参考資料

# TEST DATA OF LHA15F-24

Regulated DC Power Supply
February 2, 2022

Approved by : Tetsukazu Okamoto
Design Manager

Prepared by : Naofumi Nakada
Design Engineer

COSEL CO.,LTD.

COSEL

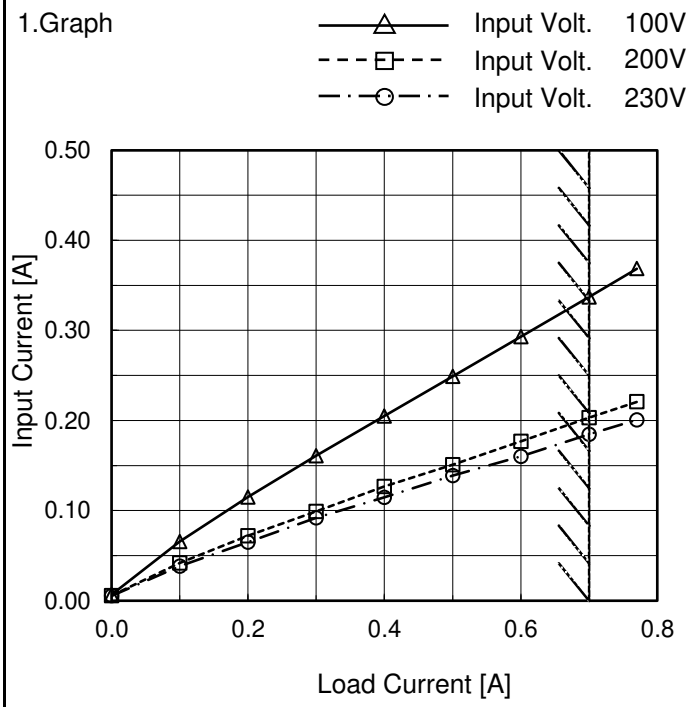
# CONTENTS

COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Input Current (by Load Current) |
| Object | ———————— |

Temperature 25°C
Testing Circuitry Figure A

1.Graph




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] |
| 0.00 | 0.007 | 0.006 | 0.006 |
| 0.10 | 0.066 | 0.042 | 0.038 |
| 0.20 | 0.115 | 0.072 | 0.065 |
| 0.30 | 0.161 | 0.099 | 0.092 |
| 0.40 | 0.205 | 0.127 | 0.115 |
| 0.50 | 0.249 | 0.151 | 0.139 |
| 0.60 | 0.293 | 0.177 | 0.160 |
| 0.70 | 0.337 | 0.203 | 0.185 |
| 0.77 | 0.369 | 0.221 | 0.201 |
| -- | - | - | - |
| -- | - | - | - |



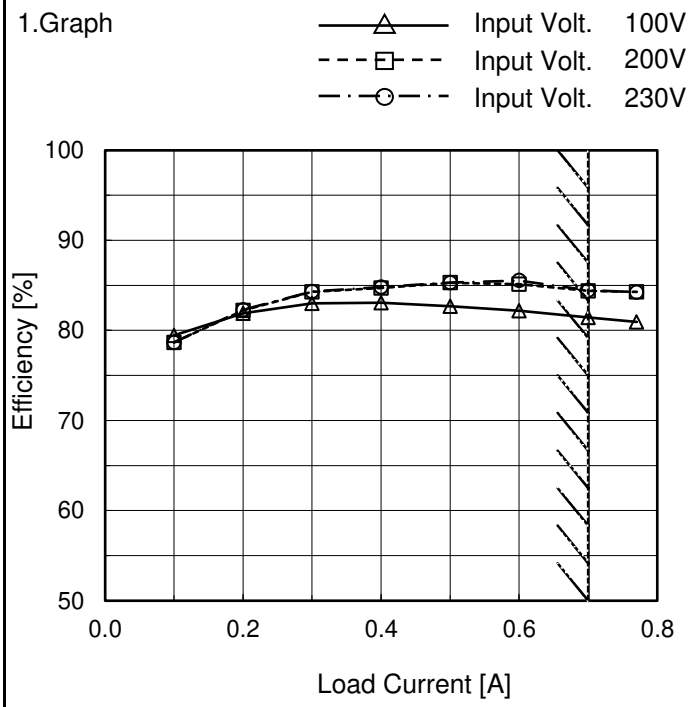
BC-11877

COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Efficiency (by Load Current) |
| Object | ———————— |

Temperature 25°C
Testing Circuitry Figure A

1.Graph




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

2.Values

| Load Current [A] | Efficiency [%] | | |
|---|---|---|---|
| | Input Volt. 100[V] | Input Volt. 200[V] | Input Volt. 230[V] |
| 0.00 | - | - | - |
| 0.10 | 79.5 | 78.7 | 78.7 |
| 0.20 | 81.9 | 82.2 | 82.3 |
| 0.30 | 83.0 | 84.3 | 84.3 |
| 0.40 | 83.1 | 84.7 | 84.8 |
| 0.50 | 82.7 | 85.3 | 85.3 |
| 0.60 | 82.2 | 85.1 | 85.5 |
| 0.70 | 81.5 | 84.4 | 84.5 |
| 0.77 | 80.9 | 84.3 | 84.3 |
| -- | - | - | - |
| -- | - | - | - |



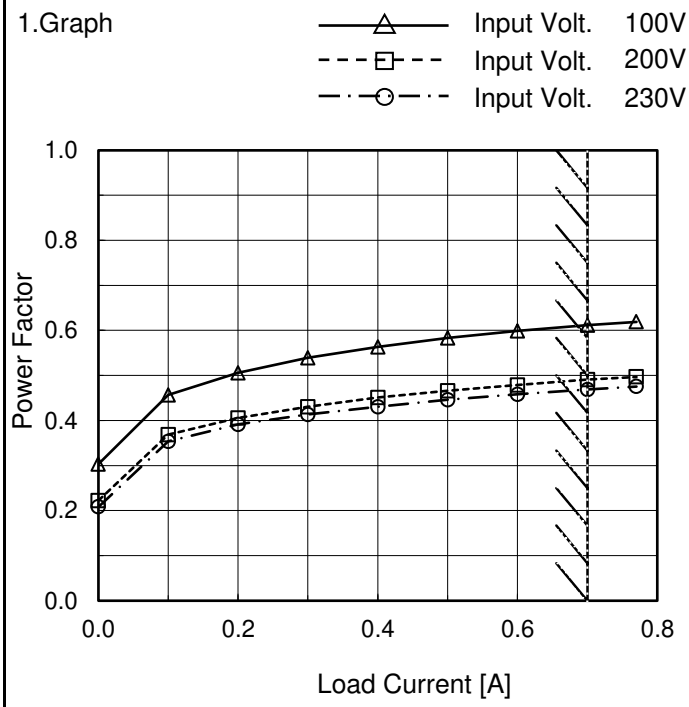
BC-11877

COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Power Factor (by Load Current) |
| Object | ———————— |

