COSEL

TEST DATA OF KHEA30F-5

Regulated DC Power Supply
April 28, 2014

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COSEL CO.,LTD.

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Model	KHEA30F-5
Item	Input Current (by Load Current)
Object	———————

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1.Graph
— △ — Input Volt.   100V
- - -▣- - - Input Volt.   115V
— ·-○— ·- 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. 115[V]	Input Volt. 230[V]
0.00	0.015	0.015	0.020
0.25	0.051	0.048	0.037
0.50	0.079	0.072	0.052
0.75	0.106	0.097	0.067
1.00	0.131	0.119	0.081
1.50	0.180	0.163	0.106
2.00	0.230	0.208	0.132
2.50	0.278	0.251	0.157
4.00	0.424	0.380	0.230
5.00	0.526	0.469	0.280
5.50	0.579	0.516	0.305

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Model	KHEA30F-5
Item	Input Power (by Load Current)
Object	———————

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

————△———— Input Volt.   100V
– – –⊟– – – Input Volt.   115V
—·—⊖—·— Input Volt.   230V

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. 115[V]	Input Volt. 230[V]
0.00	0.42	0.44	0.51
0.25	2.02	2.06	2.42
0.50	3.45	3.47	3.88
0.75	4.94	4.95	5.44
1.00	6.35	6.37	6.96
1.50	9.19	9.18	9.65
2.00	12.15	12.12	12.48
2.50	15.06	14.99	15.24
4.00	24.05	23.84	23.70
5.00	30.24	29.90	29.40
5.50	33.44	33.03	32.30

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Model	KHEA30F-5
Item	Efficiency (by Input Voltage)
Object	
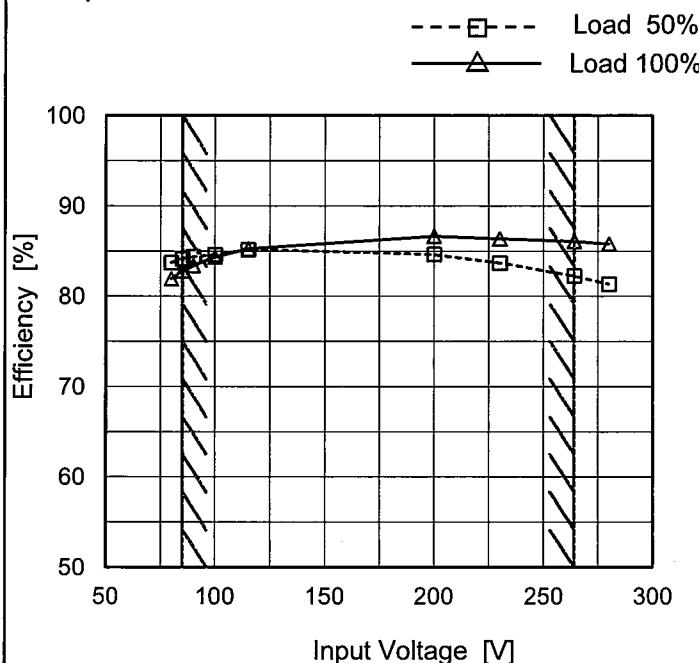
Temperature   25°C
Testing Circuitry   Figure A

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	83.7	81.9
85	84.1	82.8
90	84.4	83.4
100	84.6	84.3
115	85.2	85.3
200	84.6	86.7
230	83.7	86.4
264	82.3	86.1
280	81.4	85.8

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Model	KHEA30F-5
Item	Efficiency (by Load Current)
Object	

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

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

Load Current [A]

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

2.Values

Load Current [A]	Efficiency [%]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
0.00	-	-	-
0.25	62.7	61.6	52.3
0.50	73.3	73.0	65.3
0.75	76.9	76.7	69.8
1.00	79.7	79.5	72.8
1.50	82.7	82.8	78.8
2.00	84.1	84.3	81.9
2.50	84.6	85.2	83.7
4.00	84.6	85.3	85.8
5.00	84.3	85.3	86.4
5.50	83.5	84.6	86.5

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Model	KHEA30F-5
Item	Power Factor (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]	Power Factor	
	Load 50%	Load 100%
80	0.572	0.608
85	0.560	0.594
90	0.550	0.583
100	0.541	0.575
115	0.519	0.554
200	0.435	0.465
230	0.417	0.452
264	0.401	0.430
280	0.394	0.425

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Model	KHEA30F-5
Item	Power Factor (by Load Current)
Object	———————
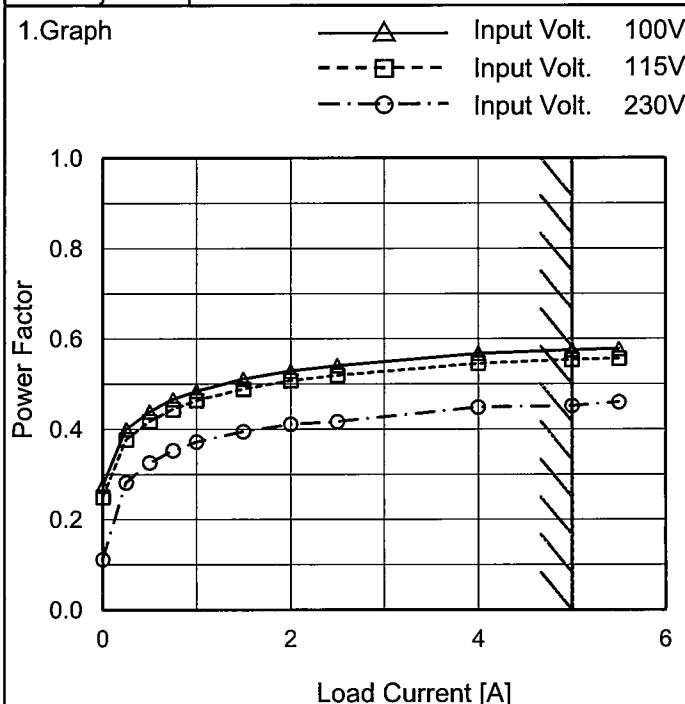
Temperature 25°C
Testing Circuitry Figure A

