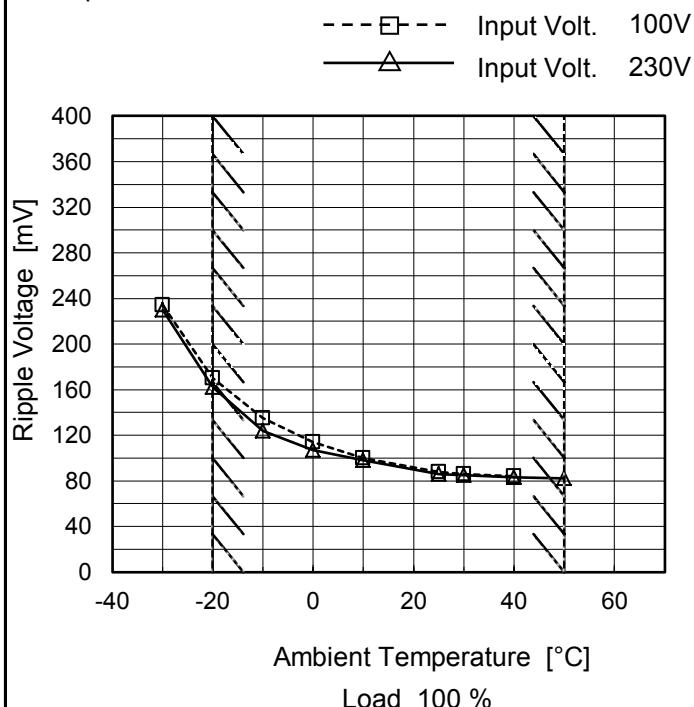
T1: Due to AC Input Line
T2: Due to Switching

Fig. Complex Ripple Wave Form

COSEL

Model	PCA600F-15
Item	Ripple Voltage (by Ambient Temp.)
Object	+15V43A

1. Graph



Measured by 20 MHz Oscilloscope.

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

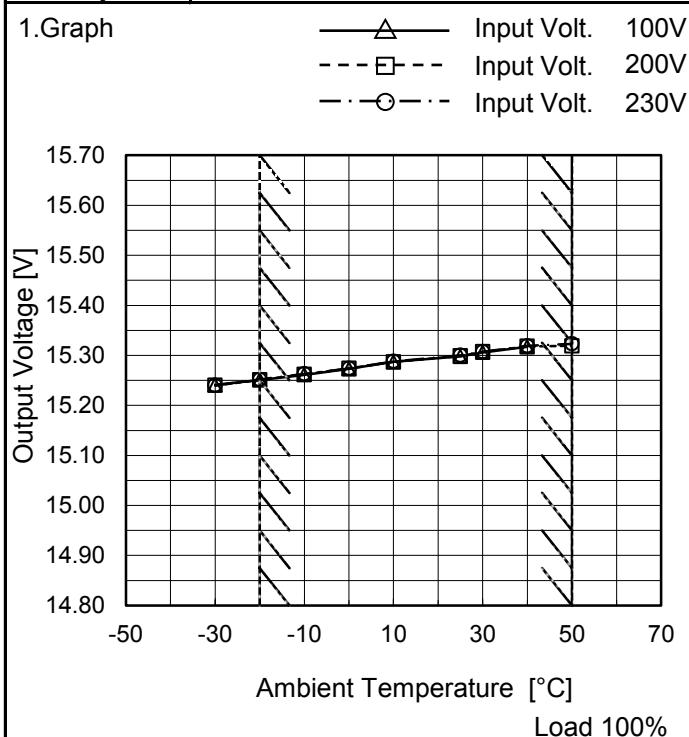
Testing Circuitry Figure C

2. Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
-30	234	230
-20	170	162
-10	135	124
0	114	107
10	100	98
25	88	86
30	86	85
40	84	83
50	-	82
--	-	-
--	-	-