Temperature 25°C
Testing Circuitry Figure A

1.Graph




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

2.Values

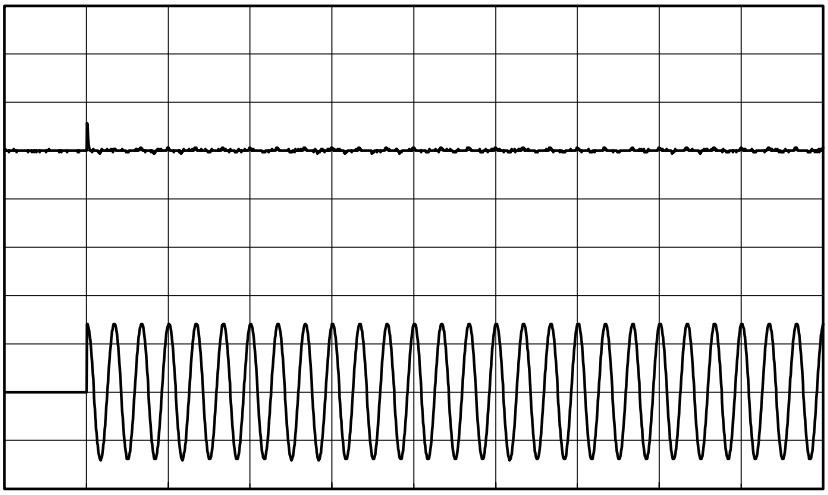
| Load Current [A] | Power Factor | | |
|---|---|---|---|
| | Input Volt. 100[V] | Input Volt. 200[V] | Input Volt. 230[V] |
| 0.00 | 0.303 | 0.222 | 0.209 |
| 0.10 | 0.457 | 0.368 | 0.353 |
| 0.20 | 0.505 | 0.406 | 0.391 |
| 0.30 | 0.539 | 0.431 | 0.414 |
| 0.40 | 0.564 | 0.451 | 0.431 |
| 0.50 | 0.583 | 0.466 | 0.446 |
| 0.60 | 0.599 | 0.479 | 0.458 |
| 0.70 | 0.612 | 0.491 | 0.469 |
| 0.77 | 0.619 | 0.497 | 0.476 |
| -- | - | - | - |
| -- | - | - | - |



BC-11877

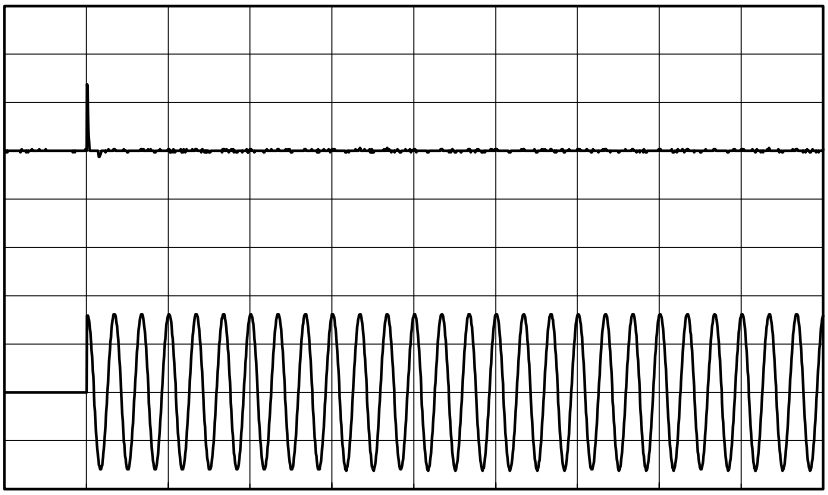
COSEL

| | | |
|---|---|---|
| Model | LHA15F-24 | |
| Item | Inrush Current | Temperature 25° C<br>Testing Circuitry Figure A |
| Object | ———————— | |



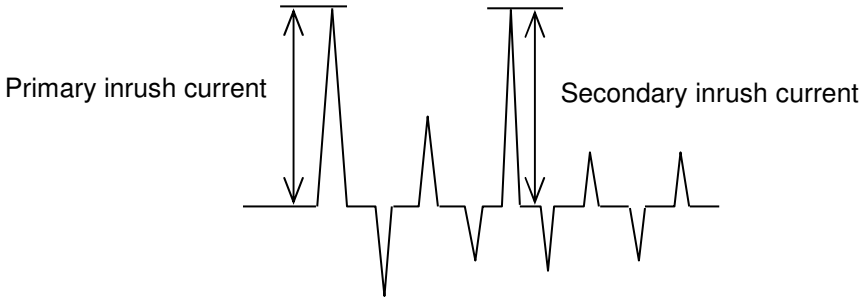

Input Voltage 100 V
Frequency 60 Hz
Load 100 %

Primary inrush current :
11.4 A
Secondary inrush current :
1.2 A




Input Voltage 230 V
Frequency 60 Hz
Load 100 %

Primary inrush current :
27.6 A
Secondary inrush current :
1.2 A



COSEL

| | | |
|---|---|---|
| Model | LHA15F-24 | |
| Item | Leakage Current | Temperature 25°C<br>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 | 0.02 | 0.05 | 0.05 | Operation |
| | | One of phases | 0.03 | 0.07 | 0.07 | Stand by |
| IEC62368-1 | Figure B-2 | Both phases | 0.02 | 0.05 | 0.05 | Operation |
| | | One of phases | 0.03 | 0.07 | 0.07 | Stand by |
| | Figure B-3 | Both phases | 0.02 | 0.05 | 0.05 | Operation |
| | | One of phases | 0.03 | 0.07 | 0.07 | Stand by |

The value for "One of phases" is the reference value only.