1.Graph
———△——— Input Volt. 100V
– – –⊟– – – Input Volt. 115V
—·–⊖—·· Input Volt. 230V

Load Current [A]

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

2.Values

Load Current [A]	Power Factor		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
0.00	0.274	0.250	0.112
0.25	0.400	0.377	0.282
0.50	0.439	0.418	0.326
0.75	0.466	0.444	0.353
1.00	0.485	0.464	0.372
1.50	0.511	0.489	0.395
2.00	0.529	0.508	0.411
2.50	0.541	0.519	0.417
4.00	0.568	0.546	0.449
5.00	0.575	0.554	0.452
5.50	0.578	0.556	0.460

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Model	KHEA30F-5
Item	Inrush Current
Object	———————

Temperature   25°C
Testing Circuitry   Figure A

Input
Current
[20A/div]

Input
Voltage
[100V/div]

Time   [50ms/div]

Input Voltage   115 V
Frequency   60 Hz
Load   100 %

Primary inrush current :
                              17.0 A

Secondary inrush current :
                              1.6 A

Input
Current
[20A/div]

Input
Voltage
[200V/div]

Time   [50ms/div]

Input Voltage   230 V
Frequency   60 Hz
Load   100 %

Primary inrush current :
                              36.7 A

Secondary inrush current :
                              1.9 A

Primary inrush current   Secondary inrush current

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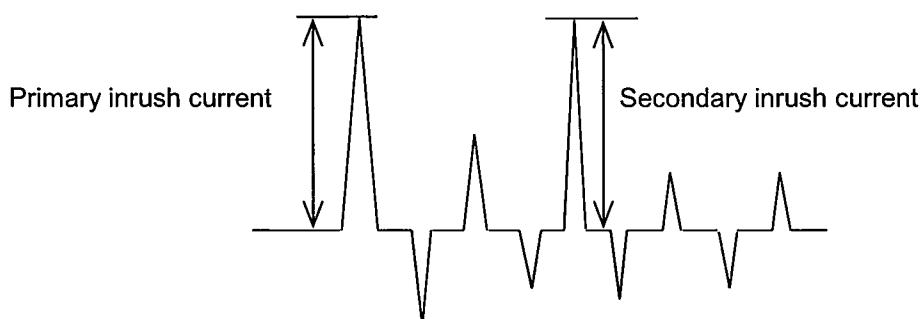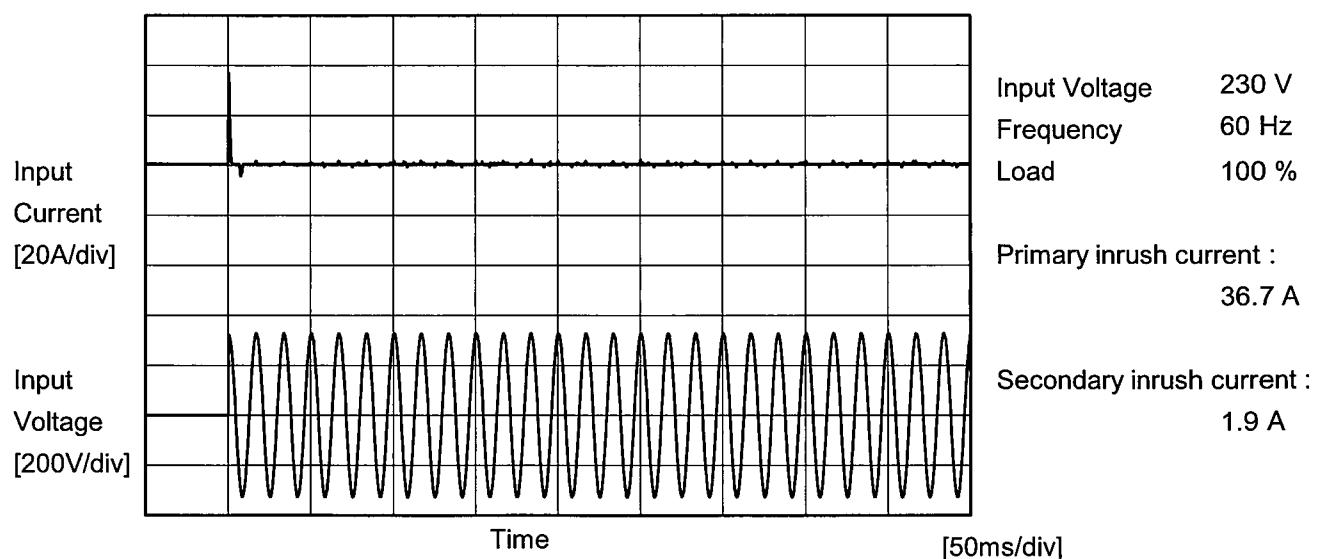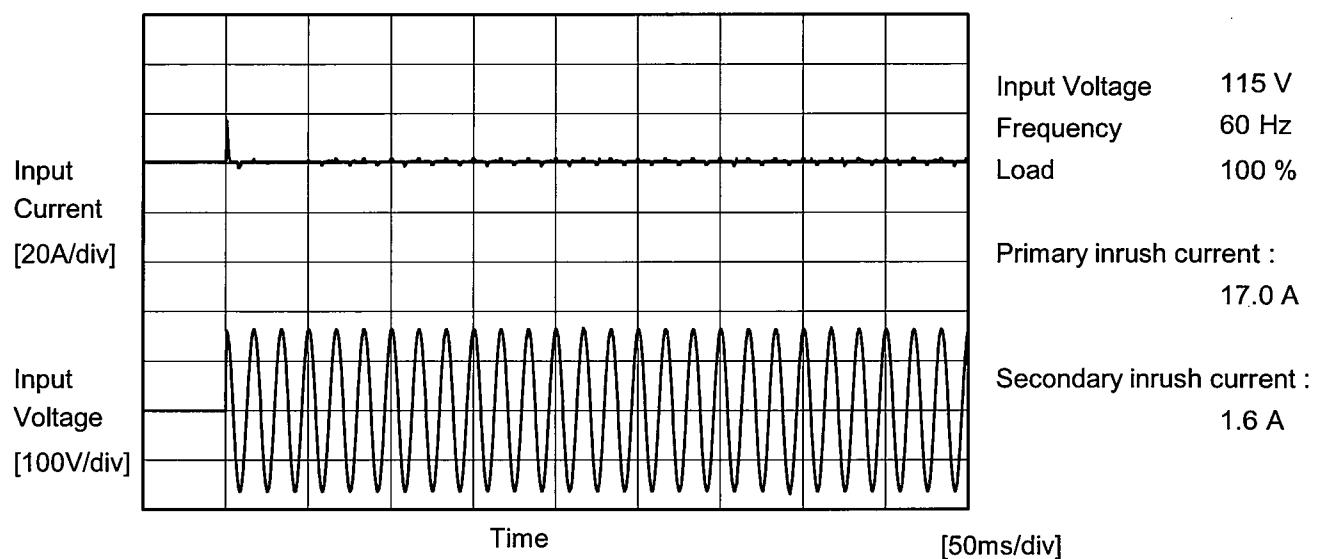
Model	KHEA30F-5

