

TEST DATA OF TUHS10F24

Regulated DC Power Supply
February 28, 2014

Approved by : Nobuyuki Shiraishi
Nobuyuki Shiraishi Design Manager

Prepared by : Sakae Minamide
Sakae Minamide Design Engineer

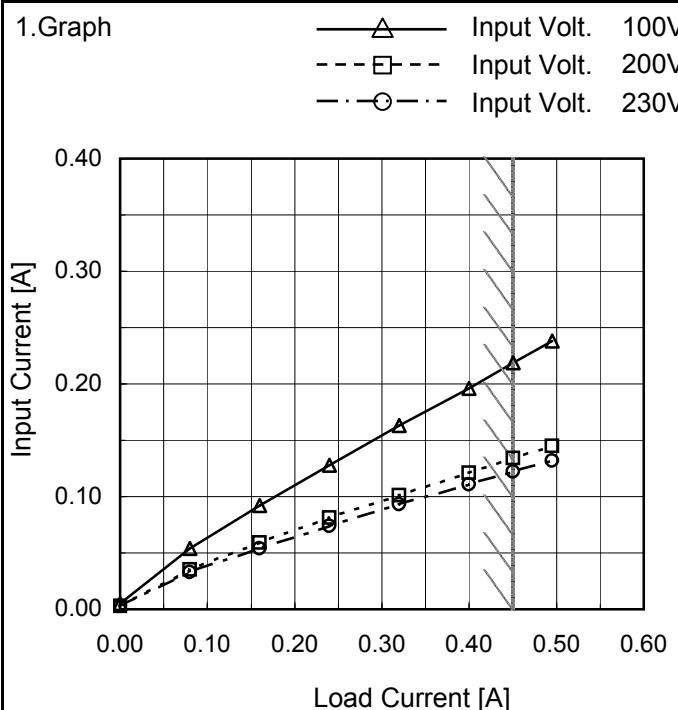
COSEL CO.,LTD.

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(Final Page 25)

Model	TUHS10F24
Item	Input Current (by Load Current)
Object	_____

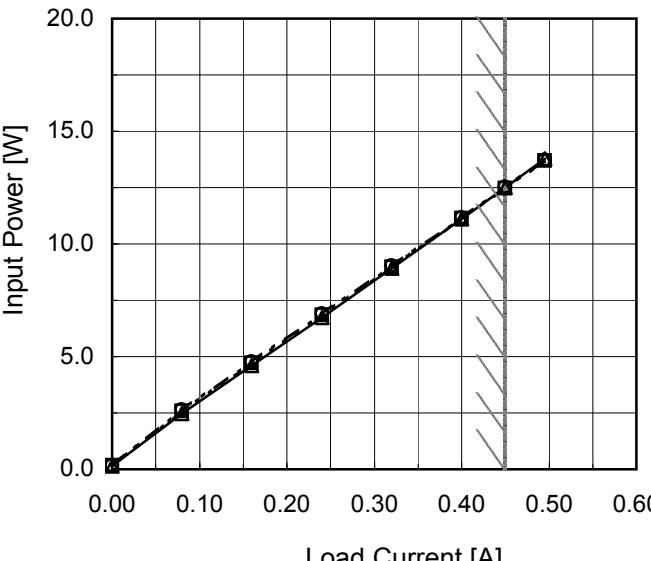


Temperature 25°C
Testing Circuitry Figure A

2. Values

Load Current [A]	Input Current [A]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
0.00	0.005	0.003	0.003
0.08	0.054	0.035	0.033
0.16	0.092	0.059	0.054
0.24	0.128	0.081	0.074
0.32	0.163	0.101	0.093
0.40	0.196	0.121	0.111
0.45	0.219	0.134	0.122
0.50	0.238	0.145	0.132
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Note: Slanted line shows the range of the rated load current.