COSEL

Model	PCA600F-15
Item	Ambient Temperature Drift
Object	+15V43A



Testing Circuitry Figure A

2.Values

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
-30	15.241	15.240	15.240
-20	15.251	15.251	15.252
-10	15.261	15.262	15.263
0	15.273	15.274	15.274
10	15.287	15.287	15.288
25	15.298	15.299	15.300
30	15.306	15.307	15.307
40	15.317	15.318	15.319
50	-	15.319	15.323
--	-	-	-
--	-	-	-

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



Model	PCA600F-15	Testing Circuitry Figure A
Item	Output Voltage Accuracy	
Object	+15V43A	

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 - 50°C

Input Voltage : 85 - 264V

Load Current : 0 - 43A

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

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

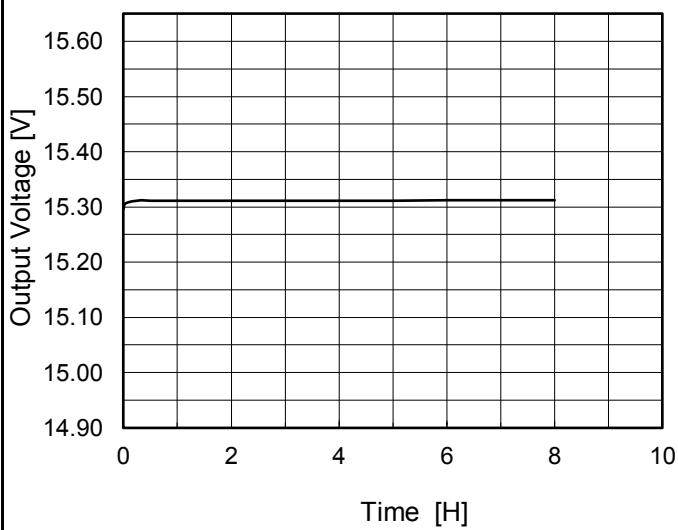
2. Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	50	264	0	15.333	± 43	± 0.3
Minimum Voltage	-20	85	38.7	15.247		

COSEL

Model	PCA600F-15
Item	Time Lapse Drift
Object	+15V43A

1.Graph



Input Volt. 230V
Load 100%

* The characteristic of AC100V is equal.