Item	Leakage Current

Object	———————————

Temperature   25°C
Testing Circuitry   Figure B

1.Results

[mA]

Standards		Input Volt.			Note
		100 [V]	115 [V]	240 [V]	
DEN-AN	Both phases	0.13	0.15	0.32	Operation
	One of phases	0.27	0.31	0.69	Stand by
IEC60950-1	Both phases	0.20	0.22	0.46	Operation
	One of phases	0.41	0.46	0.70	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	KHEA30F-5
Item	Line Regulation
Object	+5V5A

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]	Output Voltage [V]	
	Load 50%	Load 100%
80	5.078	5.075
85	5.078	5.074
90	5.077	5.073
100	5.077	5.072
115	5.077	5.071
200	5.077	5.070
230	5.078	5.070
264	5.079	5.070
280	5.079	5.070

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Model	KHEA30F-5
Item	Load Regulation
Object	+5V5A

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

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

Output Voltage [V] vs Load Current [A]

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. 115[V]	Input Volt. 230[V]
0.00	5.082	5.082	5.082
0.25	5.080	5.080	5.080
0.50	5.079	5.079	5.079
0.75	5.079	5.079	5.079
1.00	5.078	5.078	5.079
1.50	5.078	5.078	5.078
2.00	5.077	5.077	5.078
2.50	5.077	5.077	5.078
4.00	5.074	5.074	5.074
5.00	5.072	5.071	5.070
5.50	5.070	5.068	5.066

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Model	KHEA30F-5
Item	Dynamic Load Response
Object	+5V5A

Temperature	25° C
Testing Circuitry	Figure A

Input Volt. 230 V   Response. t1=t2=50us. Typ
Cycle   1000 ms
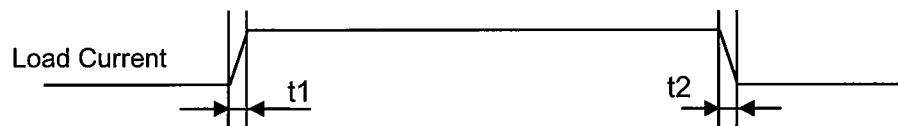
Load Current   t1   t2

Min.Load (0A) ←→
Load 100% (5A)

200mV/div

2 ms/div   20 ms/div
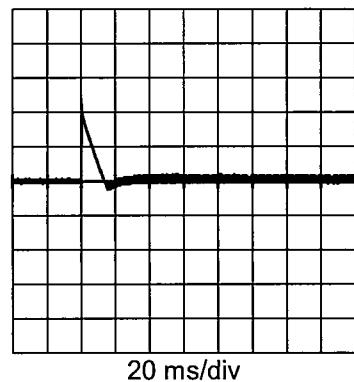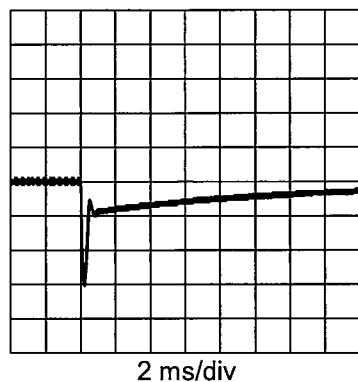
Load 30%(1.5A) ←→
Load 100% (5A)

200mV/div

2 ms/div   20 ms/div
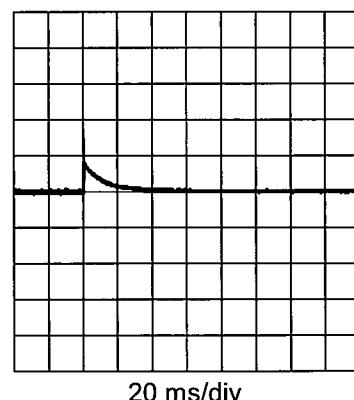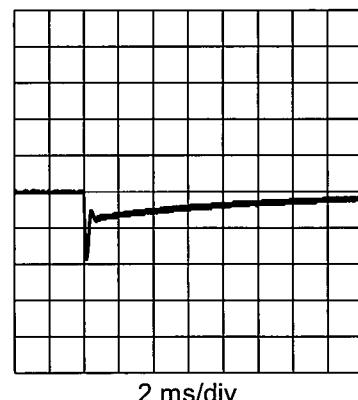
✻The characteristic of AC115V is equal.

