TEST DATA OF PCA600F-48

Regulated DC Power Supply
March 14, 2018

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COSEL CO.,LTD.

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Model	PCA600F-48
Item	Input Current (by Load Current)
Object	————————

Temperature 25°C
Testing Circuitry Figure A

1.Graph

——△——	Input Volt.	100V
---▭---	Input Volt.	200V
—·—○—·—	Input Volt.	230V

Input Current [A] vs Load Current [A]

2.Values

Load Current [A]	Input Current [A]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	0.208	0.149	0.147
2.0	1.187	0.643	0.580
4.0	2.196	1.125	0.998
6.0	3.229	1.635	1.441
8.0	4.273	2.144	1.880
10.0	5.329	2.653	2.350
12.0	6.409	3.192	2.798
13.0	6.953	3.451	3.023
14.3	7.659	3.791	3.316
--	-	-	-
--	-	-	-

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

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Model	PCA600F-48
Item	Input Power (by Load Current)
Object	————————

Temperature   25℃
Testing Circuitry   Figure A

1.Graph

———△——— Input Volt.   100V
- - -▱- - - Input Volt.   200V
—·—○—·— Input Volt.   230V

Input Power [W] (y-axis: 0, 200, 400, 600, 800, 1000)
Load Current [A] (x-axis: 0, 4, 8, 12, 16)

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

2.Values

Load Current [A]	Input Power [W]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	15.2	12.2	11.9
2.0	116.5	116.2	116.5
4.0	218.4	214.6	214.5
6.0	322.1	317.5	317.1
8.0	426.4	419.5	418.6
10.0	531.7	522.1	523.4
12.0	639.1	627.4	626.4
13.0	693.1	679.3	678.1
14.3	763.8	747.0	745.6
--	-	-	-
--	-	-	-

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Model	PCA600F-48
Item	Efficiency (by Input Voltage)
Object	

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

- - -▣- - -   Load 50%
———△———   Load 100%

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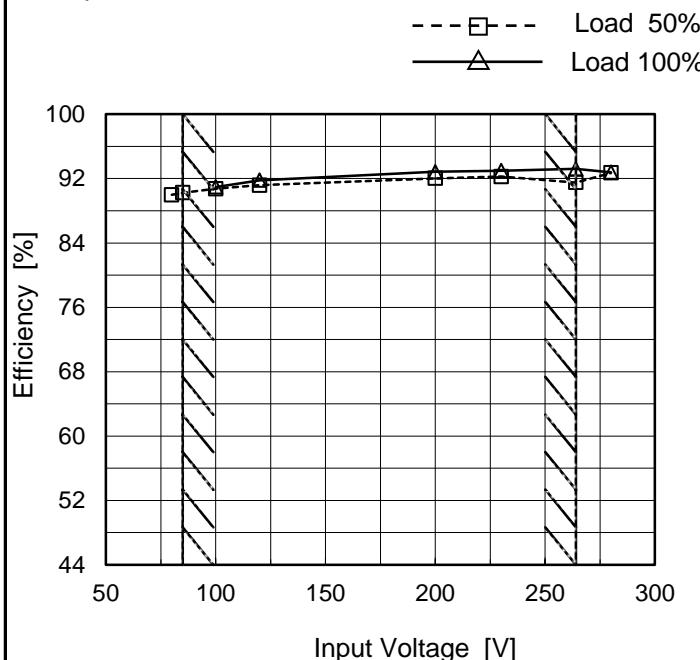
2.Values

Input Voltage [V]	Efficiency [%]	
	Load 50%	Load 100%
80	90.0	-
85	90.2	-
100	90.7	91.0
120	91.2	91.8
200	92.0	92.9
230	92.2	93.0
264	91.5	93.2
280	92.7	92.8
--	-	-

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Model	PCA600F-48
Item	Efficiency (by Load Current)
Object	————————

Temperature 25°C
Testing Circuitry Figure A

1.Graph

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

Efficiency [%] vs Load Current [A]

2.Values

Load Current [A]	Efficiency [%]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	-	-	-
2.0	83.8	84.0	83.8
4.0	89.2	90.8	90.8
6.0	90.6	91.8	91.9
8.0	91.1	92.6	92.8
10.0	91.3	93.0	92.7
12.0	91.1	92.8	93.0
13.0	91.0	92.9	93.0
14.3	90.8	92.9	93.0
--	-	-	-
--	-	-	-

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

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Model	PCA600F-48
Item	Power Factor (by Input Voltage)
Object	————————

Temperature 25°C
Testing Circuitry Figure A

1.Graph

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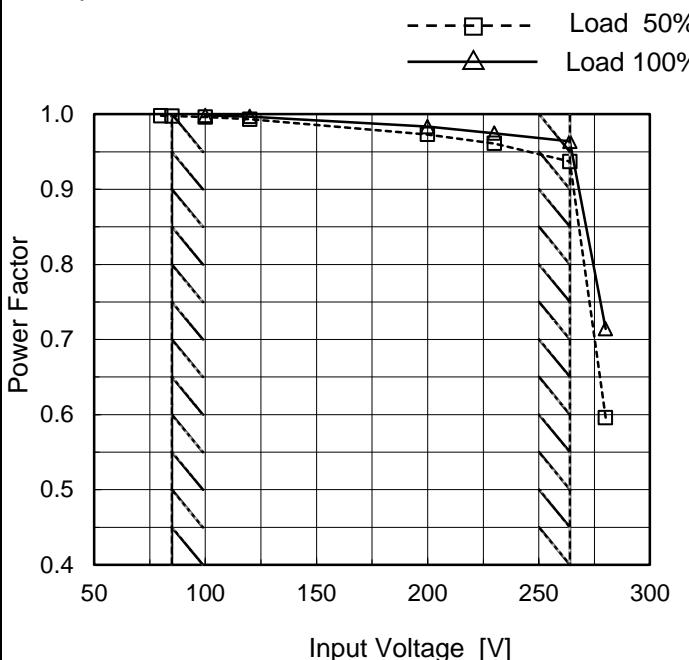
2.Values