Temperature	25°C
Testing Circuitry	Figure A

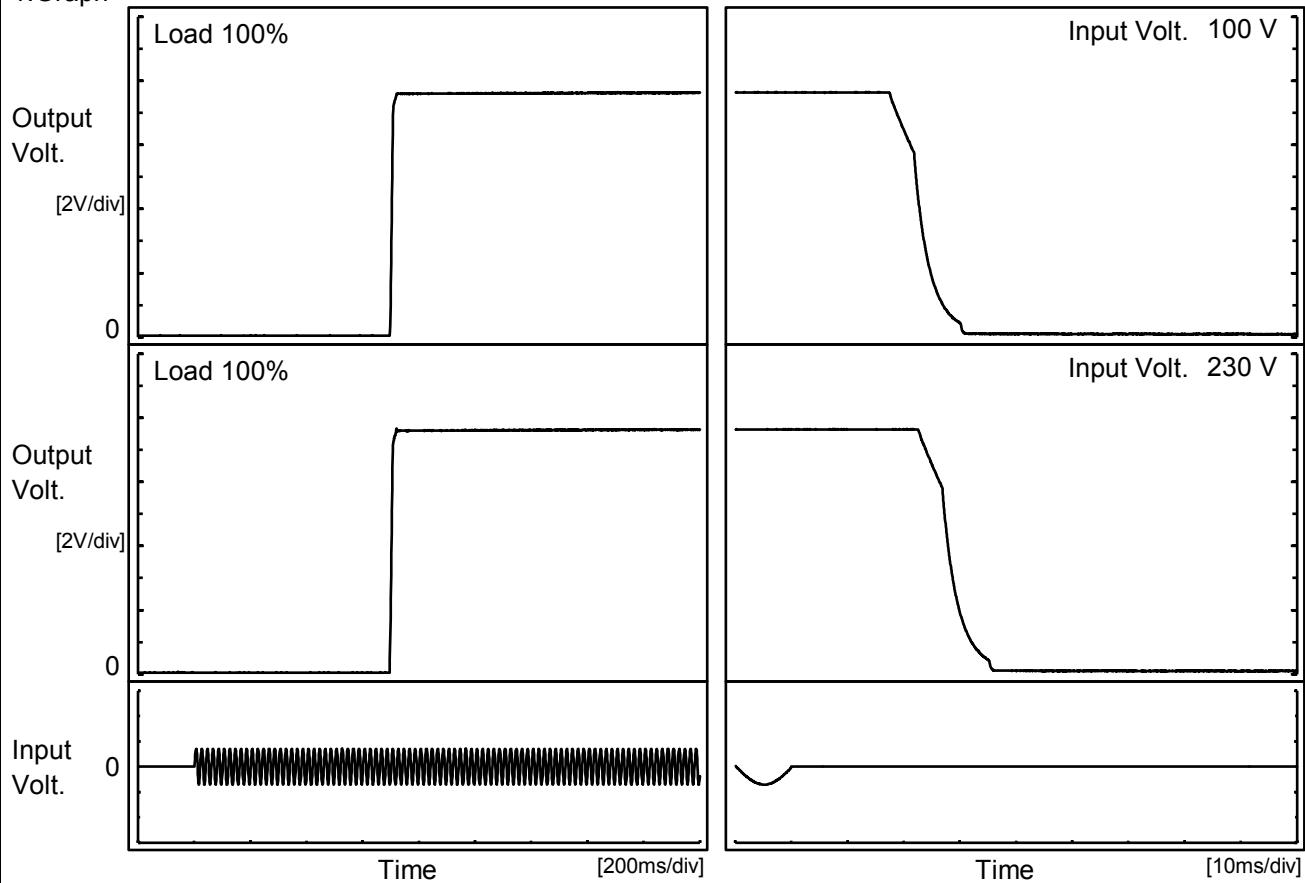
2.Values

Time since start [H]	Output Voltage [V]
0.0	15.296
0.5	15.312
1.0	15.311
2.0	15.312
3.0	15.312
4.0	15.311
5.0	15.312
6.0	15.312
7.0	15.312
8.0	15.312

COSEL

Model	PCA600F-15	Temperature Testing Circuitry	25°C
Item	Rise and Fall Time		Figure A
Object	+15V43A		

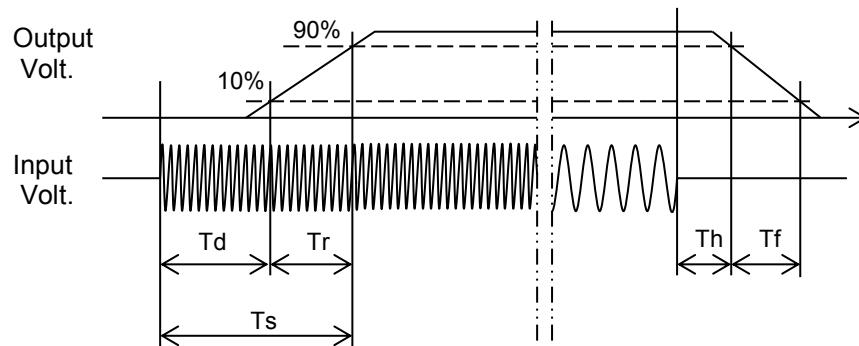
1.Graph



2.Values

[ms]

Input Volt.	Time	Td	Tr	Ts	Th	Tf
100 V		699.0	9.0	708.0	19.2	8.6
230 V		698.0	9.0	707.0	24.4	8.5



