COSEL

TEST DATA OF PCA600F-32-P2

Regulated DC Power Supply
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COSEL CO.,LTD.

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Model	PCA600F-32-P2
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

Load Current [A]

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. 200[V]	Input Volt. 230[V]
0.0	0.196	0.145	0.145
4.0	1.501	0.783	0.701
8.0	2.845	1.443	1.273
10.0	3.529	1.776	1.561
12.0	4.210	2.111	1.851
16.0	5.610	2.785	2.462
20.0	7.050	3.494	3.059
22.0	7.770	3.840	3.357
--	-	-	-
--	-	-	-
--	-	-	-

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Model	PCA600F-32-P2
Item	Input Power (by Load Current)
Object	————————

Temperature 25°C
Testing Circuitry Figure A

1.Graph

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

Input Power [W] vs Load Current [A]

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	13.8	10.4	10.4
4.0	147.7	144.5	144.5
8.0	282.3	278.0	277.6
10.0	350.8	345.0	344.0
12.0	419.0	412.1	411.0
16.0	559.0	547.7	549.0
20.0	702.0	687.3	686.0
22.0	775.0	756.0	755.0
--	-	-	-
--	-	-	-
--	-	-	-

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Model	PCA600F-32-P2
Item	Efficiency (by Input Voltage)
Object	

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

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

Efficiency [%] vs Input Voltage [V]

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

2.Values

Input Voltage [V]	Efficiency [%]	
	Load 50%	Load 100%
80	90.3	89.7
85	90.8	90.2
100	91.3	91.3
120	91.8	92.2
200	92.9	93.4
230	93.1	93.5
264	92.3	93.8
280	92.8	92.7
--	-	-

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COSEL

Model	PCA600F-32-P2
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	-	-	-
4.0	86.8	88.7	88.8
8.0	90.8	92.2	92.3
10.0	91.3	92.8	93.1
12.0	91.7	93.3	93.5
16.0	91.7	93.6	93.3
20.0	91.4	93.4	93.6
22.0	91.1	93.4	93.5
--	-	-	-
--	-	-	-
--	-	-	-

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

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Model	PCA600F-32-P2
Item	Power Factor (by Input Voltage)
Object	

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

Power Factor vs Input Voltage [V]

Legend:
- – – – ⊟ – – – Load 50%
- ——— △ ——— Load 100%

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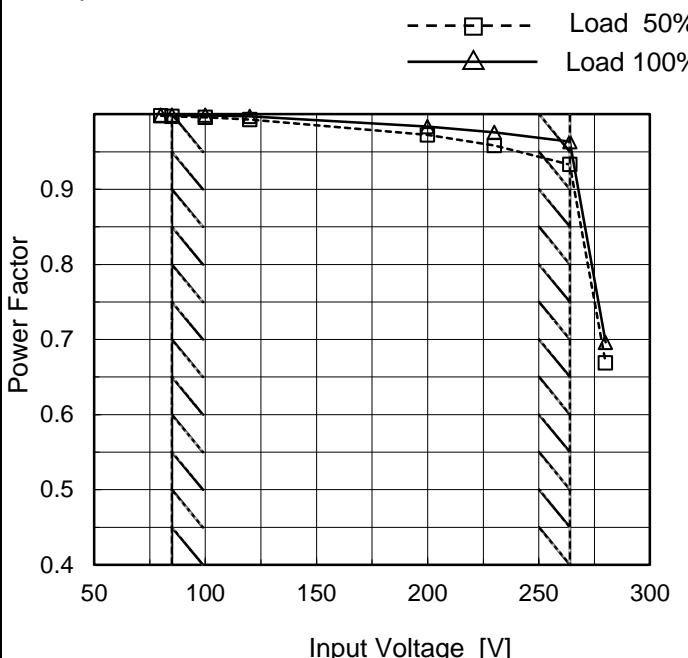
2.Values

Input Voltage [V]	Power Factor	
	Load 50%	Load 100%
80	0.998	0.999
85	0.997	0.999
100	0.996	0.999
120	0.993	0.997
200	0.972	0.984
230	0.958	0.976
264	0.933	0.963
280	0.669	0.696
--	-	-

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Model	PCA600F-32-P2
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 vs Load Current [A]

2.Values

Load Current [A]	Power Factor		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	0.701	0.360	0.311
4.0	0.985	0.923	0.896
8.0	0.995	0.964	0.949
10.0	0.996	0.972	0.958
12.0	0.995	0.977	0.967
16.0	0.998	0.984	0.970
20.0	0.997	0.984	0.976
22.0	0.999	0.984	0.978
--	-	-	-
--	-	-	-
--	-	-	-

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

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Model	PCA600F-32-P2
Item	Inrush Current
Object	————————

Temperature   25℃
Testing Circuitry   Figure A

Input
Current
[20A/div]

Input
Voltage
[100V/div]

Time   [100ms/div]

Input Voltage   100 V
Frequency   50 Hz
Load   100 %

Primary inrush current :
                15.9A
Secondary inrush current :
                18.0A

Input
Current
[20A/div]

Input
Voltage
[200V/div]

Time   [100ms/div]

Input Voltage   230 V
Frequency   50 Hz
Load   100 %

Primary inrush current :
                37.7A
Secondary inrush current :
                16.1A