Input Voltage [V]	Power Factor	
	Load 50%	Load 100%
80	0.998	-
85	0.998	-
100	0.996	0.998
120	0.993	0.997
200	0.973	0.983
230	0.961	0.975
264	0.937	0.964
280	0.596	0.714
--	-	-

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Model	PCA600F-48
Item	Power Factor (by Load Current)
Object	————————

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

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

Power Factor

Load Current [A]

2.Values

Load Current [A]	Power Factor		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	0.730	0.409	0.354
2.0	0.980	0.903	0.873
4.0	0.993	0.952	0.935
6.0	0.996	0.970	0.956
8.0	0.997	0.978	0.968
10.0	0.998	0.983	0.968
12.0	0.998	0.982	0.973
13.0	0.998	0.984	0.975
14.3	0.998	0.984	0.977
--	-	-	-
--	-	-	-

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

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Model	PCA600F-48
Item	Inrush Current
Object	————————

Temperature   25°C
Testing Circuitry   Figure A

Input
Current
[20A/div]

Input
Voltage
[100V/div]

Time   [200ms/div]

Input Voltage   100 V
Frequency   50 Hz
Load   100 %

Primary inrush current :
      13.2 A
Secondary inrush current :
      17.6 A

Input
Current
[20A/div]

Input
Voltage
[200V/div]

Time   [200ms/div]

Input Voltage   230 V
Frequency   50 Hz
Load   100 %

Primary inrush current :
      29.2 A
Secondary inrush current :
      12.8 A

Primary inrush current   Secondary inrush current

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Model	PCA600F-48		
Item	Leakage Current	Temperature	25°C
Object		Testing Circuitry	Figure B

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
	Figure B-3	Both phases	0.12	0.29	0.30	Operation
		One of phases	0.25	0.54	0.57	Stand by
IEC60601-1	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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Model	PCA600F-48
Item	Line Regulation
Object	+48V13A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

--- ▭ --- Load 50%
—— △ —— Load 100%

Output Voltage [V] vs Input Voltage [V]

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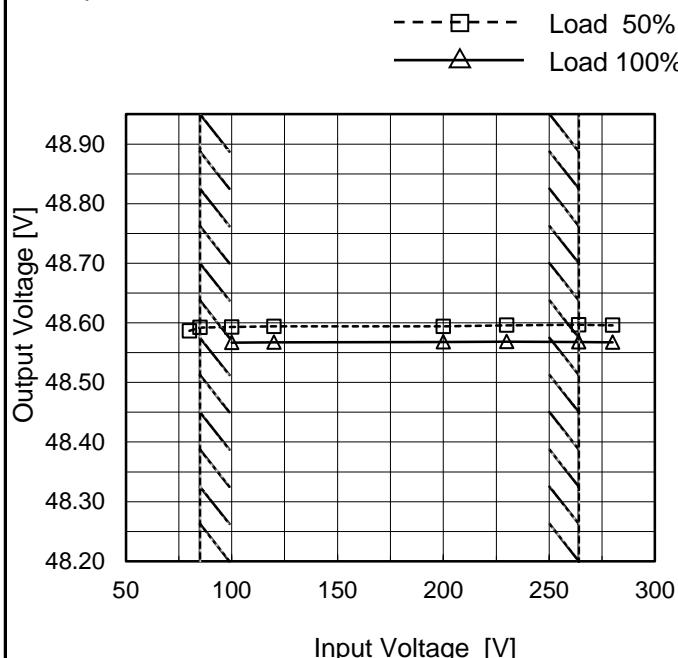
2.Values

Input Voltage [V]	Output Voltage [V]	
	Load 50%	Load 100%
80	48.587	-
85	48.592	-
100	48.593	48.567
120	48.594	48.567
200	48.594	48.568
230	48.596	48.568
264	48.597	48.568
280	48.596	48.568
--	-	-

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Model	PCA600F-48
Item	Load Regulation
Object	+48V13A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

⎯⎯△⎯⎯ Input Volt. 100V
--- ⊟ --- Input Volt. 200V
— · —○— · — Input Volt. 230V

2.Values

Load Current [A]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	48.622	48.625	48.624
2.0	48.618	48.619	48.617
4.0	48.610	48.610	48.600
6.0	48.600	48.602	48.601
8.0	48.591	48.592	48.593
10.0	48.584	48.583	48.583
12.0	48.575	48.574	48.575
13.0	48.571	48.570	48.570
14.3	48.566	48.564	48.564
--	-	-	-
--	-	-	-

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

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Model	PCA600F-48
Item	Dynamic Load Response
Object	+48V13A

Temperature   25°C
Testing Circuitry   Figure A

Input Volt.   100 V
Cycle   1000 ms

t1,t2 = 50 μs

Load Current

t1   t2

Min.Load (0A)←→
   Load 100% (13A)

1 V/div

2 ms/div   10 ms/div

Min.Load (0A)←→
   Load 50% (6.5A)