2.Condition

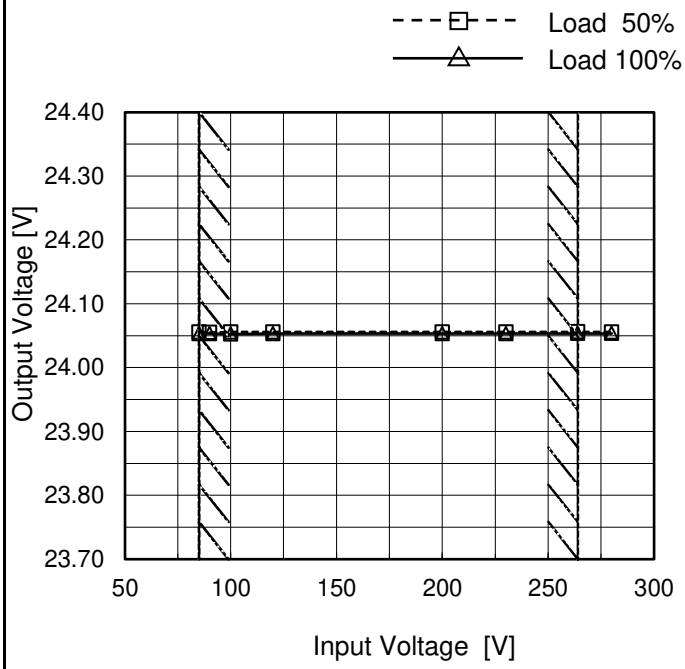
Leakage current value is concluded after measuring both phases of AC input and by choosing the larger one.

COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Line Regulation |
| Object | +24V0.7A |

Temperature 25°C
Testing Circuitry Figure A

1.Graph




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

2.Values

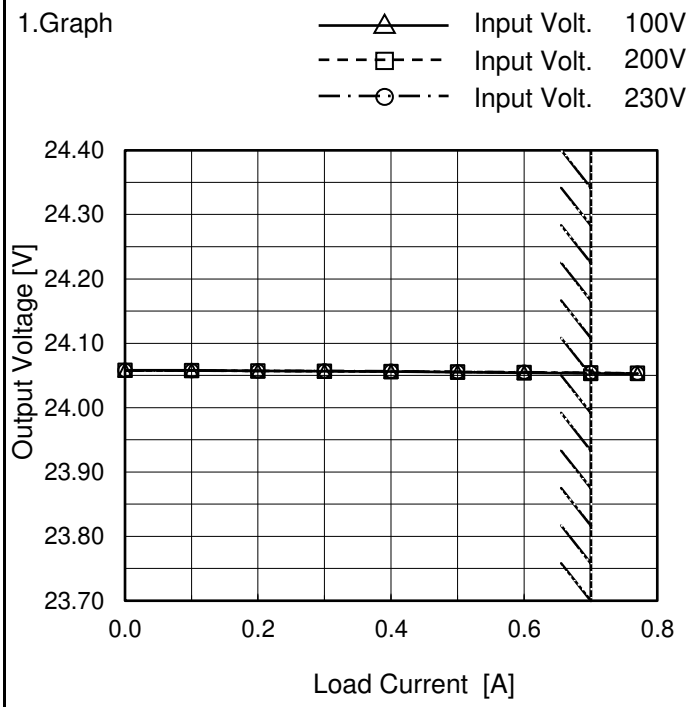
| Input Voltage [V] | Output Voltage [V] | |
|---|---|---|
| | Load 50% | Load 100% |
| 85 | 24.056 | 24.053 |
| 90 | 24.055 | 24.053 |
| 100 | 24.056 | 24.053 |
| 120 | 24.056 | 24.053 |
| 200 | 24.056 | 24.053 |
| 230 | 24.056 | 24.053 |
| 264 | 24.056 | 24.054 |
| 280 | 24.056 | 24.054 |
| -- | - | - |

COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Load Regulation |
| Object | +24V0.7A |

Temperature 25°C
Testing Circuitry Figure A

1.Graph




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

2.Values

| Load Current [A] | Output Voltage [V] | | |
|---|---|---|---|
| | Input Volt. 100[V] | Input Volt. 200[V] | Input Volt. 230[V] |
| 0.00 | 24.058 | 24.058 | 24.058 |
| 0.10 | 24.058 | 24.058 | 24.058 |
| 0.20 | 24.057 | 24.057 | 24.057 |
| 0.30 | 24.056 | 24.057 | 24.057 |
| 0.40 | 24.056 | 24.056 | 24.056 |
| 0.50 | 24.055 | 24.055 | 24.055 |
| 0.60 | 24.054 | 24.054 | 24.055 |
| 0.70 | 24.053 | 24.054 | 24.054 |
| 0.77 | 24.053 | 24.053 | 24.053 |
| -- | - | - | - |
| -- | - | - | - |

COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Dynamic Load Response |
| Object | +24V0.7A |

Temperature 25°C
Testing Circuitry Figure A

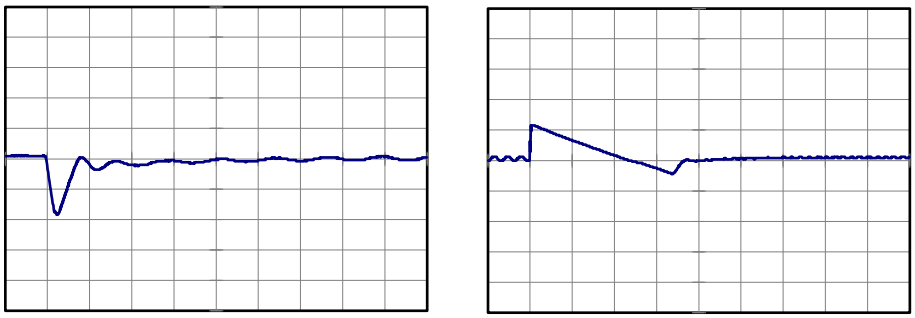
Input Volt. 230 V
Cycle 1000 ms

t1,t2 = 50 μs

Load Current

t1 t2

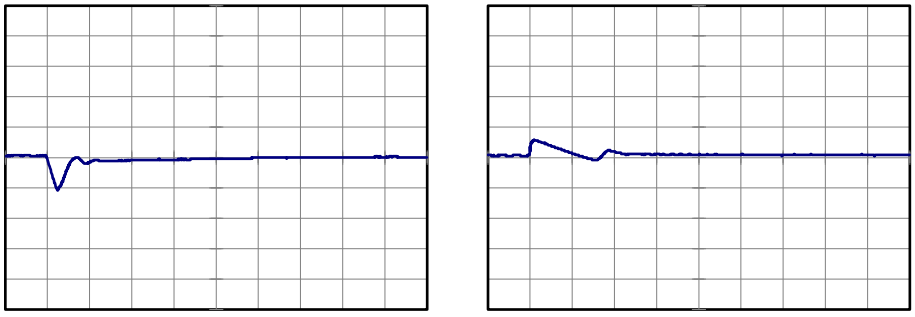
Min.Load (0A)←→
Load 100% (0.7A)