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Model	KHEA30F-5
Item	Ripple Voltage (by Load Current)
Object	+5V5A

Temperature   25°C
Testing Circuitry   Figure C

1.Graph

———△——— Input Volt. 115V
—·—O—·— Input Volt. 230V
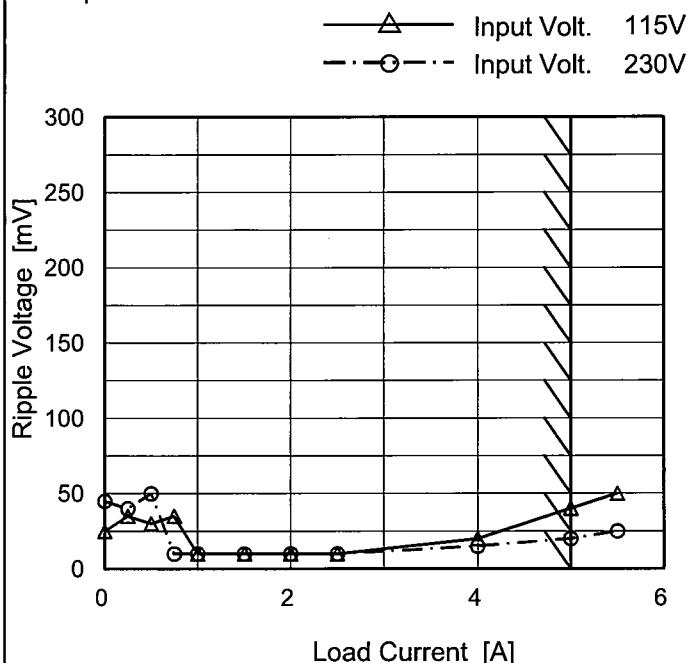
Load Current [A]

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.

2.Values

Load Current [A]	Ripple Voltage [mV]	
	Input Volt. 115 [V]	Input Volt. 230 [V]
0.00	25	45
0.25	35	40
0.50	30	50
0.75	35	10
1.00	10	10
1.50	10	10
2.00	10	10
2.50	10	10
4.00	20	15
5.00	40	20
5.50	50	25

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

Ripple [mVp-p]

Fig. Complex Ripple Wave Form

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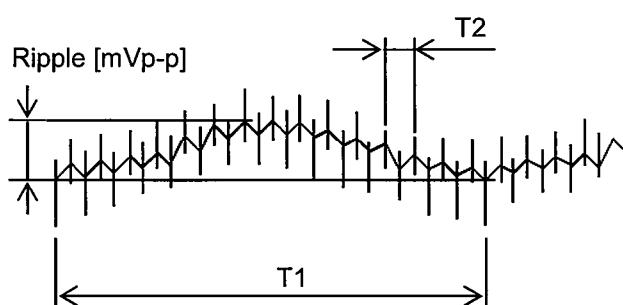
Model	KHEA30F-5
Item	Ripple-Noise
Object	+5V5A

Temperature   25°C
Testing Circuitry   Figure C

1.Graph

— △ — Input Volt.   115V
— ·—O—· · — Input Volt.   230V
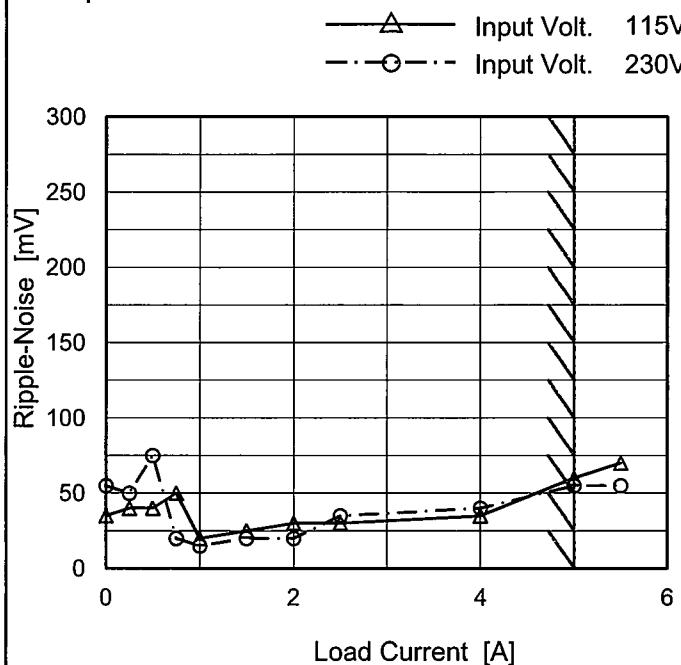
Load Current [A]

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. 115 [V]	Input Volt. 230 [V]
0.00	35	55
0.25	40	50
0.50	40	75
0.75	50	20
1.00	20	15
1.50	25	20
2.00	30	20
2.50	30	35
4.00	35	40
5.00	60	55
5.50	70	55

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

Fig. Complex Ripple Wave Form

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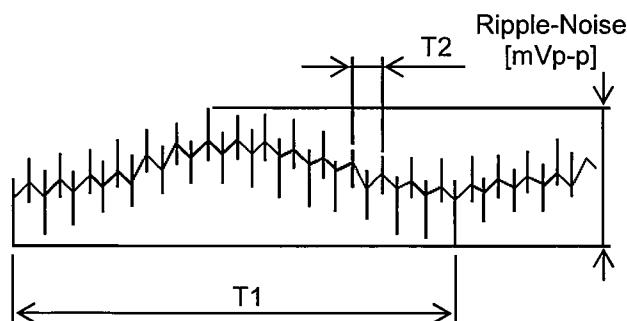
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Model	KHEA30F-5
Item	Ripple Voltage (by Ambient Temp.)
Object	+5V5A