1 V/div

2 ms/div   10 ms/div

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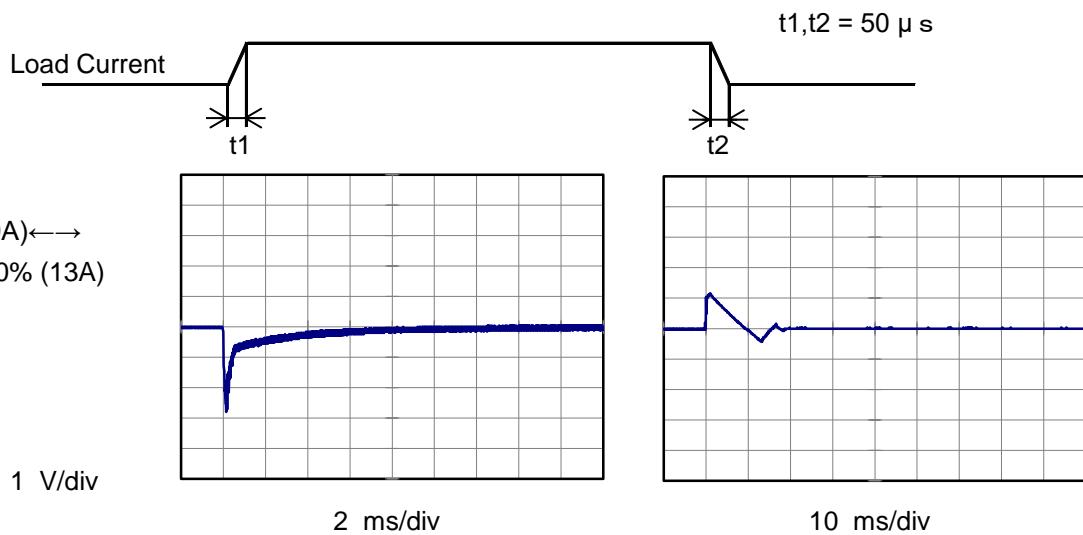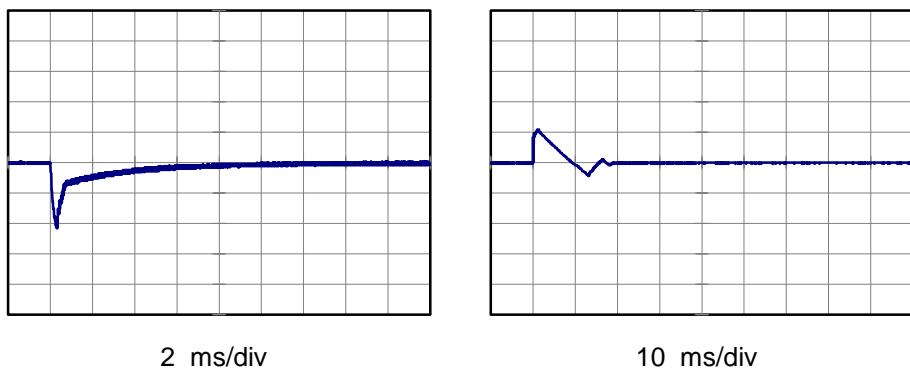
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Model	PCA600F-48
Item	Ripple Voltage (by Load Current)
Object	+48V13A

Temperature   25°C
Testing Circuitry   Figure C

1.Graph

2.Values

——△—— Input Volt.   100V
—·-○-·— Input Volt.   230V
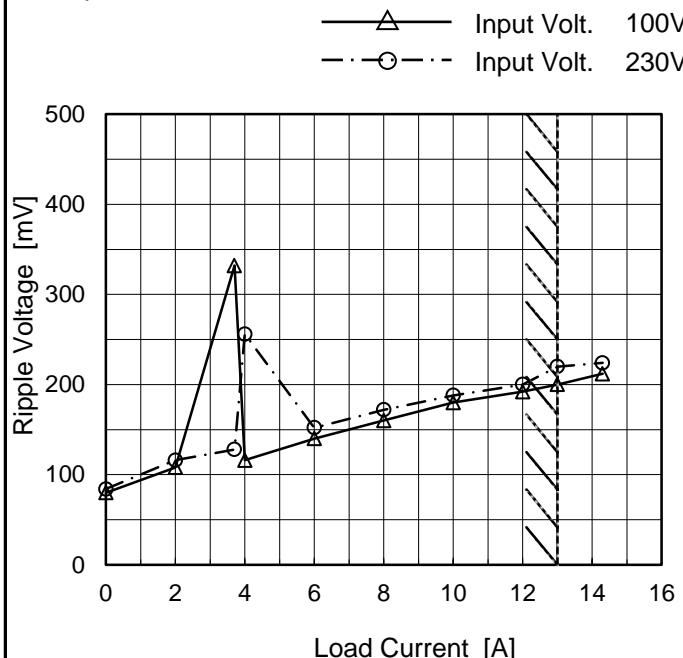
Load Current [A]

Load Current [A]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
0.0	80	84
2.0	108	116
3.7	332	128
4.0	116	256
6.0	140	152
8.0	160	172
10.0	180	188
12.0	192	200
13.0	200	220
14.3	212	224
--	-	-

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.

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

Ripple [mVp-p]

Fig. Complex Ripple Wave Form

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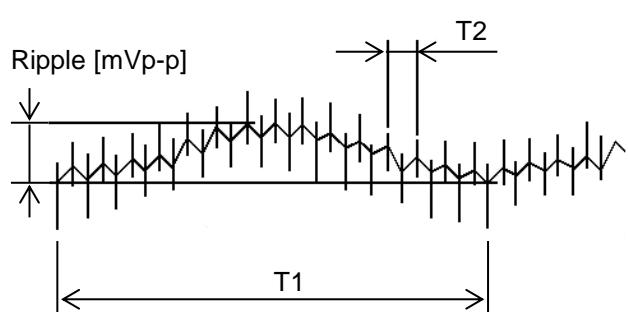
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Model	PCA600F-48
Item	Ripple-Noise
Object	+48V13A