200 mV/div

1 ms/div 4 ms/div

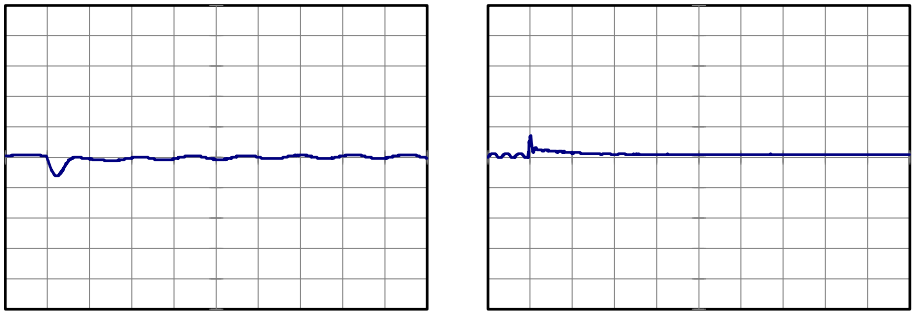
Min.Load (0A)←→
Load 50% (0.35A)



200 mV/div

1 ms/div 4 ms/div

Load 50% (0.35A)←→
Load 100% (0.7A)



200 mV/div

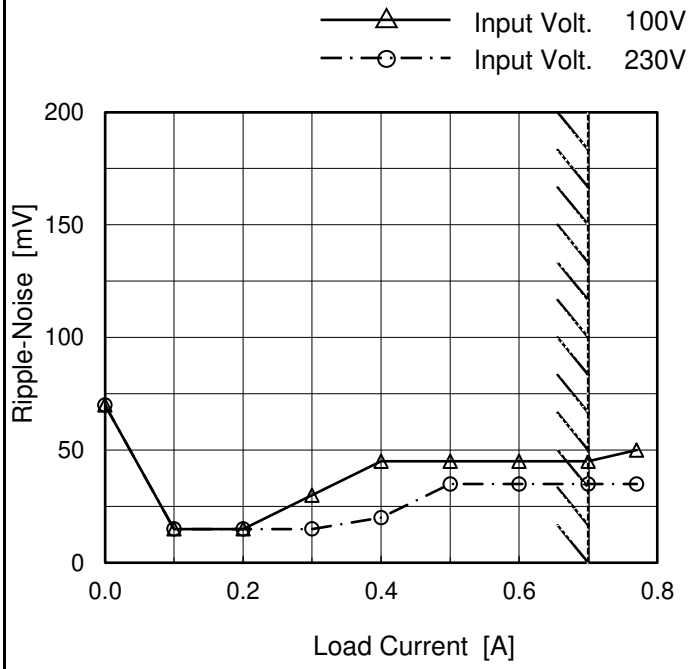
1 ms/div 4 ms/div

COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Ripple-Noise(by Load Current) |
| Object | +24V0.7A |

Temperature 25°C
Testing Circuitry Figure C

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.

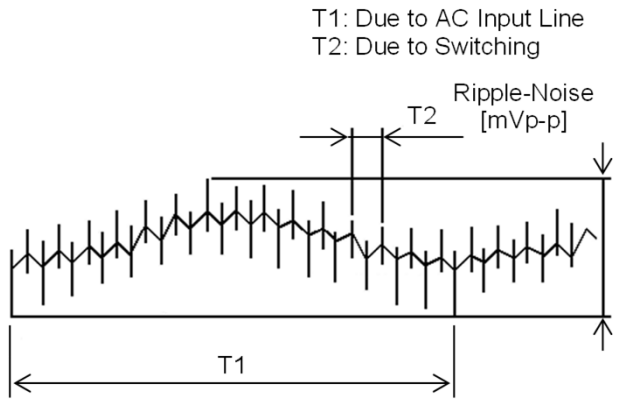



Fig. Complex Ripple Wave Form

2.Values

| Load Current [A] | Ripple-Noise [mV] | |
|---|---|---|
| | Input Volt. 100 [V] | Input Volt. 230 [V] |
| 0.00 | 70 | 70 |
| 0.10 | 15 | 15 |
| 0.20 | 15 | 15 |
| 0.30 | 30 | 15 |
| 0.40 | 45 | 20 |
| 0.50 | 45 | 35 |
| 0.60 | 45 | 35 |
| 0.70 | 45 | 35 |
| 0.77 | 50 | 35 |
| -- | - | - |
| -- | - | - |



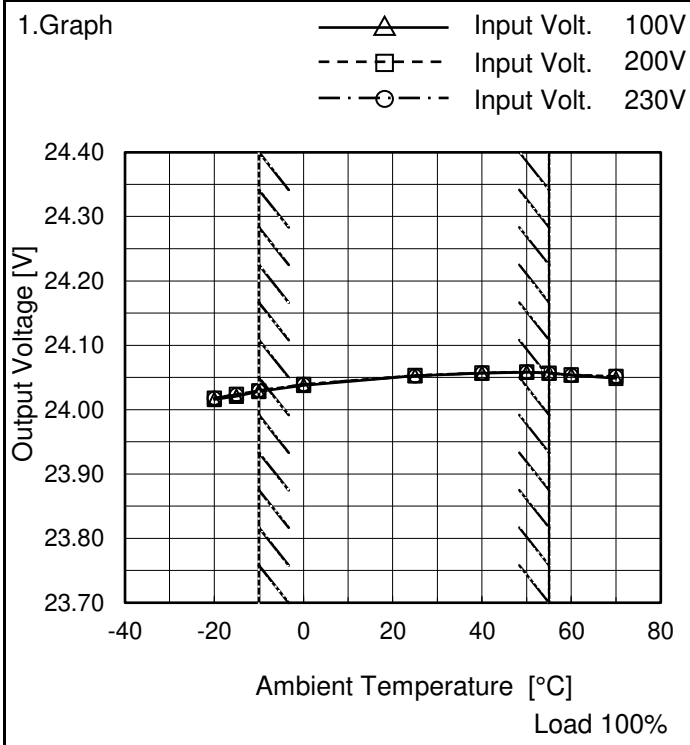
BC-11877

COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Ambient Temperature Drift |
| Object | +24V0.7A |