Testing Circuitry   Figure C

1.Graph

```
- - - ⊟ - - -   Load  115V
———△———   Load  230V
```


Ambient Temperature [°C]

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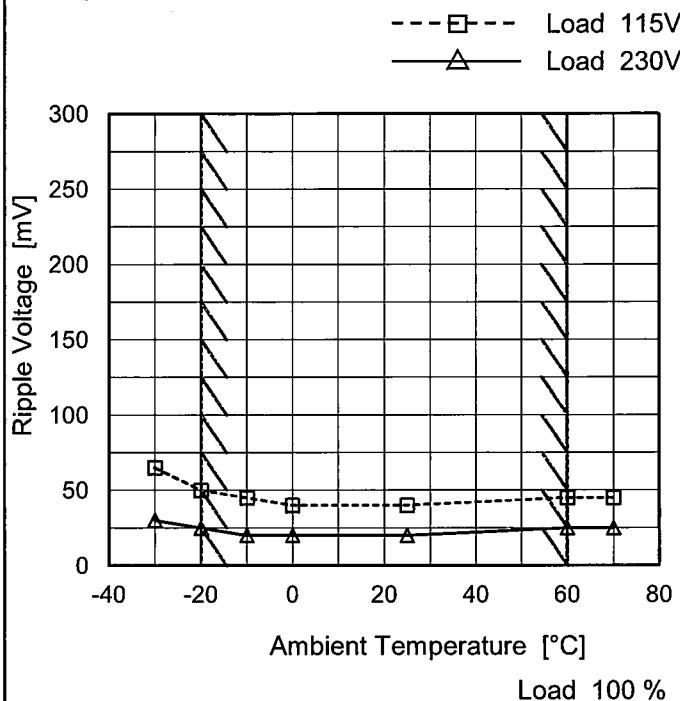
Measured by 20 MHz Oscilloscope.
Note: Slanted line shows the range of the rated
       ambient temperature.

2.Values

Ambient Temperature [°C]	Ripple Voltage [mV]	
	Input Volt. 115 [V]	Input Volt. 230 [V]
-30	65	30
-20	50	25
-10	45	20
0	40	20
25	40	20
60	45	25
70	45	25
--	-	-
--	-	-
--	-	-
--	-	-

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Model	KHEA30F-5
Item	Ambient Temperature Drift
Object	+5V5A

Testing Circuitry   Figure A

1.Graph

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

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

Ambient Temperature [°C]
Load 100%

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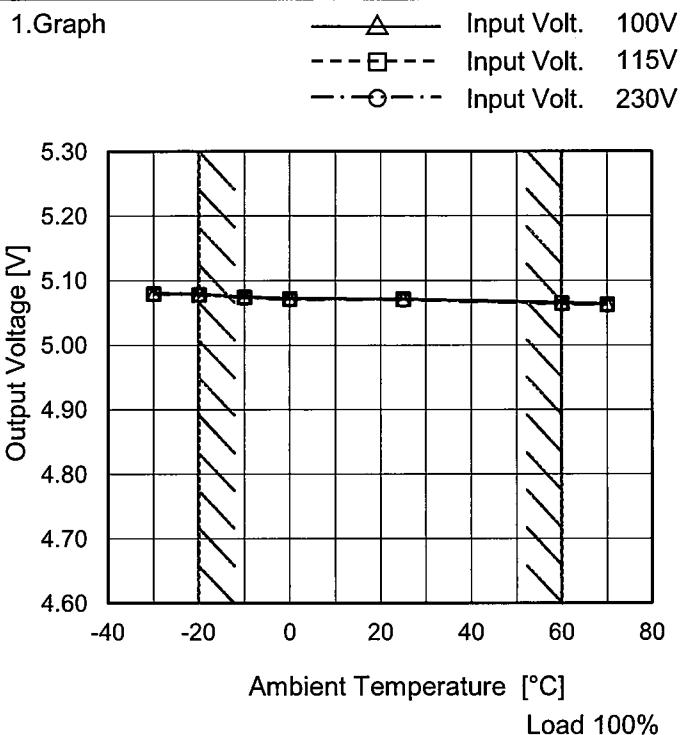
2.Values

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
-30	5.081	5.080	5.079
-20	5.079	5.078	5.078
-10	5.075	5.074	5.073
0	5.072	5.071	5.071
25	5.072	5.071	5.070
60	5.066	5.065	5.064
70	5.064	5.063	5.062
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

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Model	KHEA30F-5
Item	Output Voltage Accuracy
Object	+5V5A

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 - 60°C

Input Voltage : 85 - 264V

Load Current   : 0 - 5A

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

* Output Voltage Accuracy (Ration) = $\dfrac{\text{Output Voltage Accuracy}}{\text{Rated Output Voltage}}$ × 100

2.Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ration [%]
Maximum Voltage	-20	100	0	5.079	±8	±0.2
Minimum Voltage	60	230	5	5.064		

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Model	KHEA30F-5
Item	Time Lapse Drift
Object	+5V5A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

