

# TEST DATA OF KHEA90F-24

Regulated DC Power Supply  
November 15, 2013

Approved by : Yukihiro Takehashi  
Yukihiro Takehashi Design Manager

Prepared by : Yasunari Hirano  
Yasunari Hirano Design Engineer

**COSEL CO.,LTD.**

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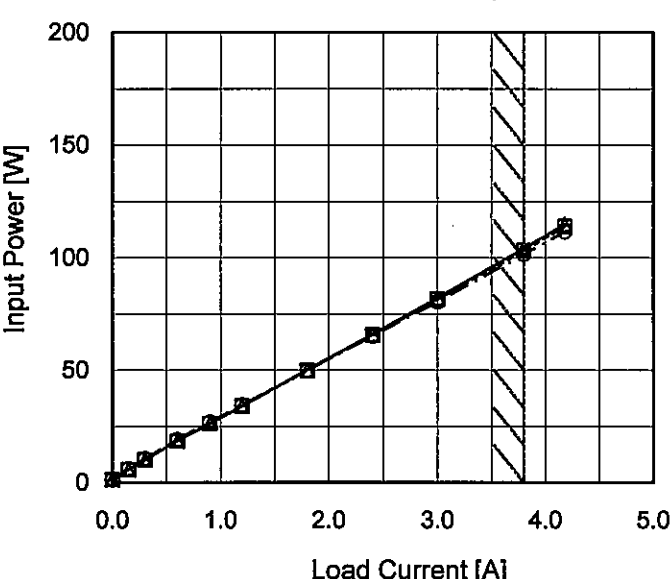
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Model		KHEA90F-24																																																				
Item		Input Current (by Load Current)																																																				
Object																																																						
1.Graph		2.Values																																																				
<div><div><div>—△—</div><div>Input Volt.</div><div>100V</div></div><div><div>---□---</div><div>Input Volt.</div><div>115V</div></div><div><div>---○---</div><div>Input Volt.</div><div>230V</div></div></div> <p>Input Current [A]</p> <p>Load Current [A]</p> <p>Note: Slanted line shows the range of the rated load current.</p>		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="3">Input Current [A]</th></tr><tr><th>Input Volt. 100[V]</th><th>Input Volt. 115[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>0.00</td><td>0.048</td><td>0.052</td><td>0.087</td></tr><tr><td>0.15</td><td>0.083</td><td>0.080</td><td>0.107</td></tr><tr><td>0.30</td><td>0.123</td><td>0.114</td><td>0.139</td></tr><tr><td>0.60</td><td>0.205</td><td>0.185</td><td>0.175</td></tr><tr><td>0.90</td><td>0.282</td><td>0.251</td><td>0.196</td></tr><tr><td>1.20</td><td>0.359</td><td>0.317</td><td>0.211</td></tr><tr><td>1.80</td><td>0.516</td><td>0.452</td><td>0.270</td></tr><tr><td>2.40</td><td>0.673</td><td>0.587</td><td>0.336</td></tr><tr><td>3.00</td><td>0.833</td><td>0.724</td><td>0.403</td></tr><tr><td>3.80</td><td>1.054</td><td>0.913</td><td>0.495</td></tr><tr><td>4.18</td><td>1.160</td><td>1.004</td><td>0.540</td></tr></table>		Load Current [A]	Input Current [A]			Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]	0.00	0.048	0.052	0.087	0.15	0.083	0.080	0.107	0.30	0.123	0.114	0.139	0.60	0.205	0.185	0.175	0.90	0.282	0.251	0.196	1.20	0.359	0.317	0.211	1.80	0.516	0.452	0.270	2.40	0.673	0.587	0.336	3.00	0.833	0.724	0.403	3.80	1.054	0.913	0.495	4.18	1.160	1.004	0.540
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Model	KHEA90F-24	
Item	Efficiency (by Input Voltage)	
Object		

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	86.3	86.6
85	86.7	87.2
90	87.0	88.0
100	87.4	89.1
115	87.7	89.8
200	88.0	90.9
230	87.5	91.0
264	87.4	91.0
280	88.9	90.9

# COSEL

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LOREL

Model	KHEA90F-24
Item	Power Factor (by Input Voltage)
Object	

Temperature	25°C
Testing Circuitry	Figure A

1.Graph

---□--- Load 50%  
—△— Load 100%

Input Voltage [V]	Power Factor (Load 50%)	Power Factor (Load 100%)
80	0.985	0.987
85	0.983	0.987
90	0.979	0.988
100	0.973	0.990
115	0.962	0.985
200	0.866	0.930
230	0.813	0.892
264	0.713	0.834
280	0.610	0.729

Power Factor

Input Voltage [V]

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

2.Values

Input Voltage [V]	Power Factor	
	Load 50%	Load 100%
80	0.985	0.987
85	0.983	0.987
90	0.979	0.988
100	0.973	0.990
115	0.962	0.985
200	0.866	0.930
230	0.813	0.892
264	0.713	0.834
280	0.610	0.729

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Model

KHEA90F-24

Item

Power Factor (by Load Current)