Testing Circuitry Figure A

1.Graph




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

2.Values

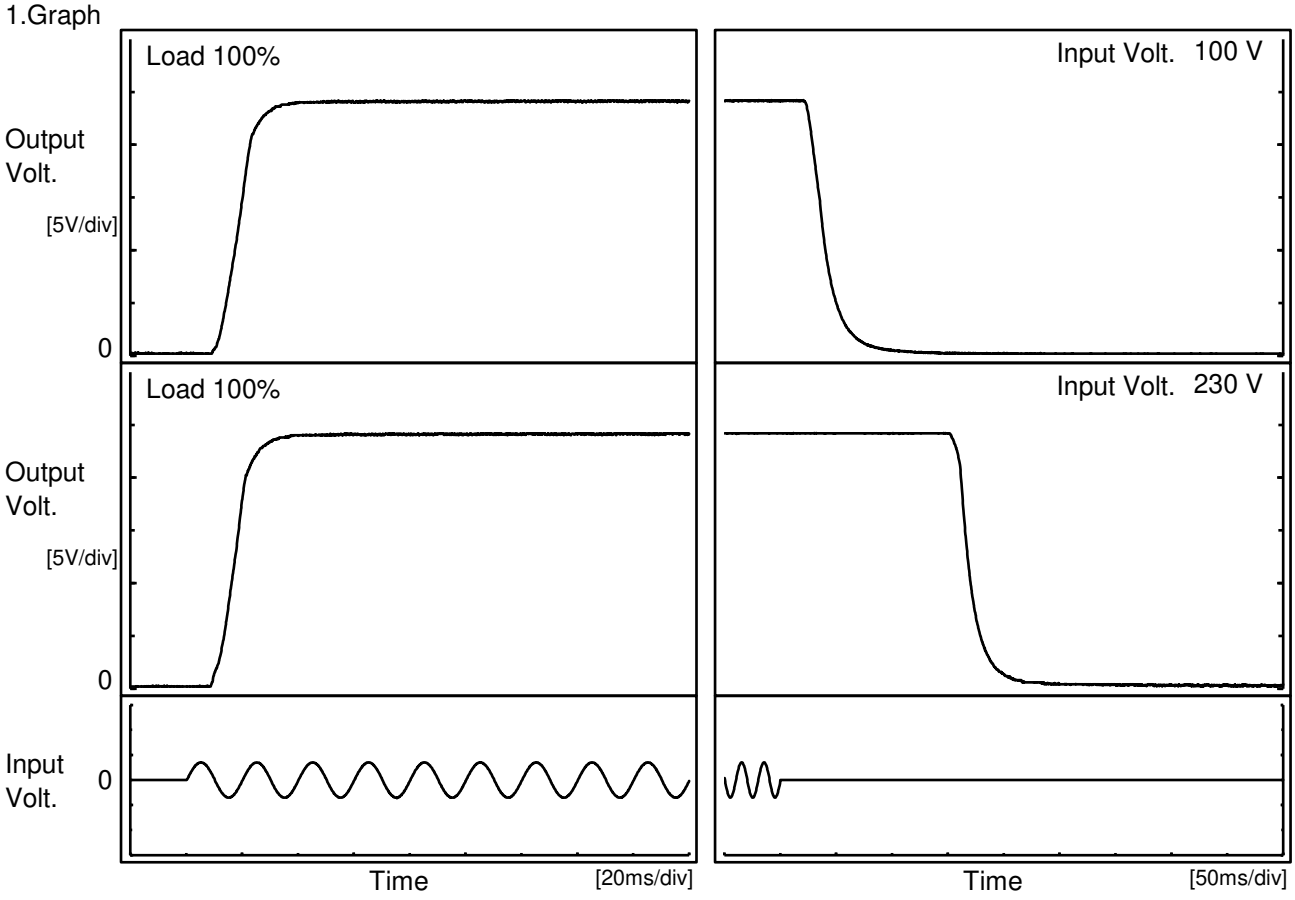
| Ambient Temperature [°C] | Output Voltage [V] | | |
|---|---|---|---|
| | Input Volt. 100[V] | Input Volt. 200[V] | Input Volt. 230[V] |
| -20 | 24.016 | 24.018 | 24.018 |
| -15 | 24.021 | 24.024 | 24.023 |
| -10 | 24.028 | 24.029 | 24.029 |
| 0 | 24.038 | 24.039 | 24.039 |
| 25 | 24.053 | 24.053 | 24.053 |
| 40 | 24.056 | 24.057 | 24.057 |
| 50 | 24.058 | 24.059 | 24.058 |
| 55 | 24.057 | 24.057 | 24.057 |
| 60 | 24.054 | 24.054 | 24.054 |
| 70 | 24.049 | 24.052 | 24.051 |
| -- | - | - | - |

COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Rise and Fall Time |
| Object | +24V0.7A |

Temperature 25°C
Testing Circuitry Figure A

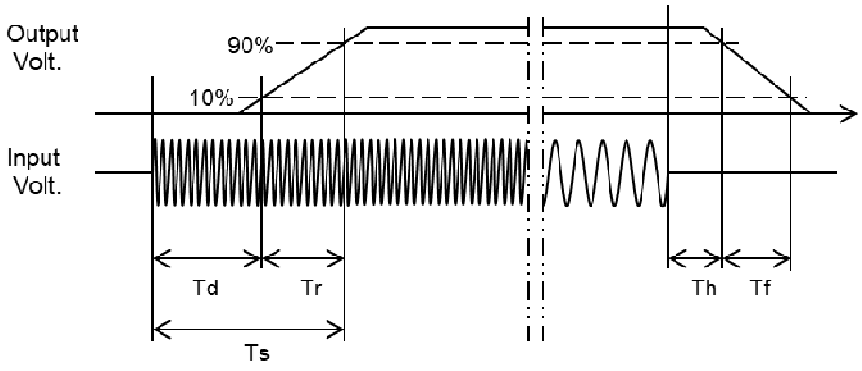
1.Graph




2.Values

[ms]

| Input Volt. \ Time | Td | Tr | Ts | Th | Tf |
|---|---|---|---|---|---|
| 100 V | 12.7 | 12.8 | 25.5 | 24.8 | 27.3 |
| 230 V | 11.8 | 12.6 | 24.4 | 159.5 | 28.3 |