COSEL

Model	PCA600F-15	Temperature Testing Circuitry	25°C Figure A																																		
Item	Hold-Up Time																																				
Object	+15V43A																																				
1. Graph			2. Values																																		
<p>Graph showing Hold-Up Time [ms] vs Input Voltage [V] for PCA600F-15 at 25°C. The Y-axis is logarithmic from 1 to 1000 ms. The X-axis ranges from 50 to 300 V. Two curves are shown: Load 50% (dashed line with squares) and Load 100% (solid line with triangles). Both curves show a minimum hold-up time around 100-120V and increasing time as input voltage increases above 200V. A slanted line indicates the rated input voltage range.</p>			<table border="1"> <thead> <tr> <th rowspan="2">Input Voltage [V]</th> <th colspan="2">Hold-Up Time [ms]</th> </tr> <tr> <th>Load 50%</th> <th>Load 100%</th> </tr> </thead> <tbody> <tr> <td>80</td> <td>36</td> <td>-</td> </tr> <tr> <td>85</td> <td>36</td> <td>-</td> </tr> <tr> <td>100</td> <td>36</td> <td>22</td> </tr> <tr> <td>120</td> <td>36</td> <td>22</td> </tr> <tr> <td>200</td> <td>46</td> <td>28</td> </tr> <tr> <td>230</td> <td>46</td> <td>28</td> </tr> <tr> <td>264</td> <td>46</td> <td>28</td> </tr> <tr> <td>280</td> <td>47</td> <td>28</td> </tr> <tr> <td>--</td> <td>-</td> <td>-</td> </tr> </tbody> </table>			Input Voltage [V]	Hold-Up Time [ms]		Load 50%	Load 100%	80	36	-	85	36	-	100	36	22	120	36	22	200	46	28	230	46	28	264	46	28	280	47	28	--	-	-
Input Voltage [V]	Hold-Up Time [ms]																																				
	Load 50%	Load 100%																																			
80	36	-																																			
85	36	-																																			
100	36	22																																			
120	36	22																																			
200	46	28																																			
230	46	28																																			
264	46	28																																			
280	47	28																																			
--	-	-																																			
<p>This duration covers from Shut-off of input voltage to the moment when output voltage descends to the rated range of voltage accuracy. Note: Slanted line shows the range of the rated input voltage.</p>																																					

COSEL

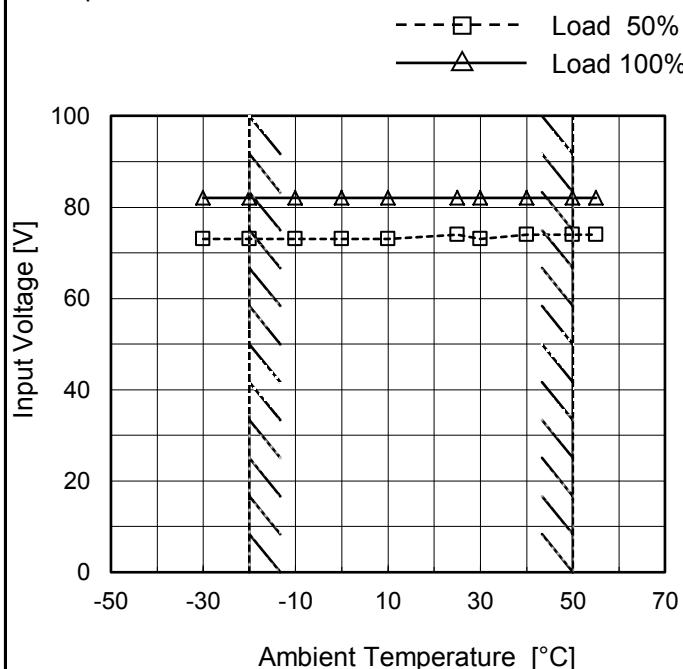
Model	PCA600F-15	Temperature	25°C																																																			
Item	Instantaneous Interruption Compensation	Testing Circuitry	Figure A																																																			
Object	+15V43A																																																					
1.Graph	<p>Graph showing Instantaneous Compensation Time [ms] vs Load Current [A] for three input voltages: 100V, 200V, and 230V. The Y-axis is logarithmic from 1 to 1000 ms. The X-axis ranges from 0 to 50 A. Data points are marked with open triangles (100V), squares (200V), and circles (230V). A slanted line indicates the rated load current range.</p>																																																					
2.Values	<table border="1"> <thead> <tr> <th rowspan="2">Load Current [A]</th> <th colspan="3">Time [ms]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 200[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr> <td>0.0</td><td>-</td><td>-</td><td>-</td></tr> <tr> <td>8.0</td><td>106</td><td>137</td><td>135</td></tr> <tr> <td>16.0</td><td>59</td><td>73</td><td>74</td></tr> <tr> <td>24.0</td><td>36</td><td>43</td><td>48</td></tr> <tr> <td>32.0</td><td>26</td><td>36</td><td>36</td></tr> <tr> <td>40.0</td><td>18</td><td>28</td><td>25</td></tr> <tr> <td>43.0</td><td>16</td><td>26</td><td>26</td></tr> <tr> <td>47.3</td><td>15</td><td>24</td><td>21</td></tr> <tr> <td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr> <td>--</td><td>-</td><td>-</td><td>-</td></tr> <tr> <td>--</td><td>-</td><td>-</td><td>-</td></tr> </tbody> </table>			Load Current [A]	Time [ms]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.0	-	-	-	8.0	106	137	135	16.0	59	73	74	24.0	36	43	48	32.0	26	36	36	40.0	18	28	25	43.0	16	26	26	47.3	15	24	21	--	-	-	-	--	-	-	-	--	-	-	-
Load Current [A]	Time [ms]																																																					
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]																																																			
0.0	-	-	-																																																			
8.0	106	137	135																																																			
16.0	59	73	74																																																			
24.0	36	43	48																																																			
32.0	26	36	36																																																			
40.0	18	28	25																																																			
43.0	16	26	26																																																			
47.3	15	24	21																																																			
--	-	-	-																																																			
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--	-	-	-																																																			
Note:	Slanted line shows the range of the rated load current.																																																					