Temperature   25°C
Testing Circuitry   Figure C

1.Graph

Input Volt.   100V
Input Volt.   230V
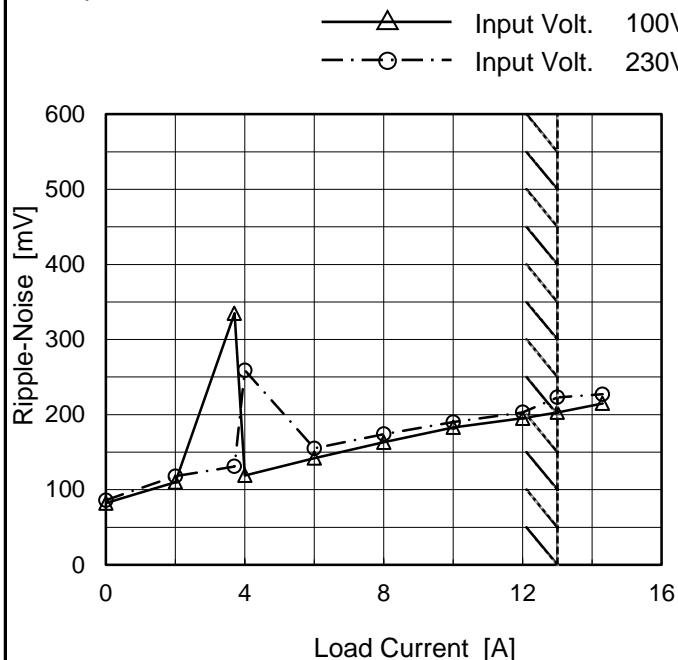
Load Current [A]

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	82	86
2.0	110	118
3.7	335	131
4.0	119	259
6.0	142	155
8.0	163	174
10.0	183	190
12.0	195	203
13.0	203	223
14.3	215	227
--	-	-

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

Ripple-Noise
[mVp-p]
T2

T1

Fig. Complex Ripple Wave Form

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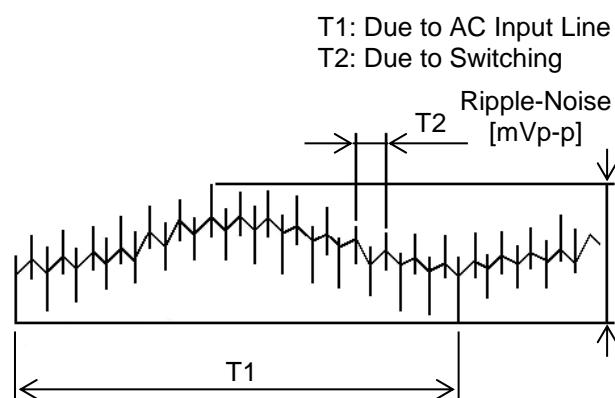
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Model	PCA600F-48
Item	Ripple Voltage (by Ambient Temp.)
Object	+48V13A

Testing Circuitry   Figure C

1.Graph

--- ⊟ --- Input Volt.   100V
——△—— Input Volt.   230V

Ambient Temperature [°C]

Load   100 %

Measured by 20 MHz Oscilloscope.
Note: Slanted line shows the range of the rated
ambient temperature.
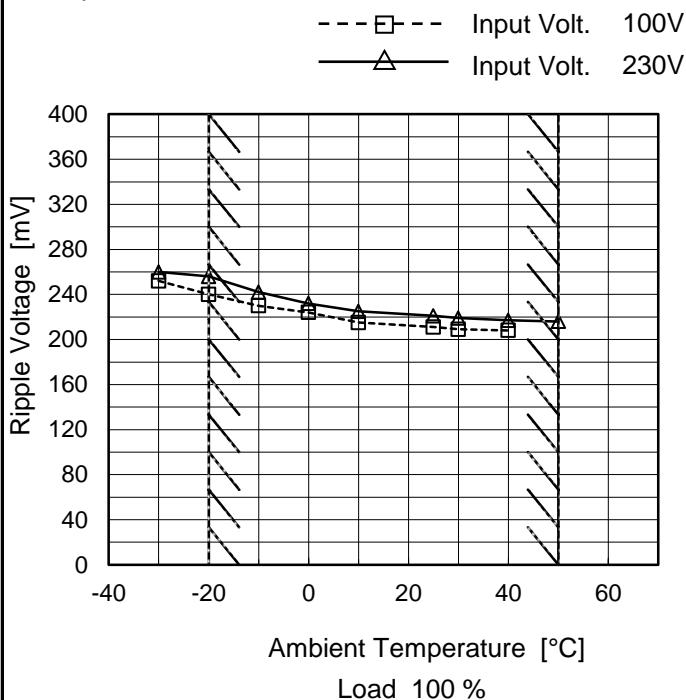
2.Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
-30	252	260
-20	240	256
-10	230	242
0	224	232
10	215	225
25	211	221
30	209	219
40	208	217
50	-	216
--	-	-
--	-	-

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Model	PCA600F-48
Item	Ambient Temperature Drift
Object	+48V13A

Testing Circuitry   Figure A

1.Graph

——△—— Input Volt.   100V
- - -⊟- - - Input Volt.   200V
—·—○—·— Input Volt.   230V

Ambient Temperature [°C]

Load 100%

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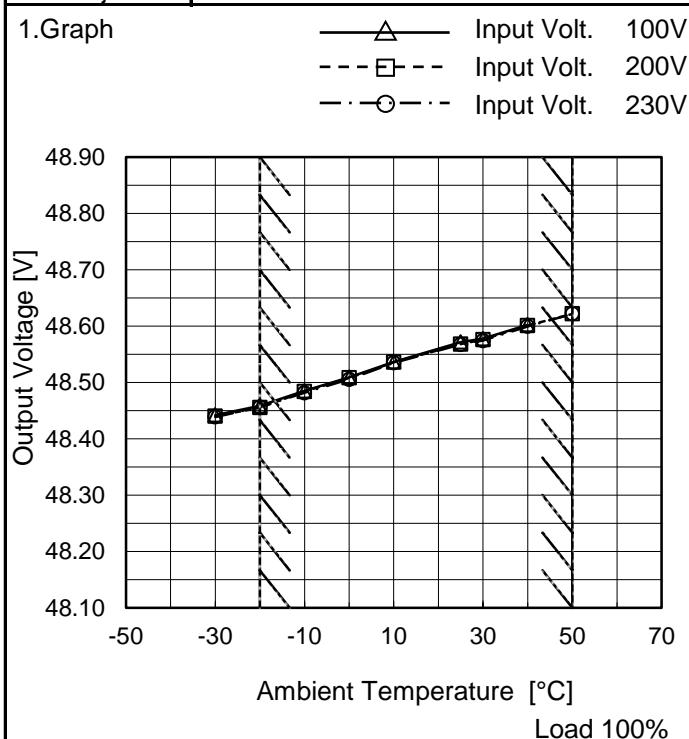
2.Values