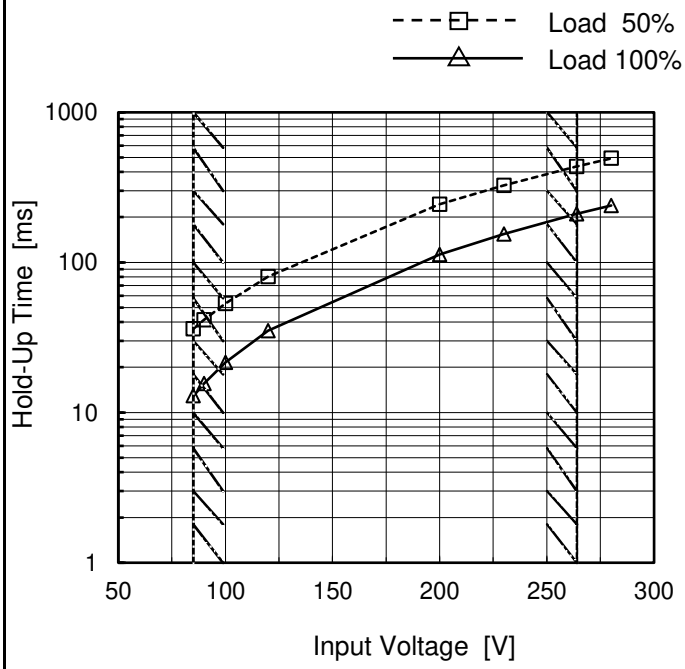


COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Hold-Up Time |
| Object | +24V0.7A |

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% |
| 85 | 36 | 13 |
| 90 | 42 | 16 |
| 100 | 53 | 22 |
| 120 | 81 | 35 |
| 200 | 244 | 113 |
| 230 | 326 | 155 |
| 264 | 435 | 211 |
| 280 | 494 | 239 |
| -- | - | - |



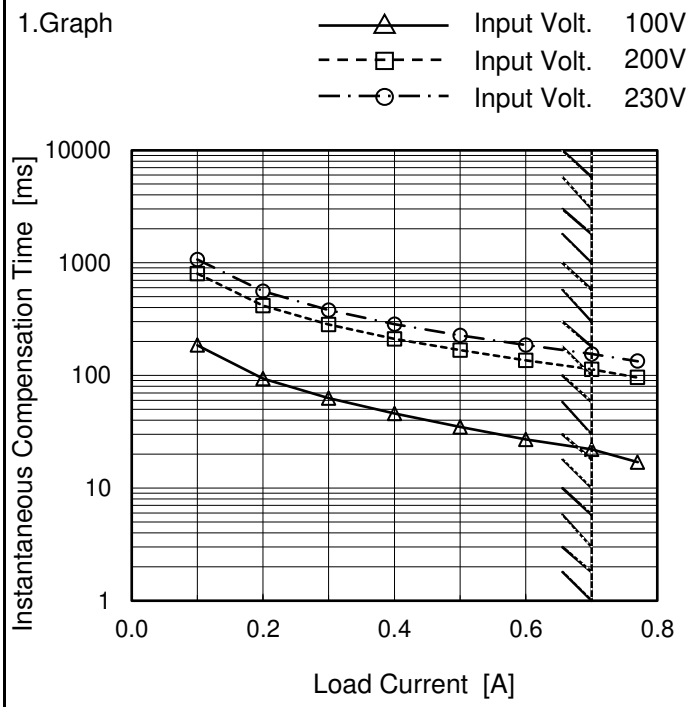
BC-11877

COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Instantaneous Interruption Compensation |
| Object | +24V0.7A |

Temperature 25°C
Testing Circuitry Figure A

1.Graph




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

2.Values

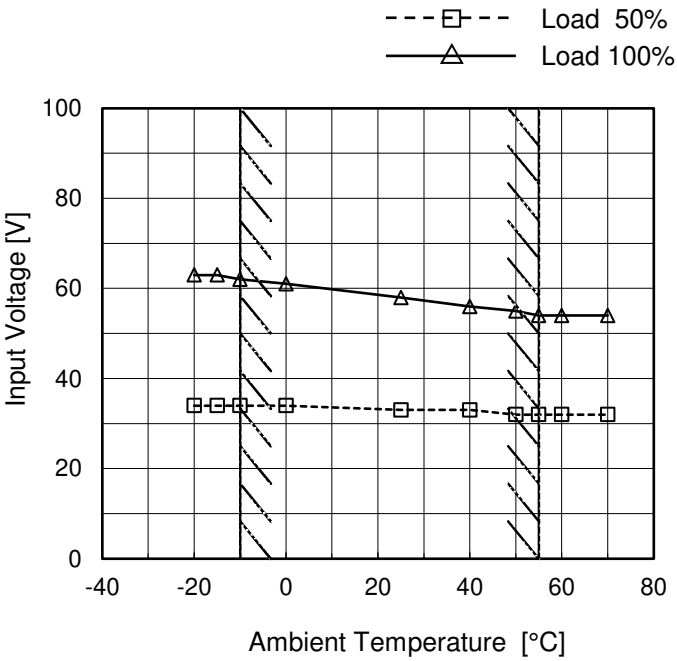
| Load Current [A] | Time [ms] | | |
|---|---|---|---|
| | Input Volt. 100[V] | Input Volt. 200[V] | Input Volt. 230[V] |
| 0.00 | - | - | - |
| 0.10 | 186 | 804 | 1072 |
| 0.20 | 94 | 418 | 560 |
| 0.30 | 63 | 284 | 381 |
| 0.40 | 46 | 211 | 285 |
| 0.50 | 35 | 168 | 227 |
| 0.60 | 27 | 136 | 186 |
| 0.70 | 22 | 113 | 155 |
| 0.77 | 17 | 96 | 134 |
| -- | - | - | - |
| -- | - | - | - |

COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Minimum Input Voltage for Regulated Output Voltage |
| Object | +24V0.7A |