Input Volt. 230V
Load 100%
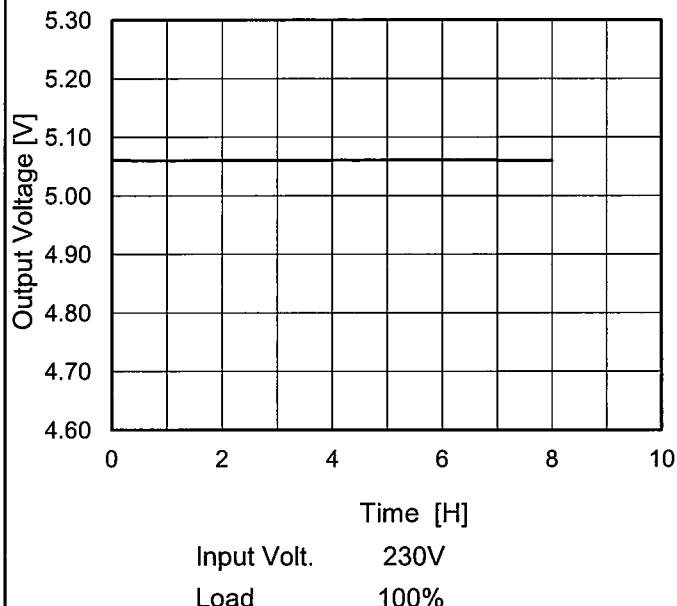
* The characteristic of AC115V is equal.

2.Values

Time since start [H]	Output Voltage [V]
0.0	5.070
0.5	5.068
1.0	5.067
2.0	5.067
3.0	5.067
4.0	5.067
5.0	5.067
6.0	5.067
7.0	5.067
8.0	5.067

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Model	KHEA30F-5
Item	Rise and Fall Time
Object	+5V5A

Temperature 25°C
Testing Circuitry Figure A

1.Graph

Load 100%

Output Volt. [1V/div]

0

Load 100%

Output Volt. [1V/div]

0

Input Volt. 0

[100V/div]

Input Volt. 115 V

Input Volt. 230 V

Time [50ms/div]

Time [50ms/div]
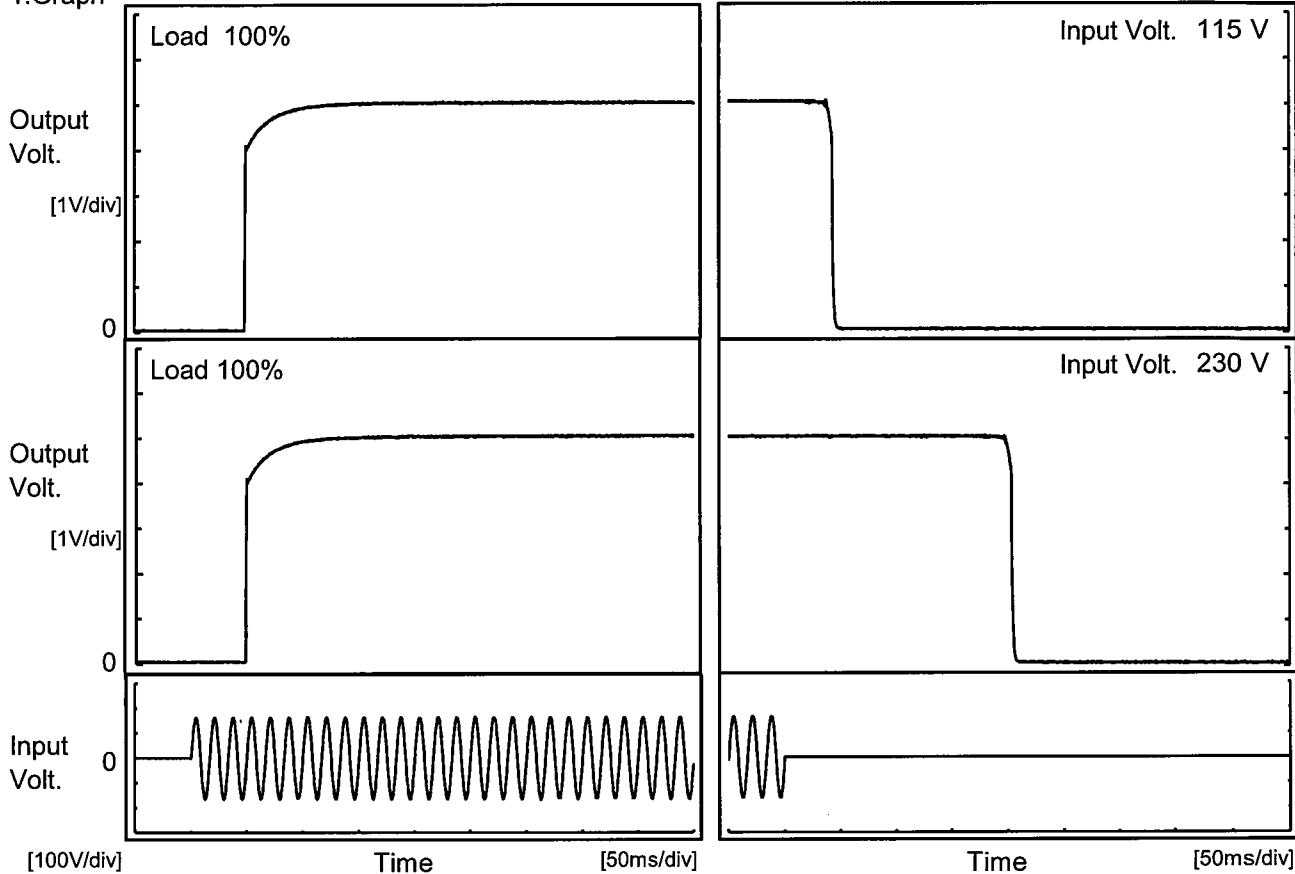
2.Values

[ms]

Input Volt \ Time	Td	Tr	Ts	Th	Tf
115V	48.8	16.3	65.1	41.5	3.3
230V	48.5	15.5	64.0	202.0	3.5

Output Volt.