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
-30	48.442	48.440	48.439
-20	48.458	48.455	48.456
-10	48.485	48.484	48.482
0	48.509	48.508	48.506
10	48.537	48.536	48.535
25	48.572	48.568	48.568
30	48.578	48.576	48.574
40	48.603	48.601	48.600
50	-	48.622	48.622
-	-	-	-
--	-	-	-

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Model	PCA600F-48				
Item	Output Voltage Accuracy		Testing Circuitry	Figure A	
Object	+48V13A				

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 - 13A

* Output Voltage Accuracy = ±(Maximum of Output Voltage - Minimum of Output Voltage) / 2

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

2.Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ratio [%]
Maximum Voltage	50	200	0	48.679	±109	±0.2
Minimum Voltage	-20	200	13	48.462		

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Model	PCA600F-48
Item	Time Lapse Drift
Object	+48V13A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

Output Voltage [V]

48.90
48.80
48.70
48.60
48.50
48.40
48.30
48.20

0   2   4   6   8   10

Time [H]

Input Volt.   230V
Load   100%

* The characteristic of AC100V is equal.

2.Values

Time since start [H]	Output Voltage [V]
0.0	48.539
0.5	48.572
1.0	48.571
2.0	48.572
3.0	48.573
4.0	48.572
5.0	48.573
6.0	48.573
7.0	48.573
8.0	48.573

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Model	PCA600F-48
Item	Rise and Fall Time
Object	+48V13A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

Load 100%

Output
Volt.

[10V/div]

0

Input Volt. 100 V

Load 100%

Output
Volt.

[10V/div]

0

Input Volt. 230 V

Input
Volt.

0

Time [200ms/div]

Time [10ms/div]

2.Values [ms]

Input Volt. Time	Td	Tr	Ts	Th	Tf
100 V	650.0	38.0	688.0	18.2	10.4
230 V	648.0	38.0	686.0	23.3	10.5

Output
Volt.

90%

10%

Input
Volt.

Td Tr Th Tf

Ts

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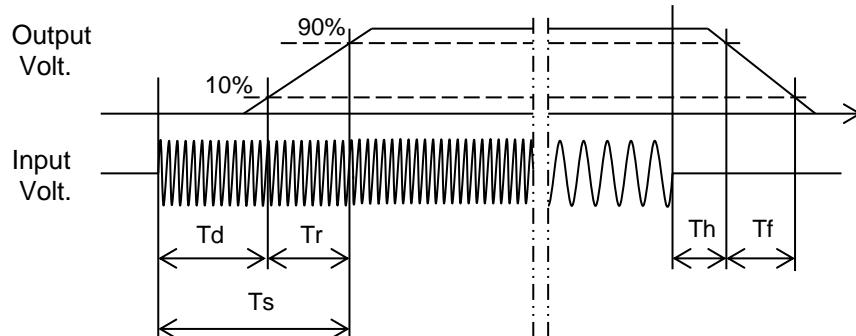
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Model	PCA600F-48
Item	Hold-Up Time
Object	+48V13A

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

- - -□- - -   Load 50%
———△———   Load 100%

Hold-Up Time [ms] vs Input Voltage [V]
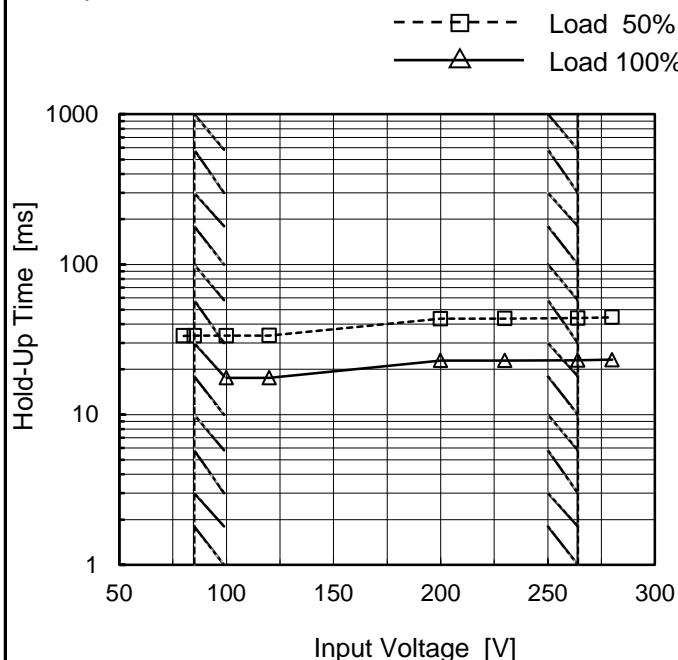
2.Values

Input Voltage [V]	Hold-Up Time [ms]	
	Load 50%	Load 100%
80	33	-
85	34	-
100	34	18
120	34	18
200	44	23
230	44	23
264	44	23
280	44	23
--	-	-

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.