Testing Circuitry Figure A

1.Graph




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

2.Values

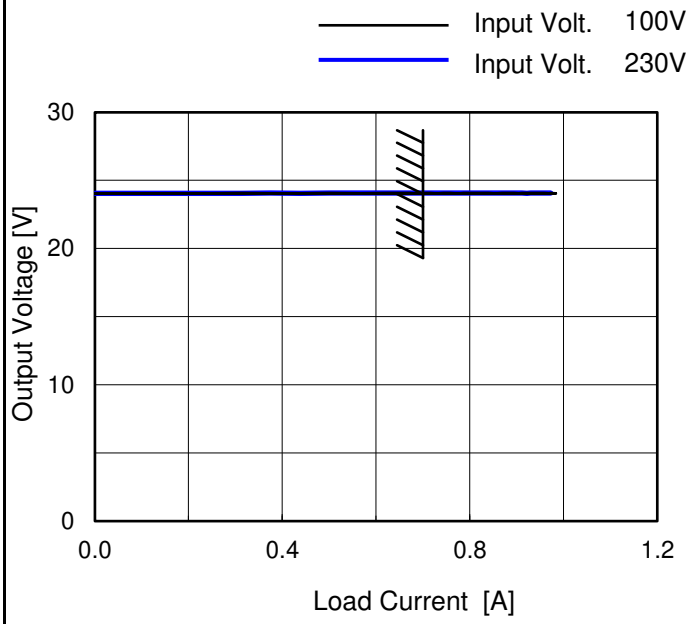
| Ambient Temperature [°C] | Input Voltage [V] | |
|---|---|---|
| | Load 50% | Load 100% |
| -20 | 34 | 63 |
| -15 | 34 | 63 |
| -10 | 34 | 62 |
| 0 | 34 | 61 |
| 25 | 33 | 58 |
| 40 | 33 | 56 |
| 50 | 32 | 55 |
| 55 | 32 | 54 |
| 60 | 32 | 54 |
| 70 | 32 | 54 |
| -- | - | - |

COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Overcurrent Protection |
| Object | +24V0.7A |

Temperature 25°C
Testing Circuitry Figure A

1.Graph




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

Overcurrent protection is Hiccup mode.

2.Values

| Output Voltage [V] | Load Current [A] | |
|---|---|---|
| | Input Volt. 100[V] | Input Volt. 230[V] |
| 24.0 | 0.98 | 0.94 |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |
| - | - | - |



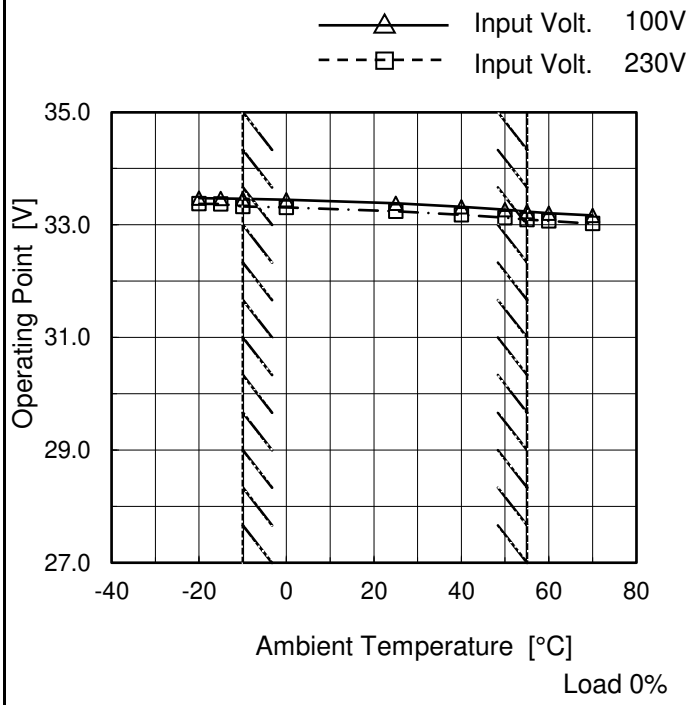
BC-11877

COSEL

| | |
|---|---|
| Model | LHA15F-24 |
| Item | Overvoltage Protection |
| Object | +24V0.7A |

Testing Circuitry Figure A

1.Graph




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] |
| -20 | 33.48 | 33.38 |
| -15 | 33.47 | 33.37 |
| -10 | 33.46 | 33.33 |
| 0 | 33.44 | 33.31 |
| 25 | 33.39 | 33.24 |
| 40 | 33.32 | 33.18 |
| 50 | 33.27 | 33.13 |
| 55 | 33.23 | 33.09 |
| 60 | 33.21 | 33.07 |
| 70 | 33.17 | 33.02 |
| -- | - | - |

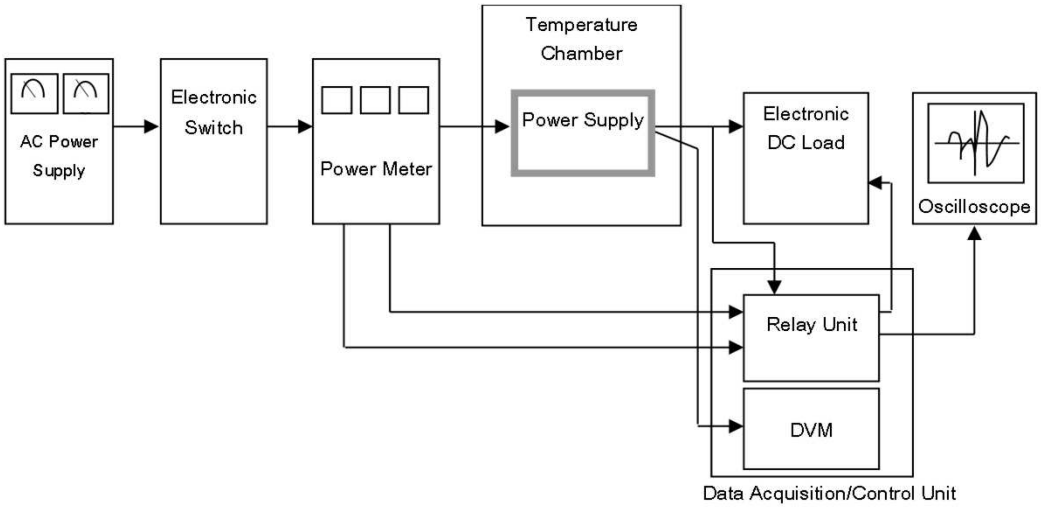



Figure A

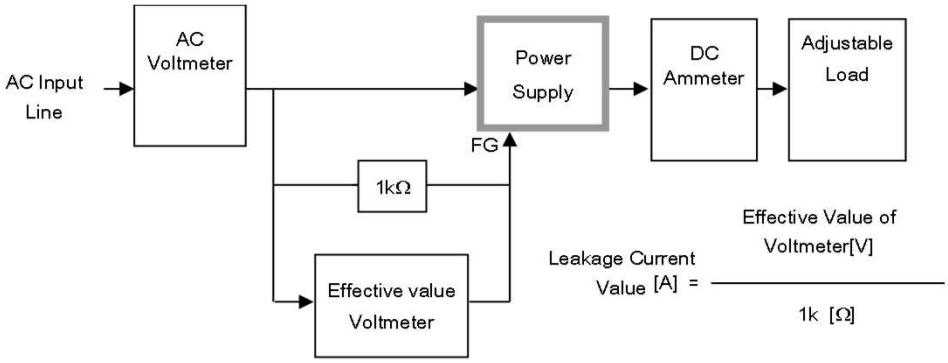



Figure B-1 ( DEN-AN )