Primary inrush current   Secondary inrush current

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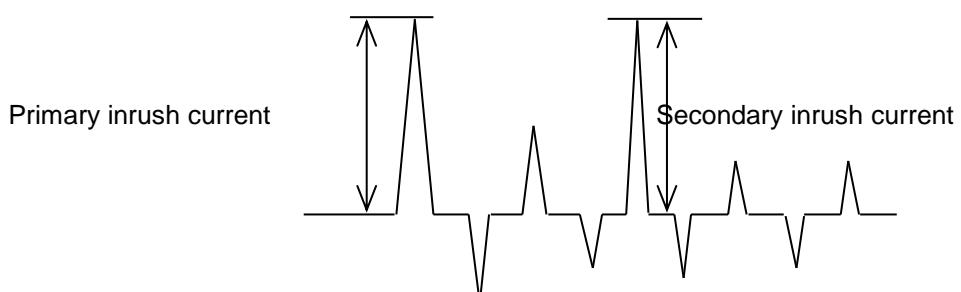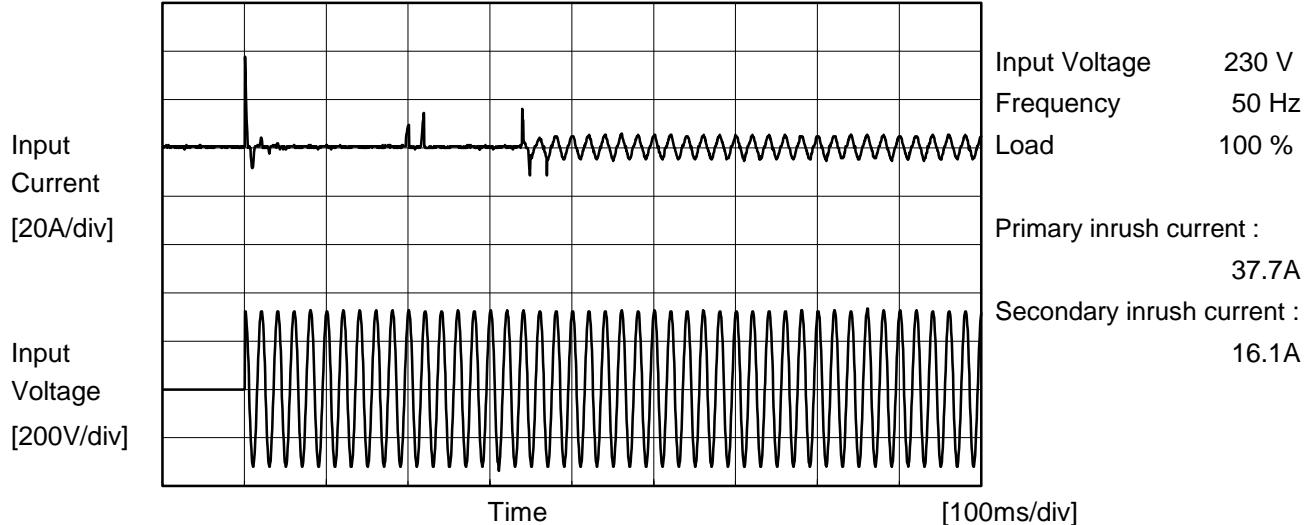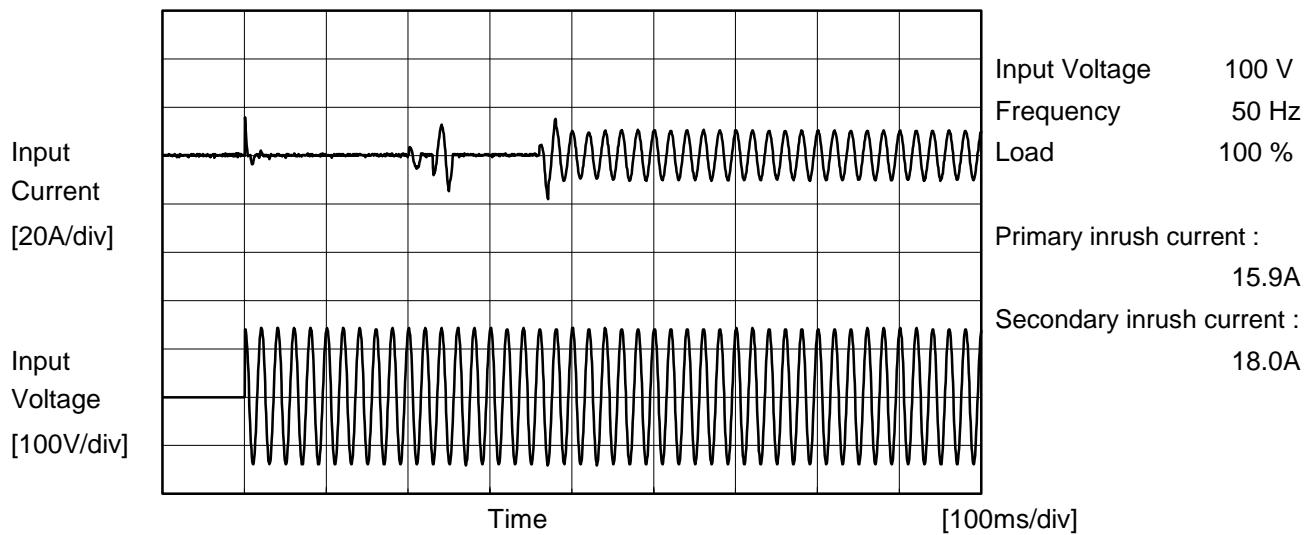
Model	PCA600F-32-P2
Item	Leakage Current
Object	

Temperature 25°C
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-32-P2
Item	Line Regulation
Object	+32V20A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

- - -⊟- - - Load 50%
——△—— Load 100%

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	32.123	32.119
85	32.123	32.119
100	32.123	32.118
120	32.123	32.117
200	32.122	32.116
230	32.125	32.119
264	32.126	32.118
280	32.126	32.116
--	-	-

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Model	PCA600F-32-P2
Item	Load Regulation
Object	+32V20A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