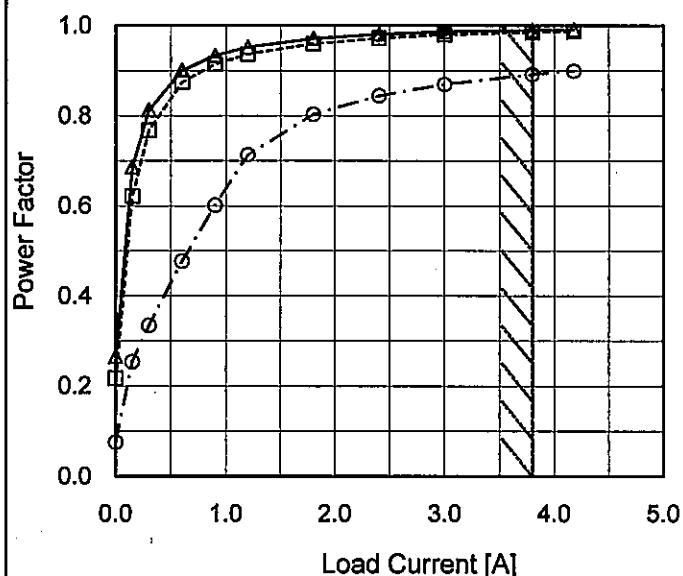
Object

Temperature  
Testing Circuitry

25°C  
Figure A

## 1. Graph

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



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

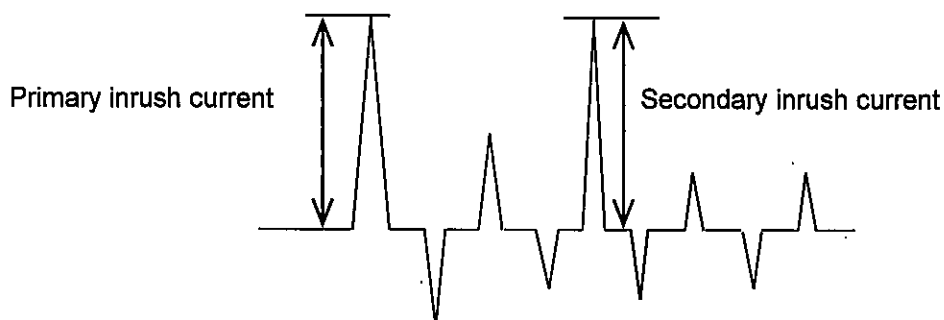
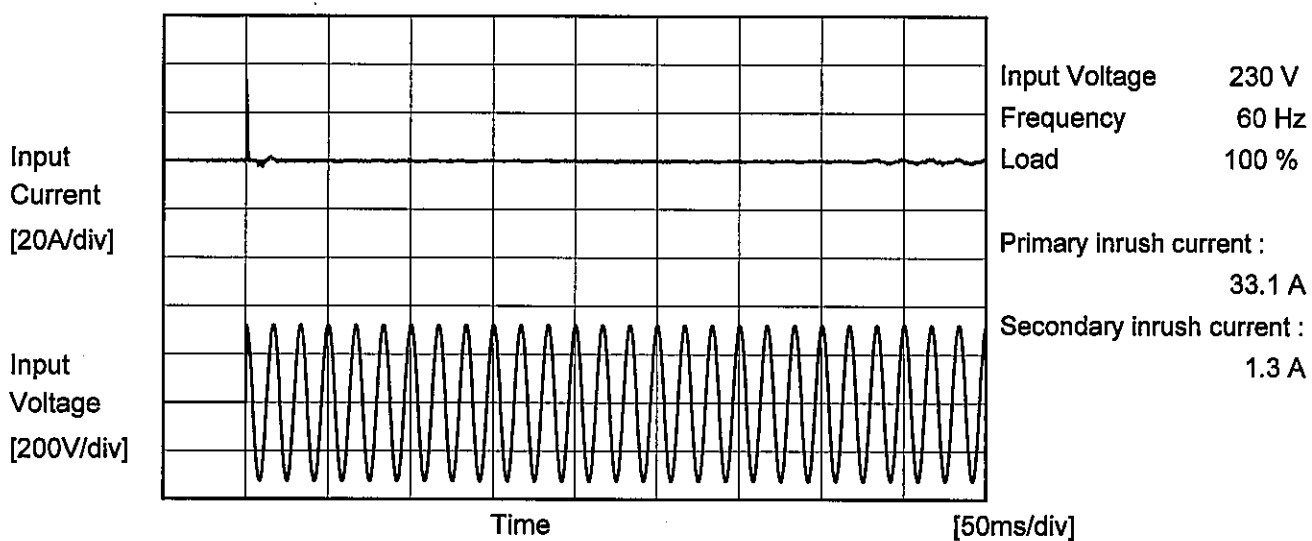
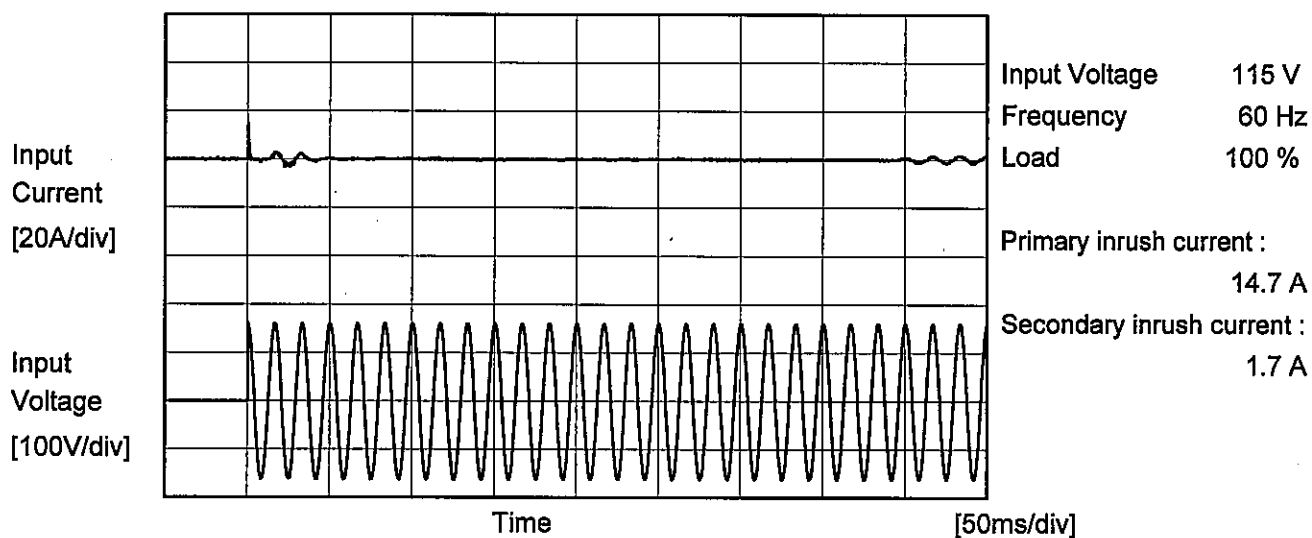
## 2. Values