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Model	PCA600F-48
Item	Instantaneous Interruption Compensation
Object	+48V13A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

— △ — Input Volt. 100V
- - - ⊟ - - - Input Volt. 200V
— · — ○ — · — Input Volt. 230V

Instantaneous Compensation Time [ms] vs Load Current [A]

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

2.Values

Load Current [A]	Time [ms]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	-	-	-
2.0	97	145	146
4.0	57	72	76
6.0	38	51	51
8.0	28	38	37
10.0	25	31	31
12.0	18	25	25
13.0	16	23	24
14.3	15	20	20
--	-	-	-
--	-	-	-

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Model	PCA600F-48
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+48V13A

Testing Circuitry   Figure A
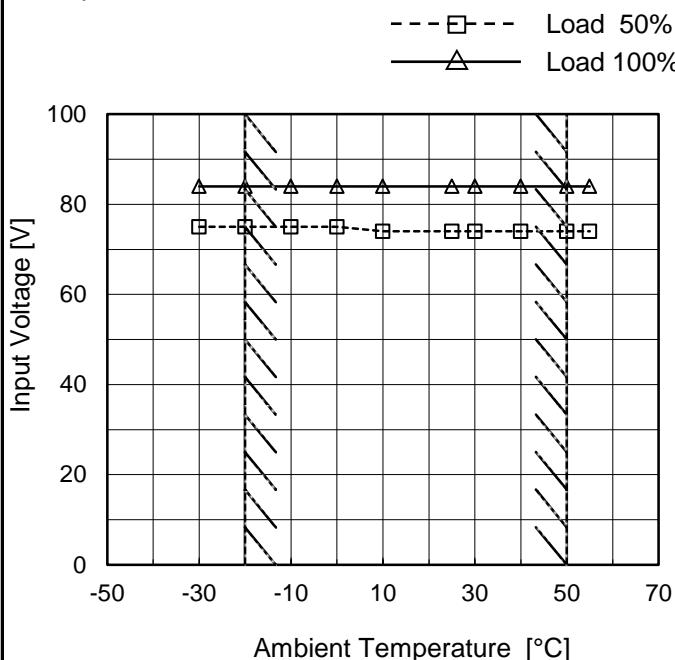
1.Graph

--- ⊟ --- Load 50%
——— △ ——— Load 100%

Input Voltage [V] vs Ambient Temperature [°C]

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

2.Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-30	75	84
-20	75	84
-10	75	84
0	75	84
10	74	84
25	74	84
30	74	84
40	74	84
50	74	84
55	74	84
--	-	-

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Model	PCA600F-48
Item	Overcurrent Protection
Object	+48V13A

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

—————— Input Volt.   100V
—————— Input Volt.   230V
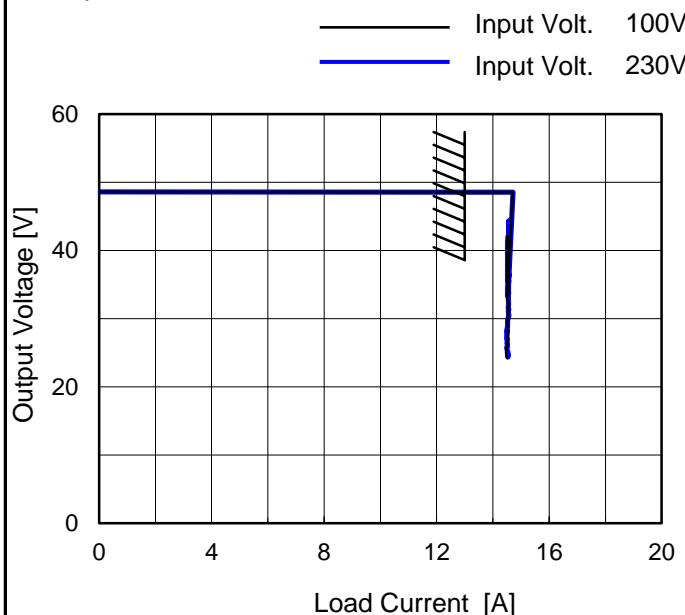
Note: Slanted line shows the range of the rated
load current.

Intermittent operation occurs when the output
voltage is from 24V to 0V.

2.Values

Output Voltage [V]	Load Current [A]	
	Input Volt. 100[V]	Input Volt. 230[V]
45.6	14.51	14.54
43.2	14.52	14.54
38.4	14.54	14.56
33.6	14.52	14.57
28.8	14.53	14.52
24.3	14.50	14.53
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

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COSEL

Model	PCA600F-48
Item	Overvoltage Protection
Object	+48V13A

Testing Circuitry   Figure A

1.Graph

———△——— Input Volt.   100V

- - -⊟- - - Input Volt.   230V

Operating Point [V] vs Ambient Temperature [°C]

Load 0%

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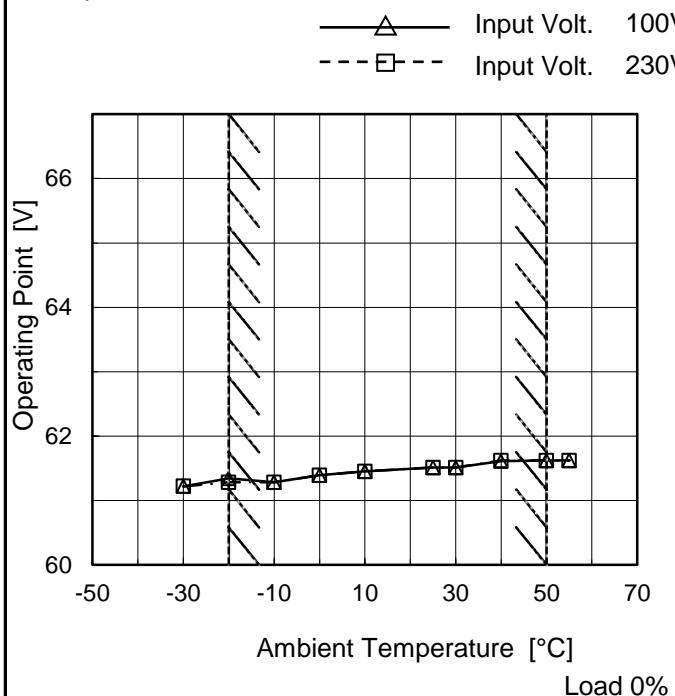
2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 230[V]
-30	61.22	61.22
-20	61.34	61.28
-10	61.28	61.28
0	61.39	61.39
10	61.45	61.45
25	61.51	61.51
30	61.51	61.51
40	61.61	61.62
50	61.62	61.62
55	61.62	61.62
--	-	-