———△——— Input Volt. 100V
– – –⊟– – – Input Volt. 200V
—·—◯—·— Input Volt. 230V

Output Voltage [V] vs Load Current [A]

2.Values

Load Current [A]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.0	32.129	32.131	32.130
4.0	32.130	32.132	32.130
8.0	32.128	32.130	32.129
10.0	32.126	32.128	32.128
12.0	32.125	32.126	32.128
16.0	32.123	32.124	32.124
20.0	32.121	32.122	32.122
22.0	32.119	32.120	32.120
--	-	-	-
--	-	-	-
--	-	-	-

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

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Model	PCA600F-32-P2
Item	Dynamic Load Response
Object	+32V20A

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% (20A)

1 V/div

2 ms/div   10 ms/div
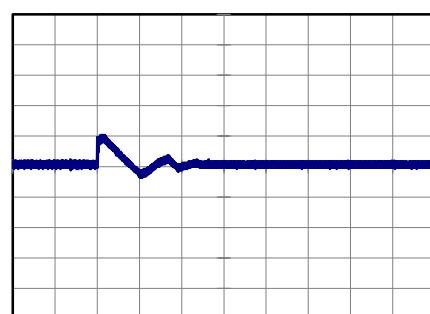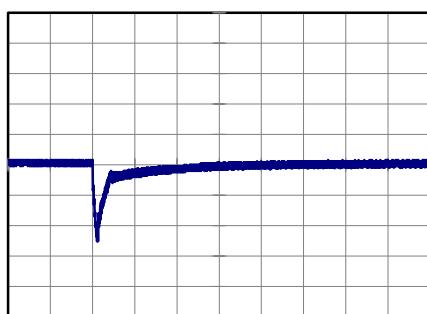
Min.Load (0A)←→
  Load 50% (10A)

1 V/div

2 ms/div   10 ms/div

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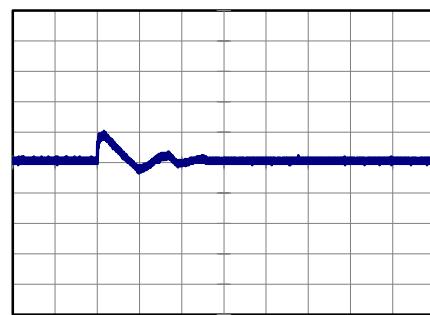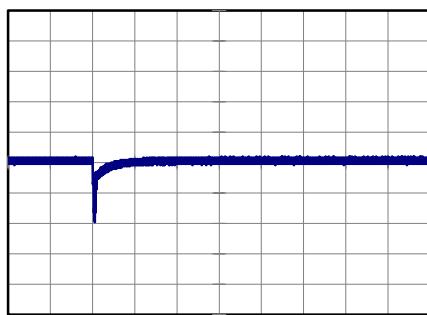
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Model	PCA600F-32-P2
Item	Ripple Voltage (by Load Current)
Object	+32V20A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

———△——— Input Volt. 100V

—·—○—·— Input Volt. 230V

Ripple Voltage [mV] vs Load Current [A]
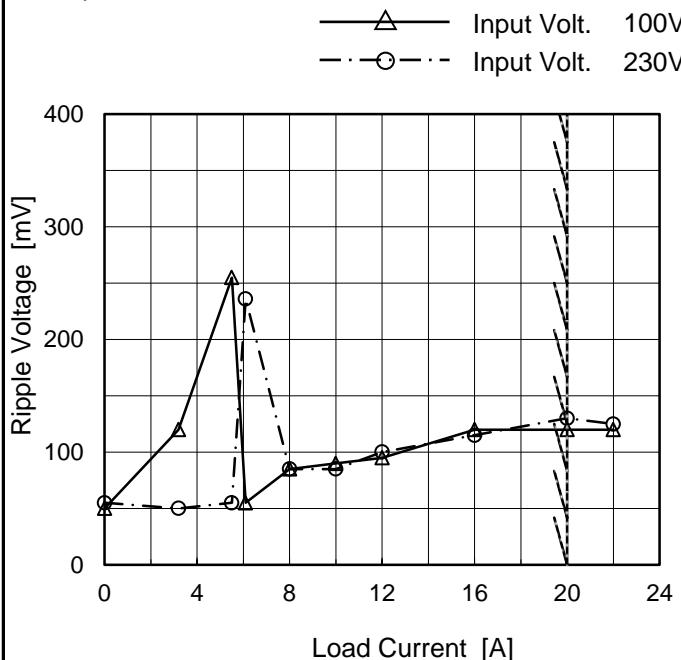
2.Values

Load Current [A]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
0.0	50	55
3.2	120	50
5.5	255	55
6.1	55	236
8.0	85	85
10.0	90	85
12.0	95	100
16.0	120	115
20.0	120	130
22.0	120	125
--	-	-

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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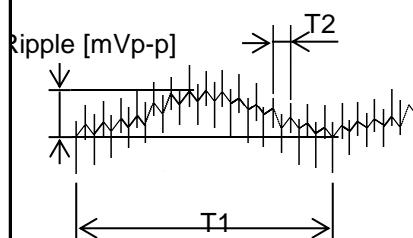
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Model	PCA600F-32-P2
Item	Ripple-Noise
Object	+32V20A