COSEL

Model	PCA600F-15
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+15V43A

Testing Circuitry Figure A

1.Graph



2.Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-30	73	82
-20	73	82
-10	73	82
0	73	82
10	73	82
25	74	82
30	73	82
40	74	82
50	74	82
55	74	82
--	-	-

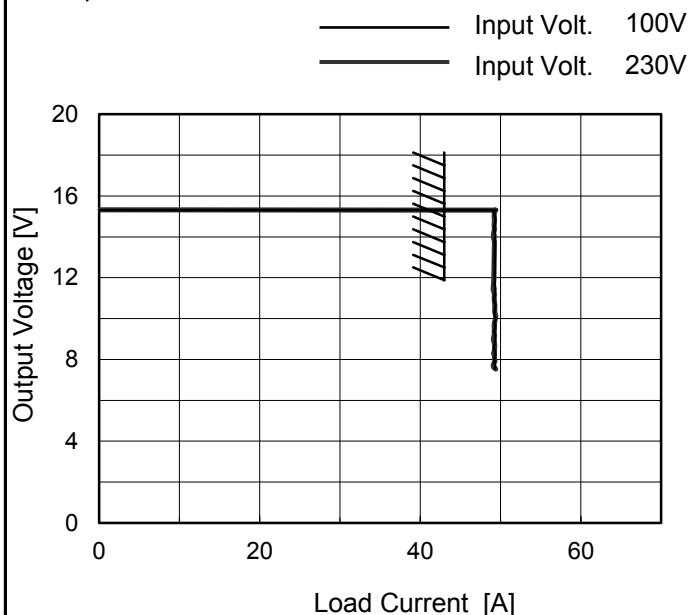
Note: Slanted line shows the range of the rated ambient temperature.

COSEL

Model	PCA600F-15
Item	Overcurrent Protection
Object	+15V43A

 Temperature 25°C
 Testing Circuitry Figure A

1.Graph



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

Intermittent operation occurs when the output voltage is from 7.5V to 0V.