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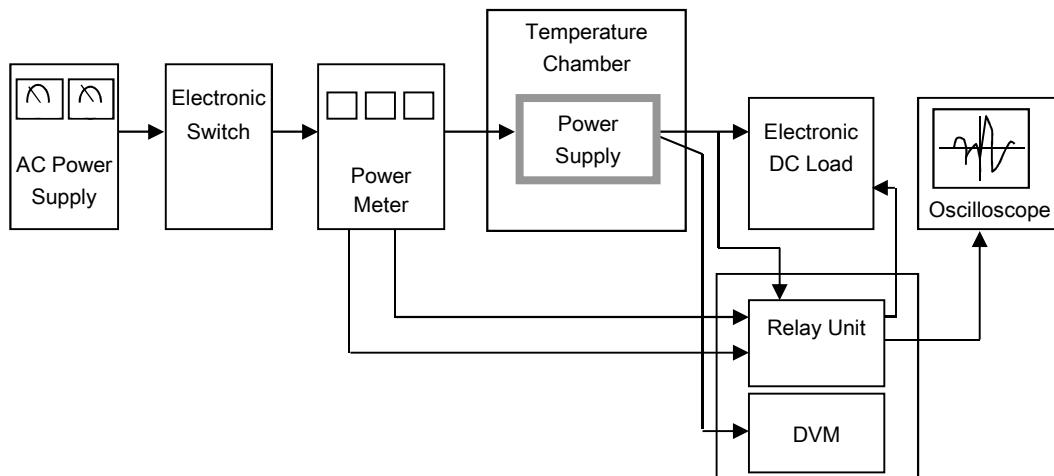
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Data Acquisition/Control Unit

Figure A

$$\text{Leakage Current Value} \; [A] = \frac{\text{Effective Value of Voltmeter}[V]}{1k \; [\Omega]}$$

Figure B-1 (DEN-AN)

$$\text{Leakage Current Value} \; [A] = \frac{\text{Effective Value of Voltmeter}[V]}{500 \; [\Omega]}$$
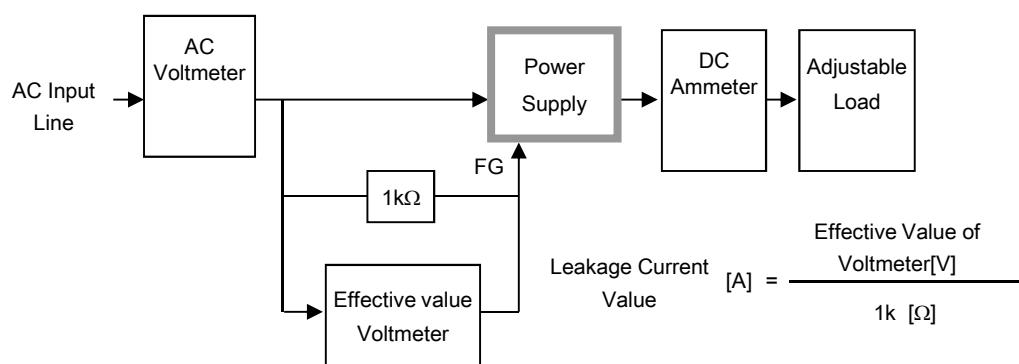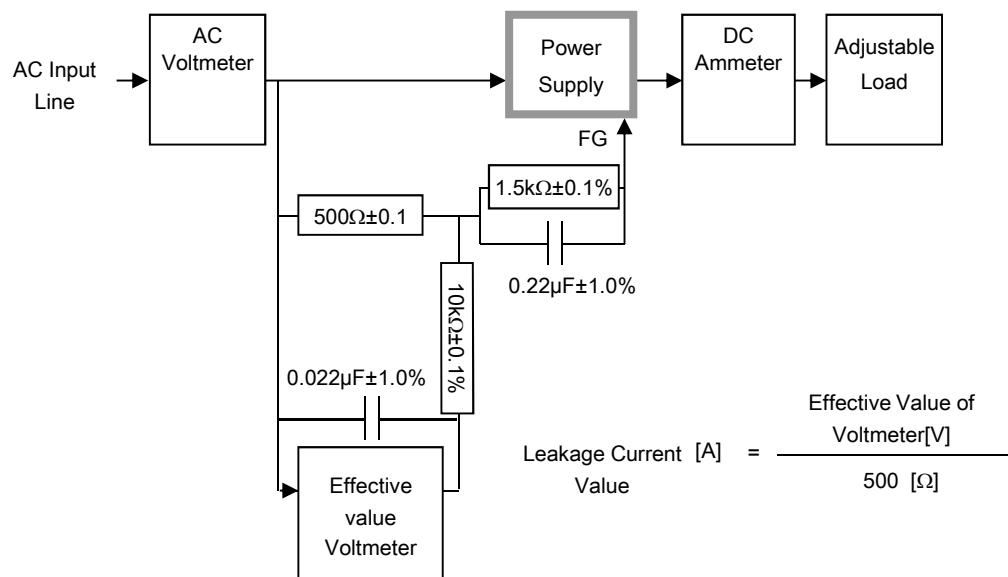
Figure B-2 (IEC62368-1 refer to IEC60990 Fig.4)