90%

10%

Input Volt.

Td | Tr

Th | Tf

Ts

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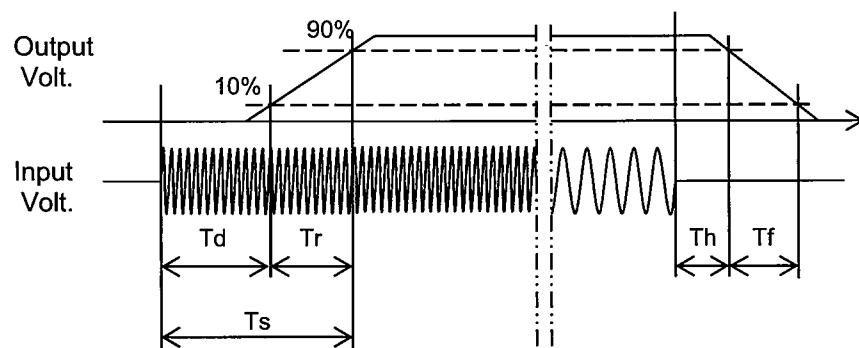
Model	KHEA30F-5
Item	Hold-Up Time
Object	+5V5A

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	37	5
85	43	8
90	50	12
100	64	24
115	89	36
200	304	138
230	408	199
264	550	270
280	621	307
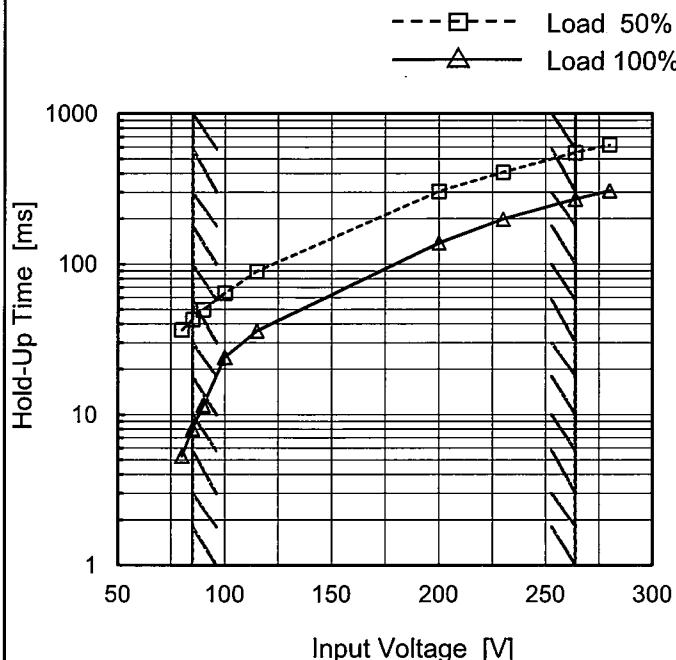
This duration covers from Shut-off of input voltage to the moment when output voltage descends to the rated range of voltage accuracy.
Note: Slanted line shows the range of the rated input voltage.

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Model	KHEA30F-5
Item	Instantaneous Interruption Compensation
Object	+5V5A
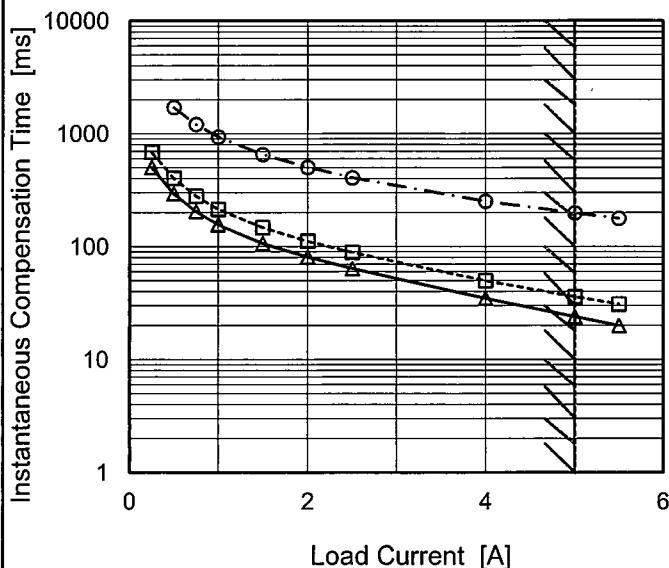
Temperature   25°C
Testing Circuitry   Figure A

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]	Time [ms]		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
0.00	-	-	-
0.25	505	690	-
0.50	295	404	1716
0.75	205	281	1215
1.00	157	215	940
1.50	107	148	657
2.00	81	112	506
2.50	64	89	408
4.00	35	50	253
5.00	24	36	199
5.50	20	31	178

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Model	KHEA30F-5
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+5V5A
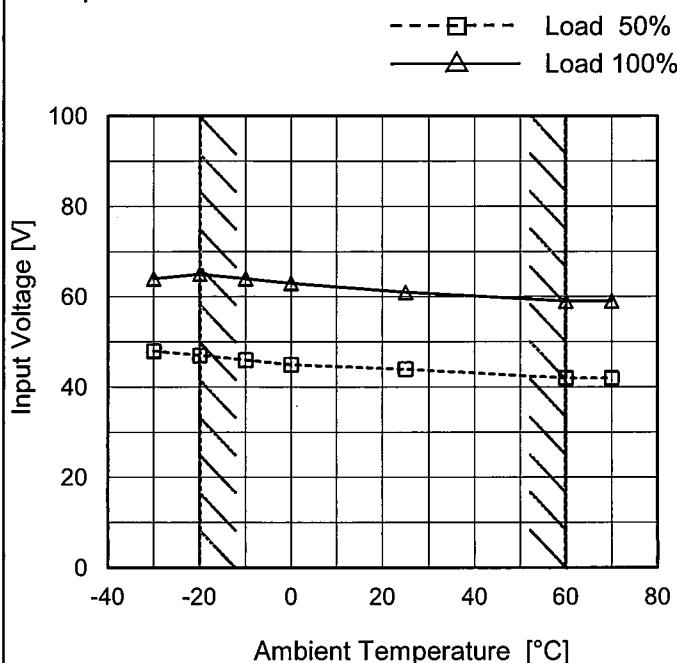
Testing Circuitry   Figure A