Load Current [A]	Power Factor		
	Input Volt. 100[V]	Input Volt. 115[V]	Input Volt. 230[V]
0.00	0.265	0.217	0.076
0.15	0.686	0.622	0.254
0.30	0.813	0.768	0.335
0.60	0.901	0.874	0.477
0.90	0.934	0.914	0.602
1.20	0.952	0.936	0.714
1.80	0.972	0.960	0.804
2.40	0.981	0.972	0.845
3.00	0.987	0.980	0.869
3.80	0.990	0.985	0.892
4.18	0.991	0.987	0.899



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Model	KHEA90F-24	Temperature	25°C
Item	Inrush Current	Testing Circuitry	Figure A
Object	_____		



**COSEL**

		Temperature 25°C Testing Circuitry Figure B
Model	KHEA90F-24	
Item	Leakage Current	
Object	_____	

## 1.Results

[mA]

Standards		Input Volt.			Note
		100 [V]	115 [V]	240 [V]	
DEN-AN	Both phases	0.25	0.26	0.38	Operation
	One of phases	0.26	0.30	0.68	Stand by
IEC60950-1	Both phases	0.14	0.16	0.36	Operation
	One of phases	0.26	0.30	0.68	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.





Model		KHEA90F-24	
Item		Load Regulation	
Object		+24V3.8A	

1.Graph

—△—

Input Volt.

100V

---□---

Input Volt.

115V

---○---

Input Volt.

230V

Output Voltage [V]