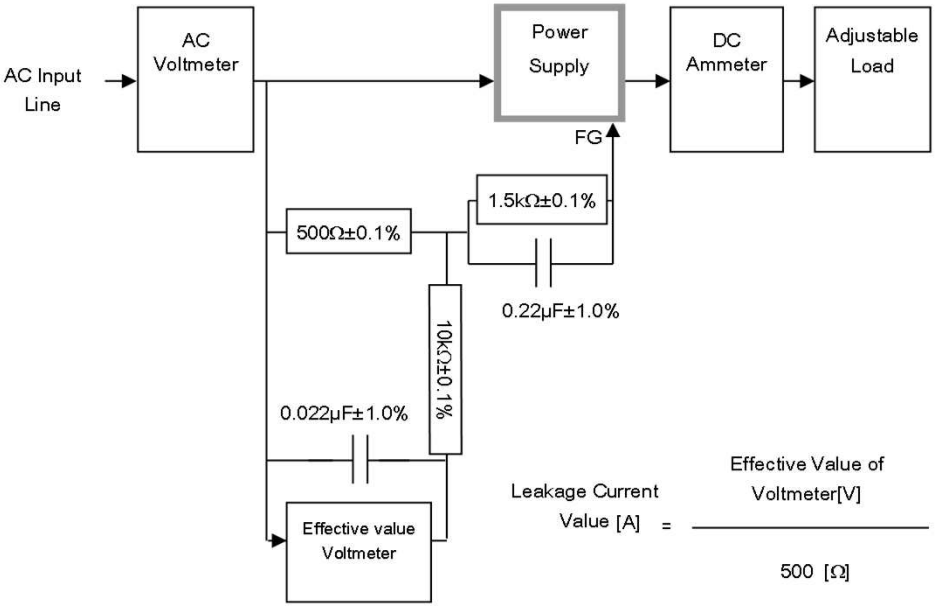



Figure B-2 ( IEC62368-1 refer to IEC60990 Fig.4 )

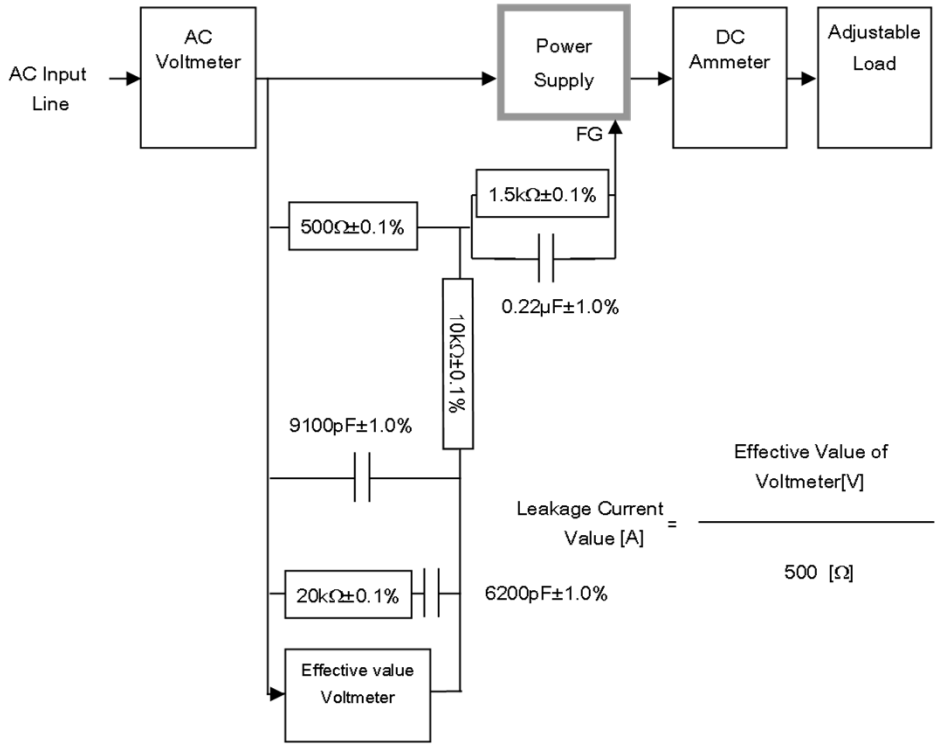
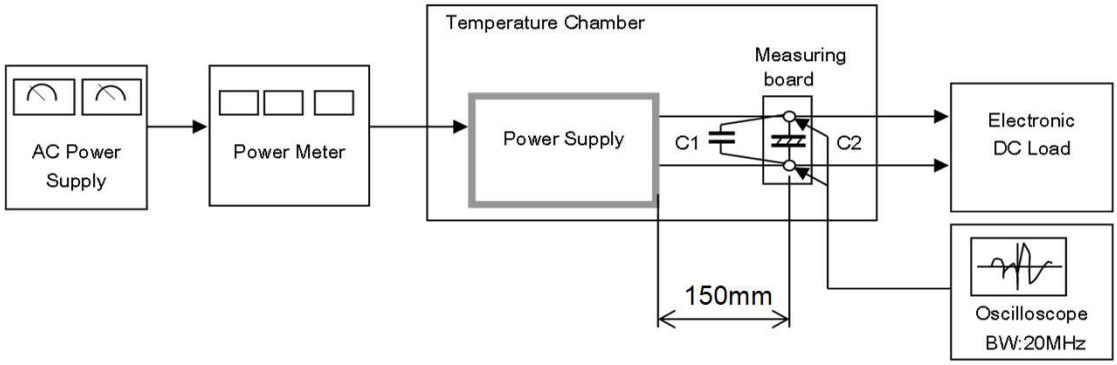



Figure B-3 ( IEC62368-1 refer to IEC60990 Fig.5 )




C1= 0.1 μF
(Ceramic capacitor)

C2= 22 μF
(Electrolytic capacitor)

Figure C