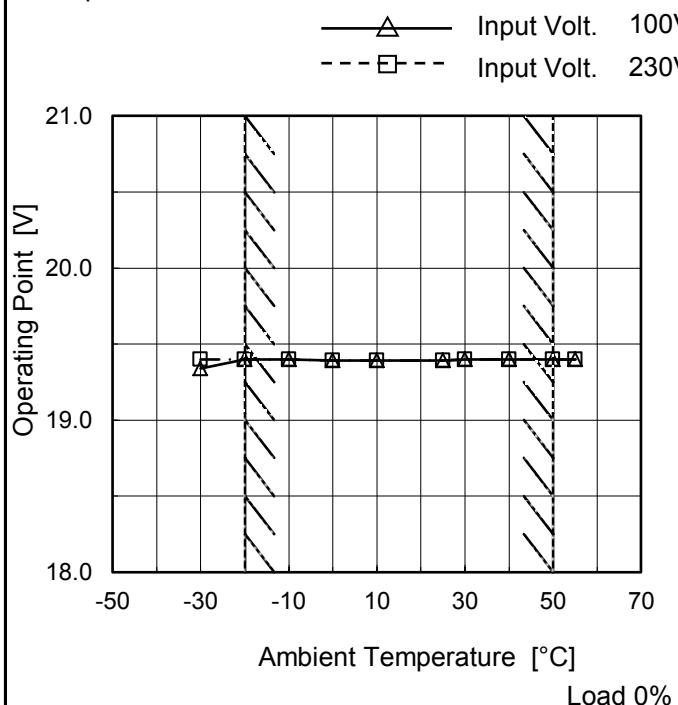
2.Values

Output Voltage [V]	Load Current [A]	
	Input Volt. 100[V]	Input Volt. 230[V]
14.3	49.23	49.22
13.5	49.27	49.23
12.0	49.27	49.16
10.5	49.23	49.29
9.0	49.34	49.10
7.6	49.28	49.39
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

COSEL

Model	PCA600F-15
Item	Overshoot Protection
Object	+15V43A

1. Graph



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

Testing Circuitry Figure A

2. Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 230[V]
-30	19.34	19.40
-20	19.40	19.40
-10	19.40	19.40
0	19.39	19.39
10	19.39	19.39
25	19.39	19.39
30	19.40	19.40
40	19.40	19.40
50	19.40	19.40
55	19.40	19.40
--	-	-