Temperature　　25°C
Testing Circuitry　Figure A

1.Graph

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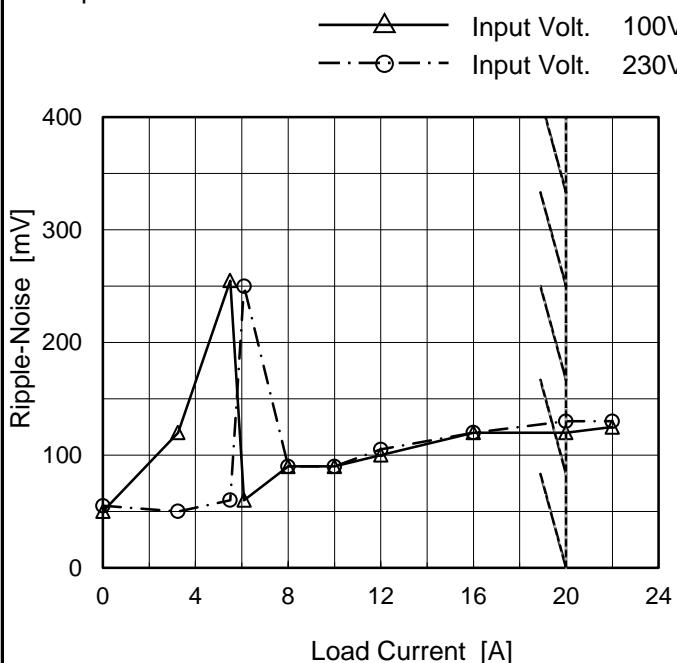
Load Current [A]

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.

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

T2　Ripple-Noise
　　 [mVp-p]

T1

Fig. Complex Ripple Wave Form

2.Values

Load Current [A]	Ripple-Noise [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
0.0	50	55
3.2	120	50
5.5	255	60
6.1	90	250
8.0	90	90
10.0	100	90
12.0	120	105
16.0	120	120
20.0	125	130
22.0	125	130
--	-	-

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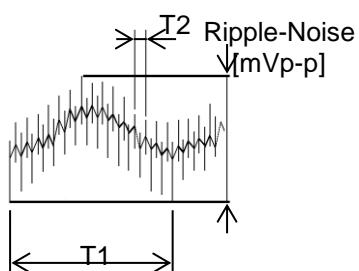
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Model	PCA600F-32-P2
Item	Ripple Voltage (by Ambient Temp.)
Object	+32V20A

Testing Circuitry   Figure A

1.Graph

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


Ambient Temperature [°C]

Load   100 %
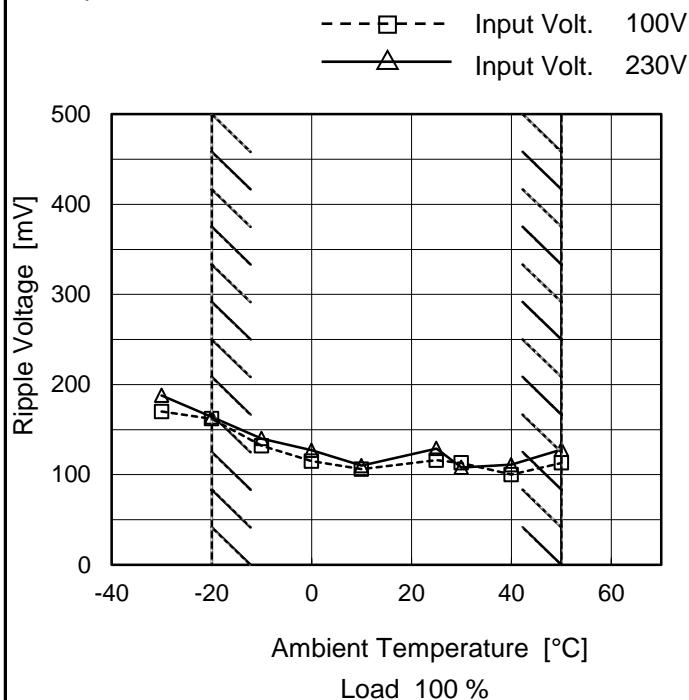
Measured by 20 MHz Oscilloscope.
Note: Slanted line shows the range of the rated
        ambient temperature.

2.Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 100 [V]	Input Volt. 230 [V]
-30	170	190
-20	160	165
-10	130	140
0	115	130
10	110	110
25	120	130
30	115	110
40	100	110
50	115	130
--	-	-
--	-	-

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Model	PCA600F-32-P2
Item	Ambient Temperature Drift
Object	+32V20A

Testing Circuitry   Figure A

1.Graph

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

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

Load 100%

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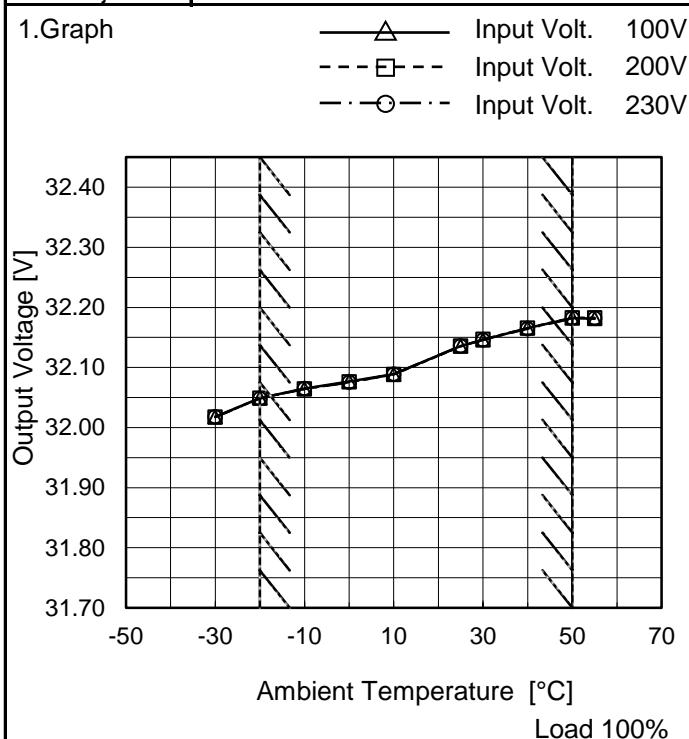
2.Values