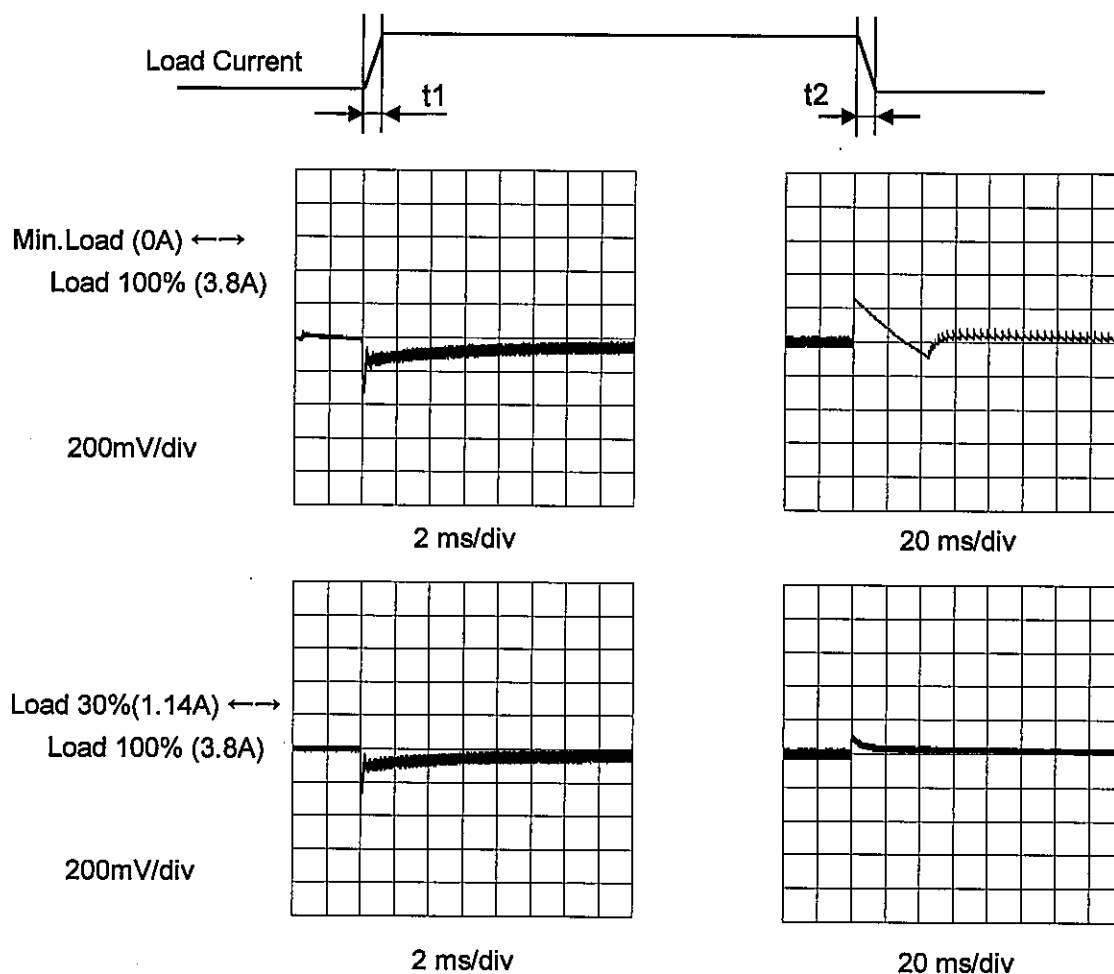
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# COSEL

Model	KHEA90F-24	Temperature	25° C
Item	Dynamic Load Response	Testing Circuitry	Figure A
Object	+24V3.8A		

Input Volt. 230 V  
Cycle 1000 ms

Response.  $t_1=t_2=50\mu s$ . Typ



\* The characteristic of AC115V is equal.

Model		KHEA90F-24	
Item		Ripple Voltage (by Load Current)	
Object		+24V3.8A	
1.Graph		2.Values	

—△—

Input Volt. 115V

---○---

Input Volt. 230V

Load Current [A]	115V [mV]	230V [mV]
0.00	65	65
0.15	100	100
0.30	85	85
0.60	100	85
0.90	20	20
1.20	20	20
1.80	25	25
2.40	25	25
3.00	40	40
3.80	65	60
4.18	75	75

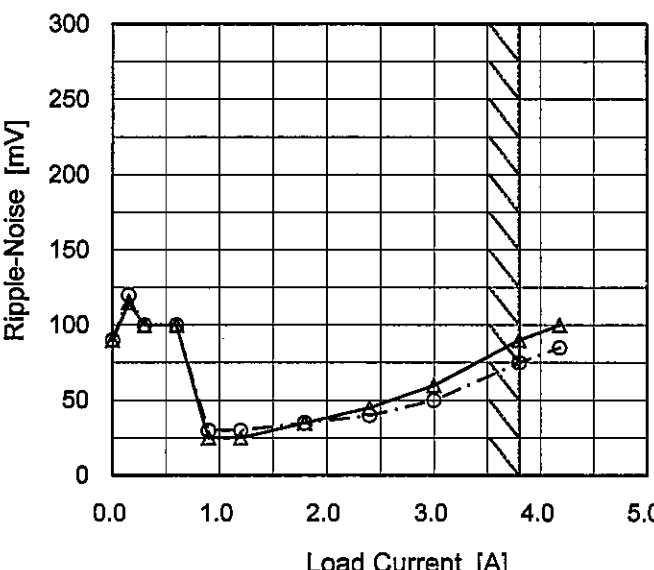
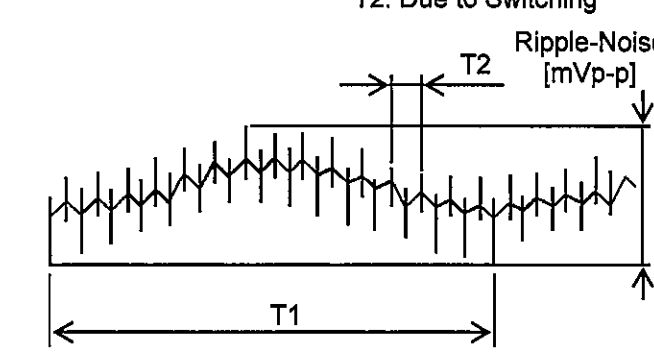
Measured by 20 MHz Oscilloscope.  
Ripple Voltage is shown as p-p in the figure below.  
Note: Slanted line shows the range of the rated load current.