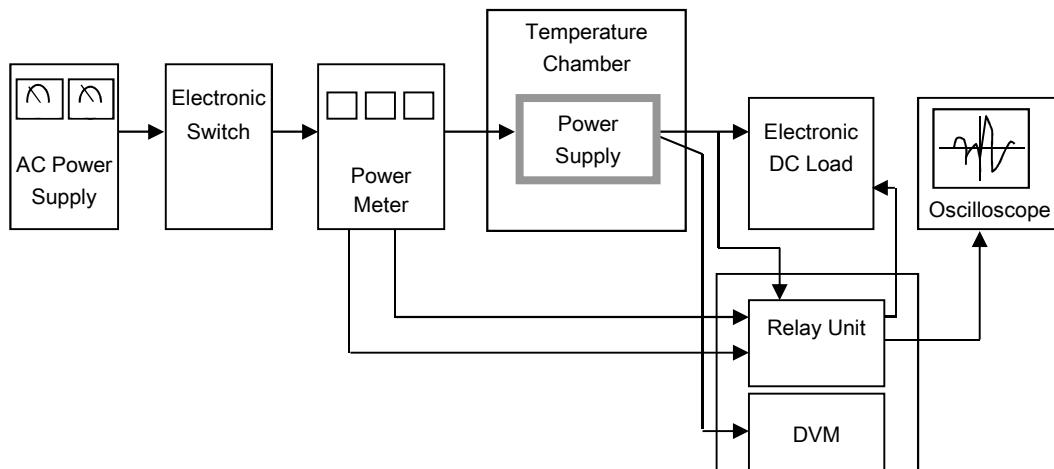


Figure A

Data Acquisition/Control Unit

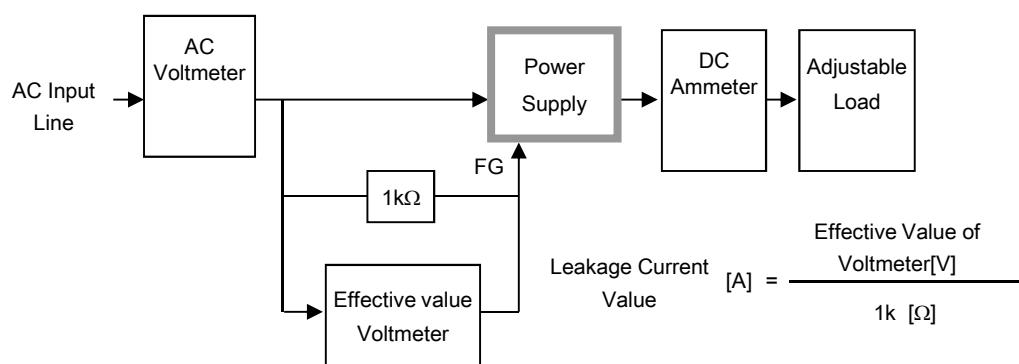


Figure B-1 (DEN-AN)

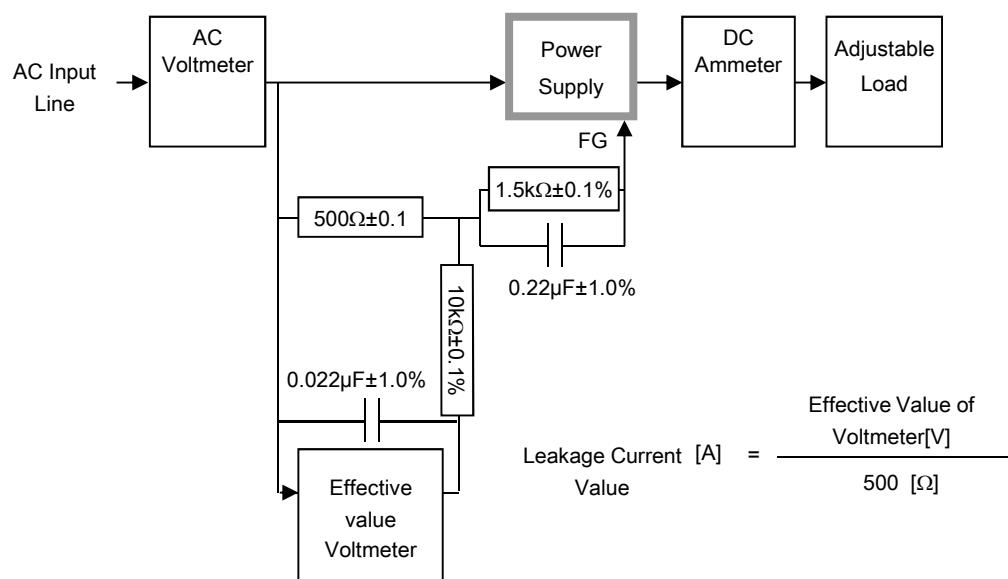


Figure B-2 (IEC62368-1 refer to IEC60990 Fig.4)