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COSEL

AC Input Line → AC Voltmeter → Power Supply → DC Ammeter → Adjustable Load

FG

500Ω±0.1%

1.5kΩ±0.1%

0.22μF±1.0%

10kΩ±0.1%

9100pF±1.0%

20kΩ±0.1%   6200pF±1.0%

Effective value Voltmeter

$$\text{Leakage Current Value [A]} = \frac{\text{Effective Value of Voltmeter[V]}}{500\ [\Omega]}$$
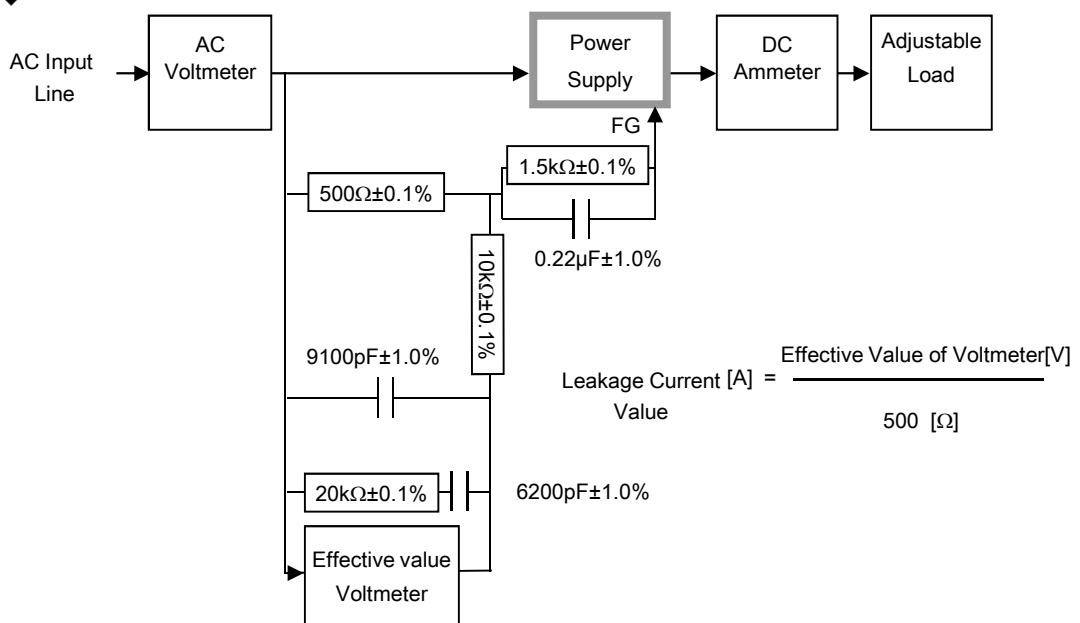
Figure B-3 (IEC62368-1 refer to IEC60990 Fig.5)

AC Input Line → AC Voltmeter → Power Supply → DC Ammeter → Adjustable Load

FG

1kΩ±1.0%

10kΩ±1.0%

0.015μF±2.0%

Effective value Voltmeter

$$\text{Leakage Current Value [A]} = \frac{\text{Effective Value of Voltmeter[V]}}{1k\ [\Omega]}$$

Figure B-4 (IEC60601-1)

Temperature Chamber

Measuring board

AC Power Supply → Power Meter → Power Supply → C1 → Electronic DC Load

Oscilloscope
BW:20MHz

150mm
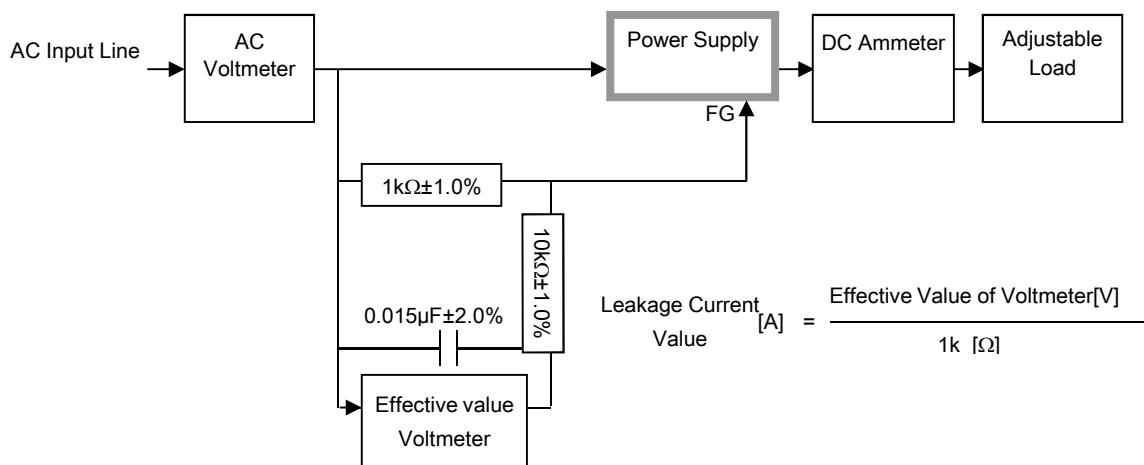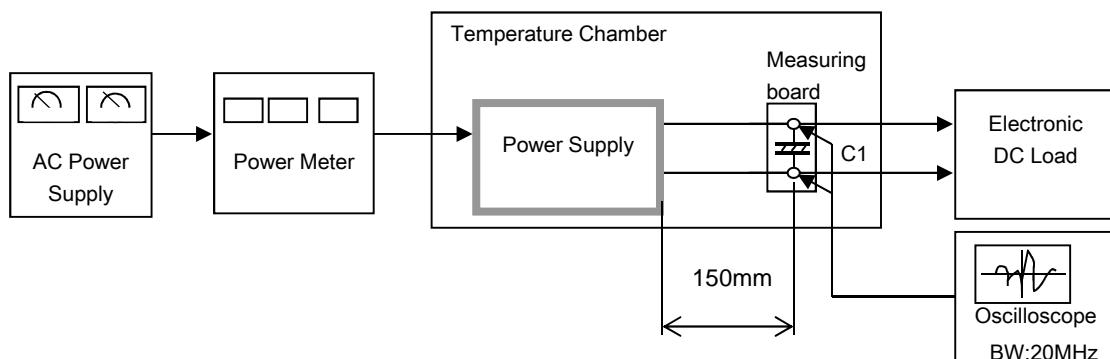
C1 = 22 μF
(Electrolytic capacitor)

Figure C

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