T1: Due to AC Input Line

T2: Due to Switching

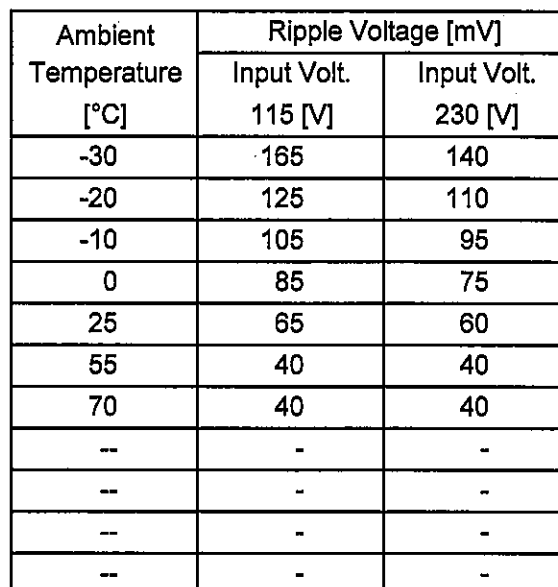
Ripple [mVp-p]

Fig. Complex Ripple Wave Form

Model		KHEA90F-24																																							
Item		Ripple-Noise																																							
Object		+24V3.8A																																							
1.Graph		2.Values																																							
<div><div><div>—△—</div><div>Input Volt.</div><div>115V</div></div><div><div>-○-</div><div>Input Volt.</div><div>230V</div></div></div>  <p>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.</p>		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="2">Ripple-Noise [mV]</th></tr><tr><th>Input Volt. 115 [V]</th><th>Input Volt. 230 [V]</th></tr><tr><td>0.00</td><td>90</td><td>90</td></tr><tr><td>0.15</td><td>115</td><td>120</td></tr><tr><td>0.30</td><td>100</td><td>100</td></tr><tr><td>0.60</td><td>100</td><td>100</td></tr><tr><td>0.90</td><td>25</td><td>30</td></tr><tr><td>1.20</td><td>25</td><td>30</td></tr><tr><td>1.80</td><td>35</td><td>35</td></tr><tr><td>2.40</td><td>45</td><td>40</td></tr><tr><td>3.00</td><td>60</td><td>50</td></tr><tr><td>3.80</td><td>90</td><td>75</td></tr><tr><td>4.18</td><td>100</td><td>85</td></tr></table>		Load Current [A]	Ripple-Noise [mV]		Input Volt. 115 [V]	Input Volt. 230 [V]	0.00	90	90	0.15	115	120	0.30	100	100	0.60	100	100	0.90	25	30	1.20	25	30	1.80	35	35	2.40	45	40	3.00	60	50	3.80	90	75	4.18	100	85
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### Testing Circuitry Figure C

## 2.Values



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



# COSEL

Model KHEA90F-24

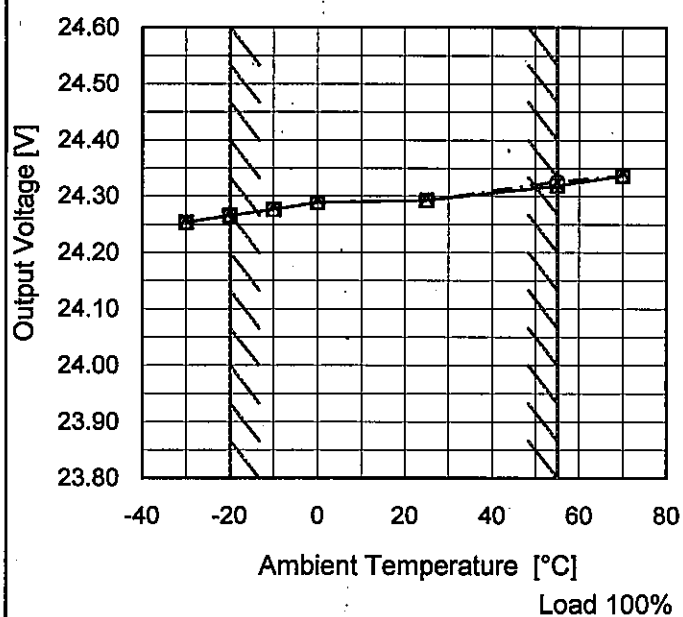
Item Ambient Temperature Drift

Object +24V3.8A

Testing Circuitry Figure A

1. Graph

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



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	24.254	24.254	24.254
-20	24.266	24.266	24.266
-10	24.276	24.276	24.276
0	24.289	24.289	24.289
25	24.292	24.292	24.292
55	24.319	24.319	24.327
70	24.337	24.337	24.337
--	-	-	-
--	-	-	-
--	-	-	-
--	-	-	-

**COSEL**

		Testing Circuitry Figure A
Model	KHEA90F-24	
Item	Output Voltage Accuracy	
Object	+24V3.8A	

### 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 - 55°C

Input Voltage : 85 - 264V

Load Current : 0 - 3.8A

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

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

### 2. Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ration [%]
Maximum Voltage	55	230	3.8	24.327	±31	±0.1
Minimum Voltage	-20	230	3.8	24.266		