COSEL

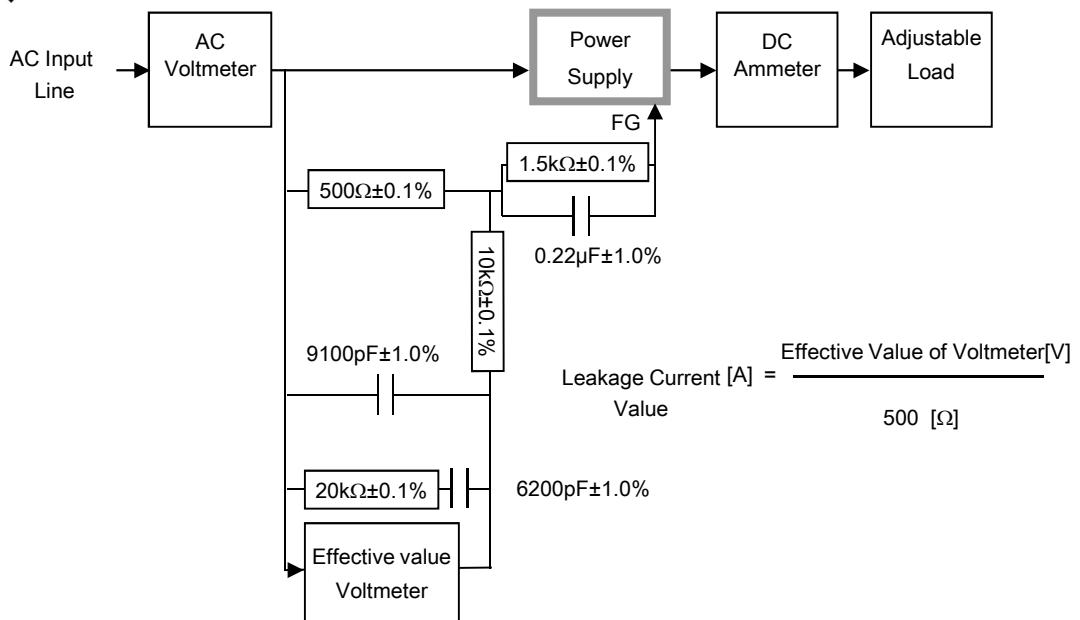


Figure B-3 (IEC62368-1 refer to IEC60990 Fig.5)

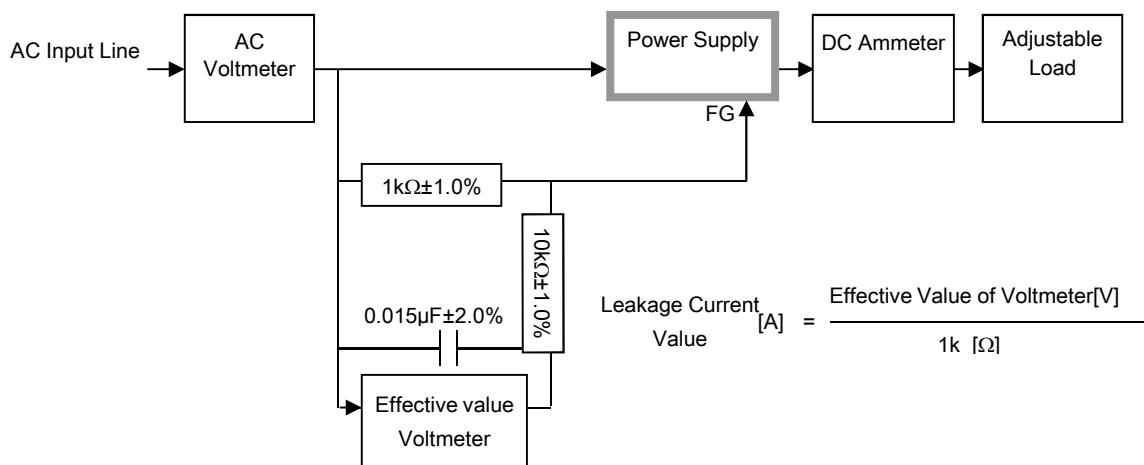
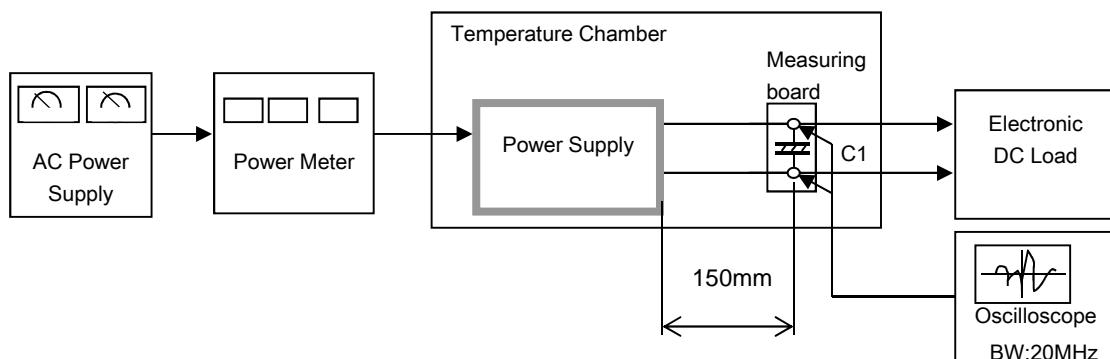


Figure B-4 (IEC60601-1)



$C1 = 22 \mu F$
(Electrolytic capacitor)

Figure C