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
-30	32.018	32.017	32.018
-20	32.049	32.049	32.048
-10	32.065	32.064	32.065
0	32.077	32.076	32.075
10	32.089	32.088	32.089
25	32.136	32.135	32.136
30	32.146	32.147	32.146
40	32.166	32.166	32.165
50	32.182	32.183	32.182
55	32.181	32.183	32.182
--	-	-	-

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Model	PCA600F-32-P2
Item	Output Voltage Accuracy
Object	+32V20A

Testing Circuitry   Figure A

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　-　20A

 * 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	264	0	32.190	±95	±0.3
Minimum Voltage	-20	264	20	32.000		

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Model	PCA600F-32-P2
Item	Time Lapse Drift
Object	+32V20A

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

Output Voltage [V]

```
32.40
32.30
32.20
32.10
32.00
31.90
31.80
31.70
     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	32.099
0.5	32.111
1.0	32.111
2.0	32.111
3.0	32.111
4.0	32.111
5.0	32.113
6.0	32.113
7.0	32.114
8.0	32.114

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Model	PCA600F-32-P2
Item	Rise and Fall Time
Object	+32V20A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

Load 100% — Input Volt. 100 V

Output Volt. [5V/div]

0

Load 100% — Input Volt. 230 V

Output Volt. [5V/div]

0

Input Volt. 0

Time [100ms/div]

Time [10ms/div]
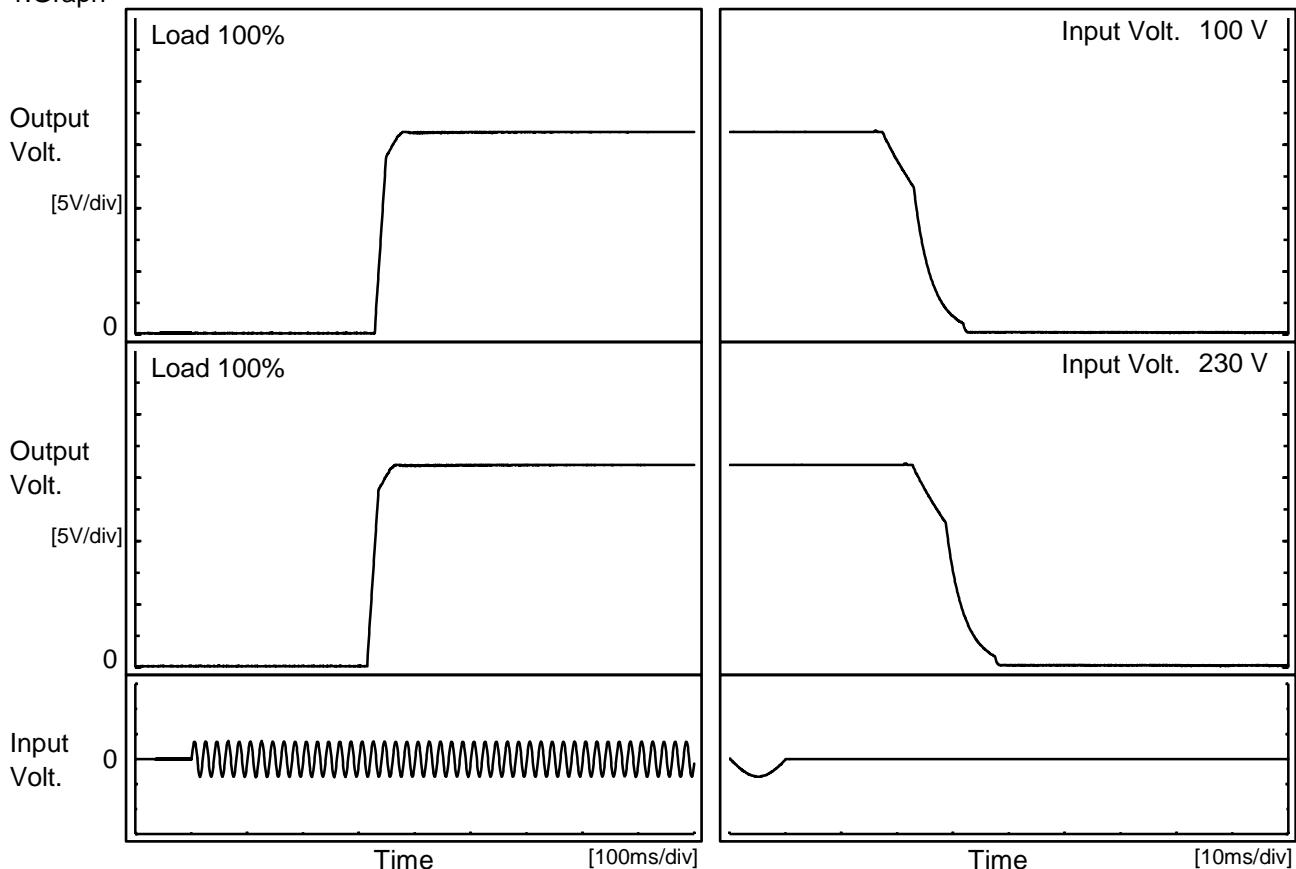
2.Values

[ms]

Input Volt. Time	Td	Tr	Ts	Th	Tf
100 V	330.5	24.5	355.0	19.1	10.4
230 V	317.0	24.5	341.5	24.5	10.7
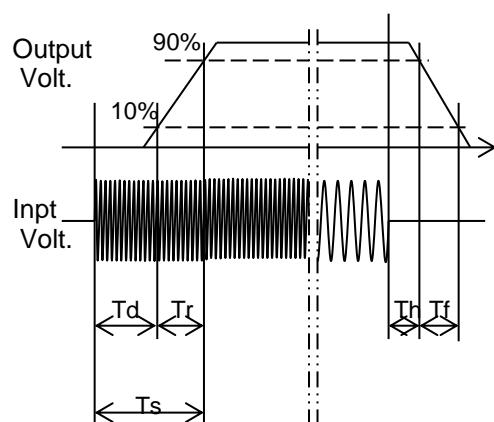
Output Volt.
90%
10%

Inpt Volt.

Td Tr Th Tf

Ts

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Model	PCA600F-32-P2
Item	Hold-Up Time
Object	+32V20A

Temperature   25°C
Testing Circuitry   Figure A

1.Graph
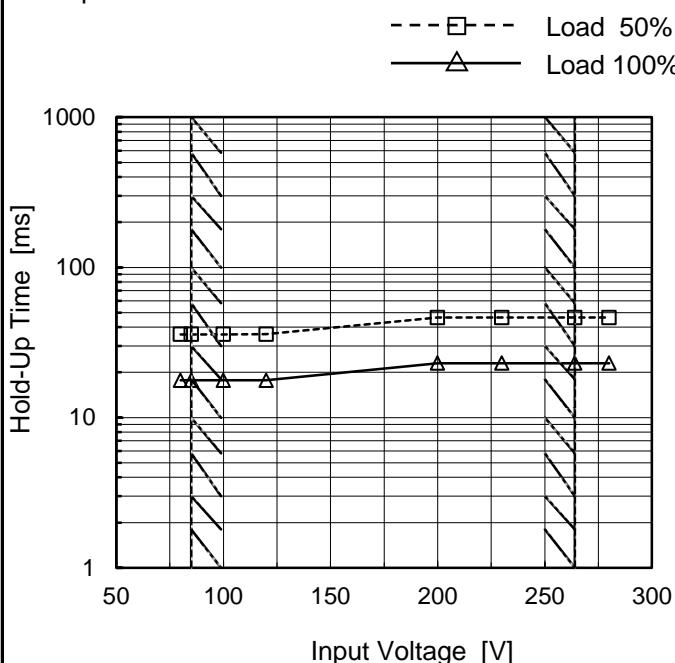
2.Values

Input Voltage [V]	Hold-Up Time [ms]	
	Load 50%	Load 100%
80	36	18
85	36	18
100	36	18
120	36	18
200	46	23
230	46	23
264	46	23
280	46	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-32-P2
Item	Instantaneous Interruption Compensation
Object	+32V20A

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	-	-	-
4.0	83	110	111
8.0	46	59	59
10.0	37	48	48
12.0	27	34	34
16.0	18	30	30
20.0	15	24	20
22.0	10	17	16
--	-	-	-
--	-	-	-
--	-	-	-

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Model	PCA600F-32-P2
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+32V20A

Testing Circuitry   Figure A

1.Graph

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


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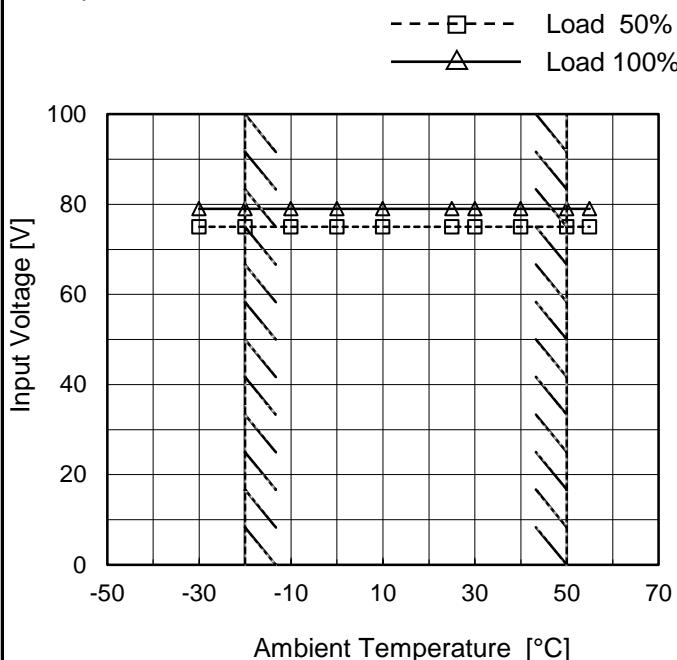