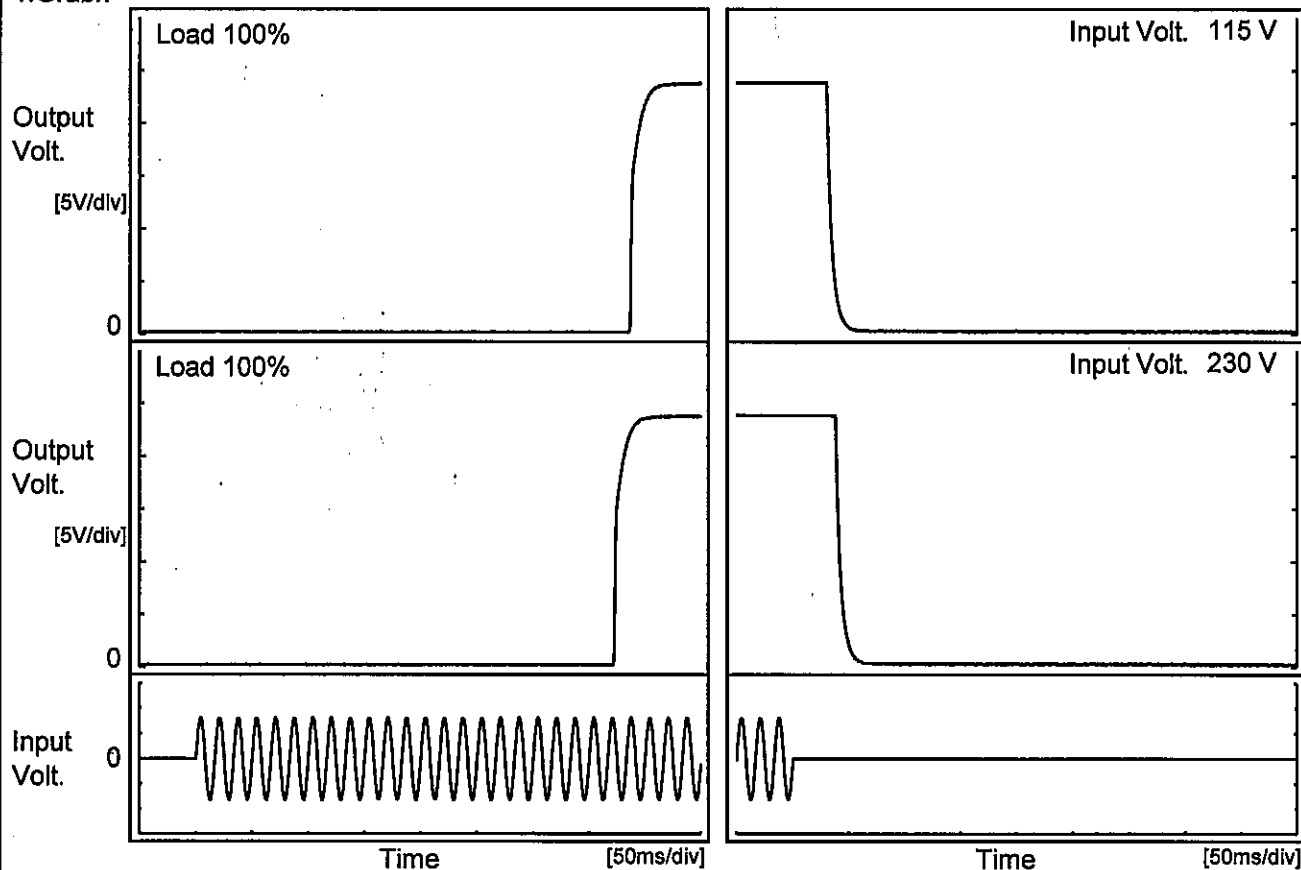
# COSEL

Model	KHEA90F-24		
Item	Time Lapse Drift	Temperature	25°C
Object	+24V3.8A	Testing Circuitry	Figure A
1.Graph		2.Values	
<div><div>Output Voltage [V]</div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></di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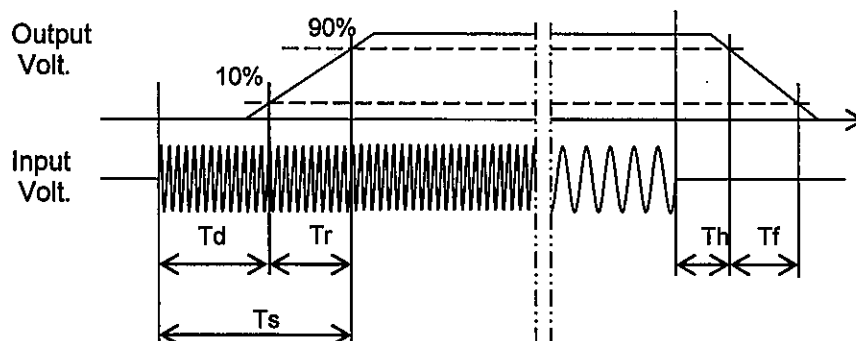
Model	KHEA90F-24	Temperature	25°C
Item	Rise and Fall Time	Testing Circuitry	Figure A
Object	+24V3.8A		