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	48	64
-20	47	65
-10	46	64
0	45	63
25	44	61
60	42	59
70	42	59
--	-	-
--	-	-
--	-	-
--	-	-

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|	
Model	KHEA30F-5
Item	Overcurrent Protection
Object	+5V5A

Temperature   25°C
Testing Circuitry   Figure A

1.Graph

——○ Input Volt. 115V
——□ Input Volt. 230V
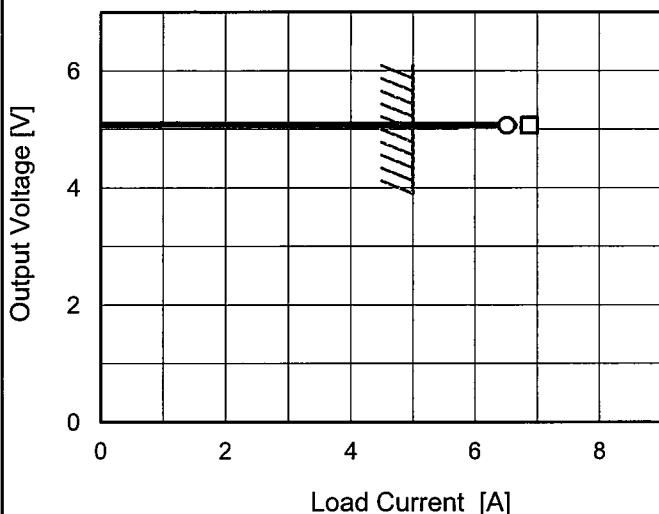
Load Current [A]

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

    Intermittent operation occurs when overcurrent
protection is activated.

2.Values

Output Voltage [V]	Load Current [A]	
	Input Volt. 115[V]	Input Volt. 230[V]
5.07	6.63	6.84
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
--	-	-
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BC-10814

COSEL

Model	KHEA30F-5
Item	Overvoltage Protection
Object	+5V5A
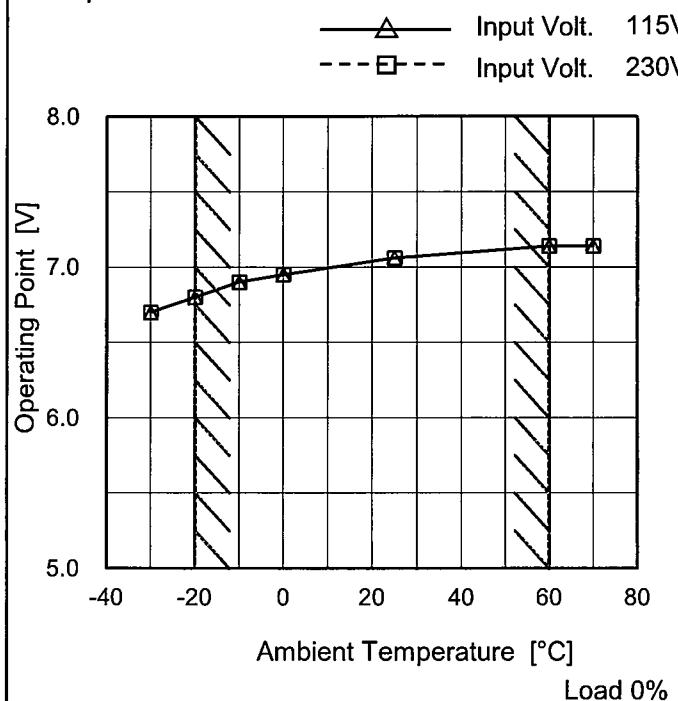
Testing Circuitry   Figure A

1.Graph

———△——— Input Volt.   115V

– – –⊟– – – 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. 115[V]	Input Volt. 230[V]
-30	6.70	6.70
-20	6.80	6.80
-10	6.90	6.90
0	6.95	6.95
25	7.06	7.06
60	7.14	7.14
70	7.14	7.14
--	-	-
--	-	-
--	-	-
--	-	-

BC-10814

COSEL

Electronic Switch

AC Power Supply

Power Meter

Temperature Chamber
Power Supply

Electronic DC Load

Oscilloscope

Relay Unit

DVM

Data Acquisition/Control Unit

Figure A

AC Input Line

AC Voltmeter

Power Supply

PE

DC Ammeter

Adjustable Load

1kΩ

Effective value

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

Figure B (DEN-AN)

AC Input Line

AC Voltmeter

Power Supply

PE

DC Ammeter

Adjustable Load

500Ω±0.1%

1.5kΩ±0.1%

10kΩ±0.1%

0.22µF±1.0%

0.022µF±1.0%

Effective value

Leakage Current Value   [A] $=$ $\dfrac{\text{Effective Value of Voltmeter[V]}}{500 \ [\Omega]}$

Figure B (IEC60950-1)

BC-10814

COSEL

Temperature Chamber

AC Power Supply

Power Meter

Power Supply

Measuring board

C1 C2

Electronic DC Load

150mm

Oscilloscope BW:20MHz

C1= 0.1 µF
(Ceramic capacitor)
C2= 22 µF
(Electrolytic capacitor)

Figure C

BC-10814