2.Values

Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-30	75	79
-20	75	79
-10	75	79
0	75	79
10	75	79
25	75	79
30	75	79
40	75	79
50	75	79
55	75	79
--	-	-

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Model	PCA600F-32-P2
Item	Overcurrent Protection
Object	+32V20A

Temperature　　　25°C
Testing Circuitry　　Figure A

1.Graph

——————　Input Volt.　100V
——————　Input Volt.　230V

Output Voltage [V] vs Load Current [A]
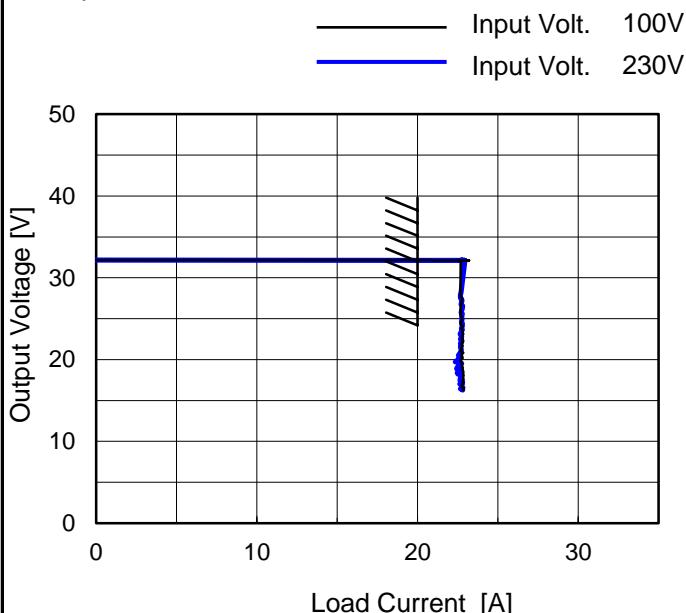
Note: Slanted line shows the range of the rated load current.

Intermittent operation occurs when the output voltage is from 16V to 0V.

2.Values

Output Voltage [V]	Load Current [A]	
	Input Volt. 100[V]	Input Volt. 230[V]
30.4	22.70	22.95
28.8	22.71	22.95
25.6	22.70	22.70
22.4	22.81	22.66
19.2	22.76	22.59
16.1	22.82	22.81
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-

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COSEL

Model	PCA600F-32-P2
Item	Overvoltage Protection
Object	+32V20A

Testing Circuitry   Figure A

1.Graph

—△— Input Volt.   100V

---▯--- Input Volt.   230V

Ambient Temperature [°C]

Load 0%

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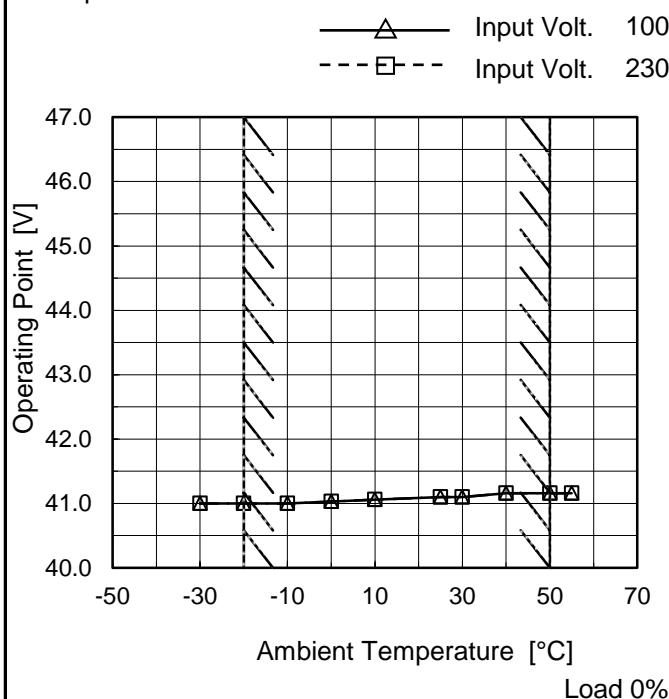
2.Values

Ambient Temperature [°C]	Operating Point [V]	