## 1. Graph



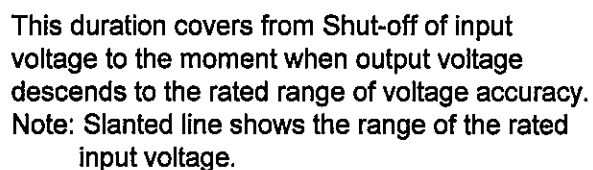
## 2. Values

Input Volt.	Time	Td	Tr	Ts	Th	Tf
115 V		387.3	13.3	400.6	30.8	10.3
230 V		373.0	13.0	386.0	38.5	10.5



Temperature	25°C
Testing Circuitry	Figure A

## 2.Values



Input Voltage [V]	Hold-Up Time [ms]	
	Load 50%	Load 100%
80	56	24
85	59	25
90	61	25
100	65	27
115	68	30
200	77	37
230	78	38
264	79	39
280	81	39

</

# COSEL

Model		KHEA90F-24
Item		Minimum Input Voltage for Regulated Output Voltage
Object		+24V3.8A

1.Graph

Load 50%

Load 100%

100

80

60

40

20

0

Model	KHEA90F-24	Temperature      25°C Testing Circuitry   Figure A																																																
Item	Overcurrent Protection																																																	
Object	+24V3.8A																																																	
1.Graph		2.Values																																																
<div><div><div></div>Input Volt.    115V</div><div><div></div>Input Volt.    230V</div></div> <p>Note: Slanted line shows the range of the rated load current. Intermittent operation occurs when overcurrent protection is activated.</p>		<table><tr><th rowspan="2">Output Voltage [V]</th><th colspan="2">Load Current [A]</th></tr><tr><th>Input Volt. 115[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>24.3</td><td>5.36</td><td>5.58</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr></table>		Output Voltage [V]	Load Current [A]		Input Volt. 115[V]	Input Volt. 230[V]	24.3	5.36	5.58	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-
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# COSEL

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Model	KHEA90F-24
Item	Overvoltage Protection
Object	+24V3.8A

1.Graph

—△— Input Volt. 115V  
---□--- Input Volt. 230V

Operating Point [V]

Ambient Temperature [°C]

Load 0%

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. 115[V]	Input Volt. 230[V]
-30	31.08	30.92
-20	31.31	31.19
-10	31.40	31.38
0	31.64	31.67
25	32.34	32.41
55	33.08	33.19
70	33.47	33.55
--	-	-
--	-	-
--	-	-
--	-	-

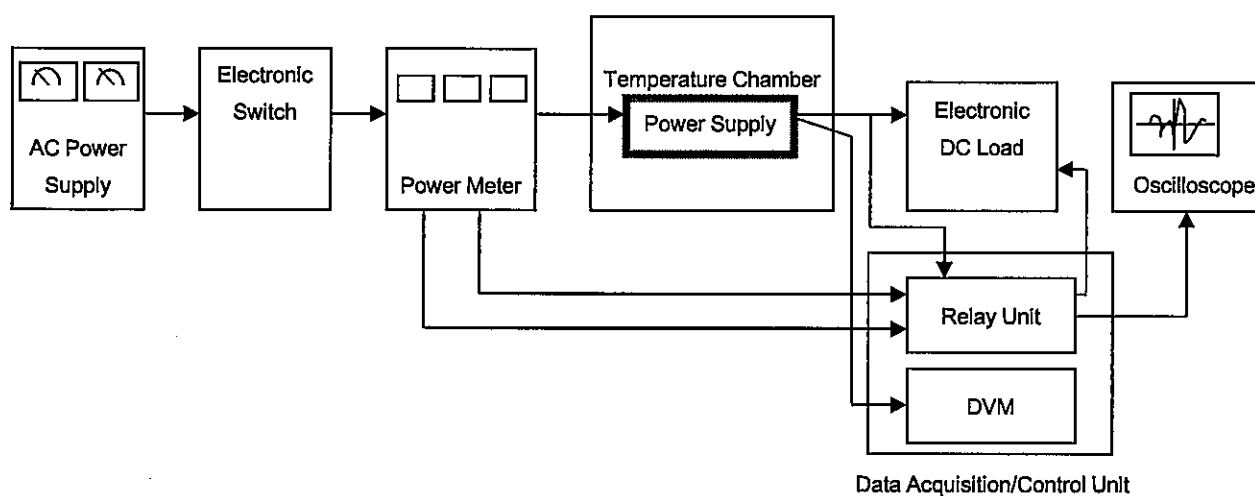


Figure A

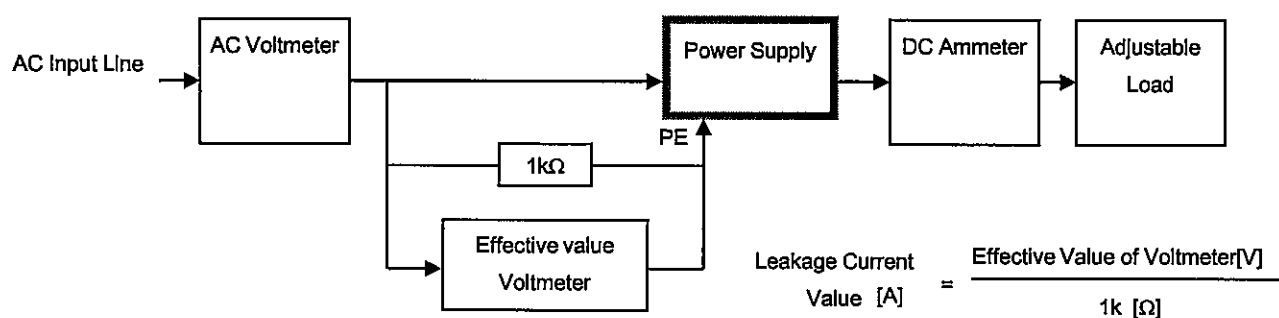


Figure B ( DEN-AN )

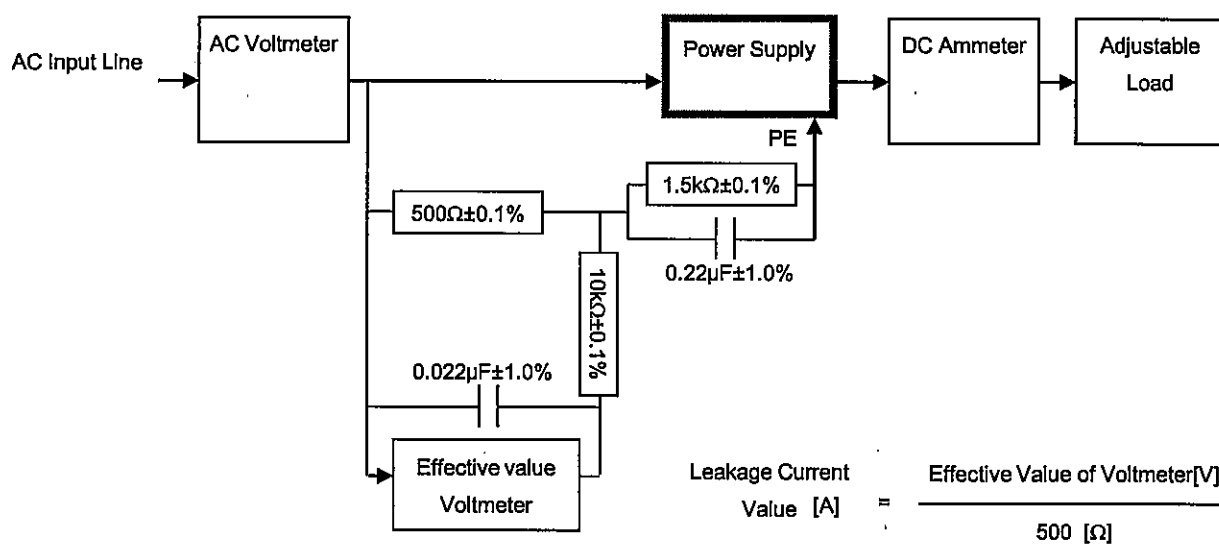


Figure B ( IEC60950-1 )

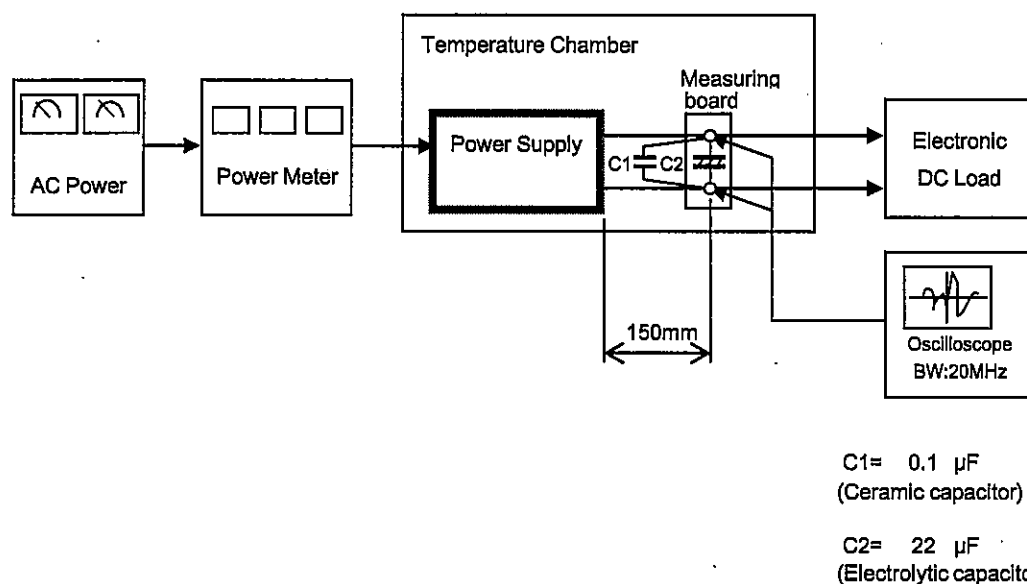


Figure C