	Input Volt. 100[V]	Input Volt. 230[V]
-30	41.00	41.00
-20	41.00	41.00
-10	41.00	41.00
0	41.03	41.03
10	41.06	41.06
25	41.10	41.10
30	41.10	41.10
40	41.16	41.16
50	41.16	41.16
55	41.16	41.16
--	-	-

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Figure A

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

Figure B-1 (DEN-AN)

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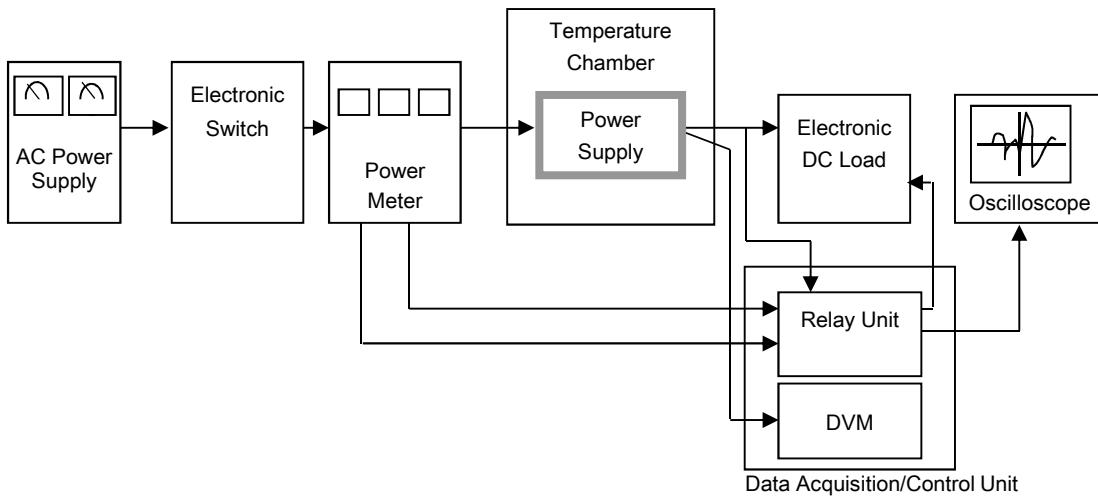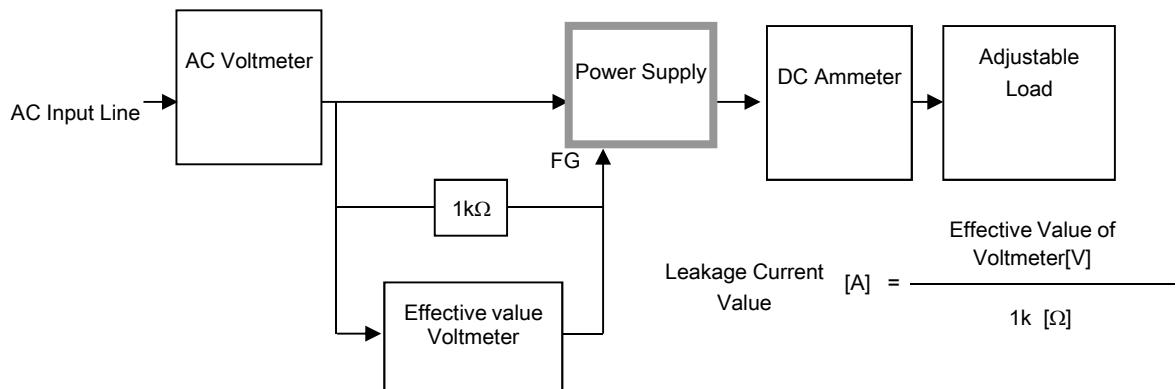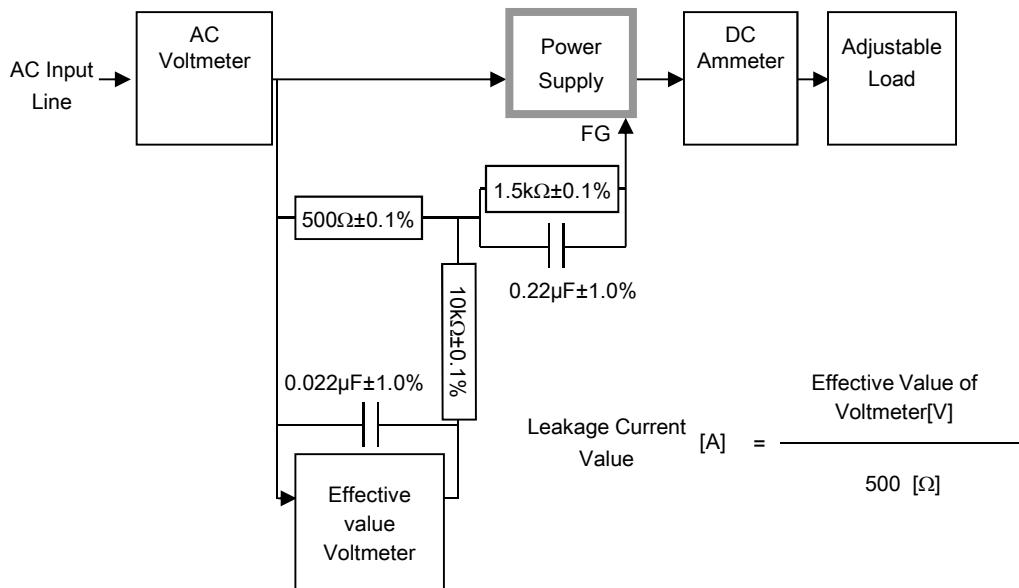
Figure B-2 (IEC62368-1 refer to IEC60990 Fig.4)

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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%

0.022uF±1.0%

20kΩ±0.1% — 6200pF±1.0%

Effective value Voltmeter

Leakage Current Value

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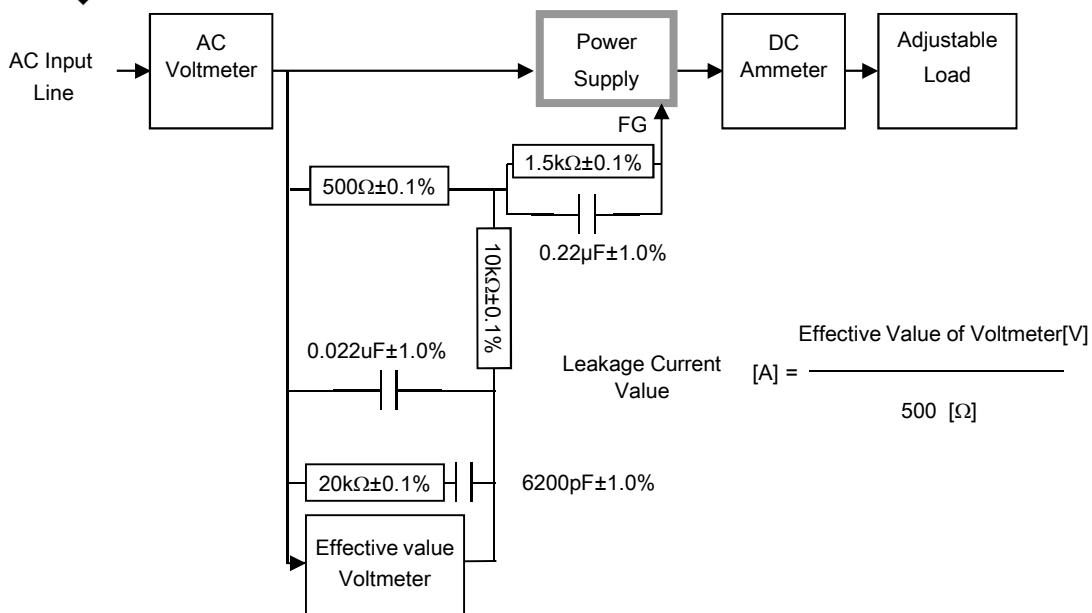
Figure B-3 (IEC62368-1 refer to IEC60990 Fig.5)

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

Leakage Current Value

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

Figure B-4 (IEC60601-1)

Temperature Chamber

AC Power Supply → Power Meter → Power Supply → Measuring board / C1 → Electronic DC Load

Oscilloscope BW:20MHz

150mm

C1 = 22 µF
(Electrolytic capacitor)

Figure C

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