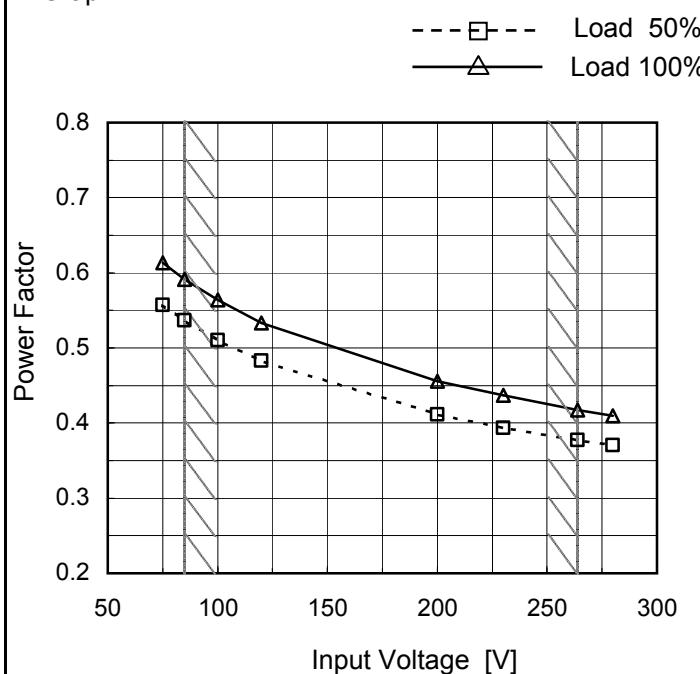
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Model	TUHS10F24
Item	Power Factor (by Input Voltage)
Object	—

1. Graph



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

Temperature 25°C
Testing Circuitry Figure A

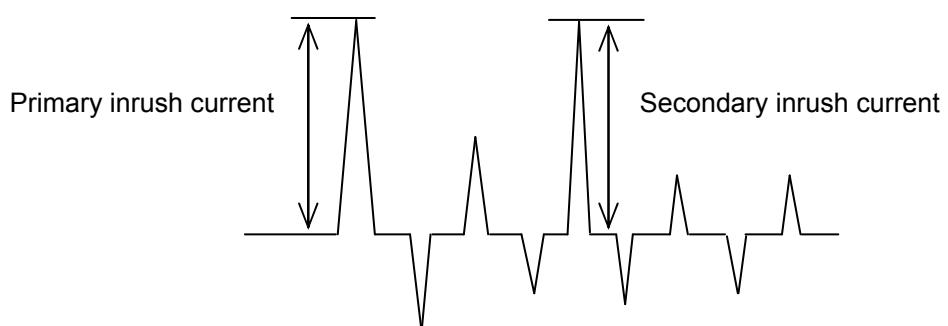
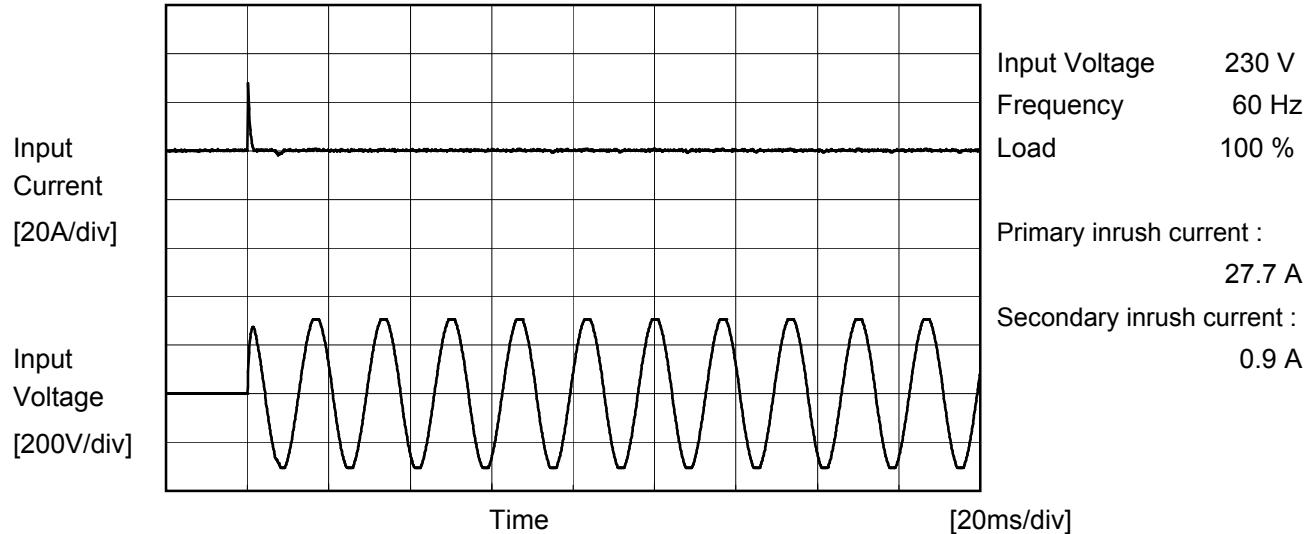
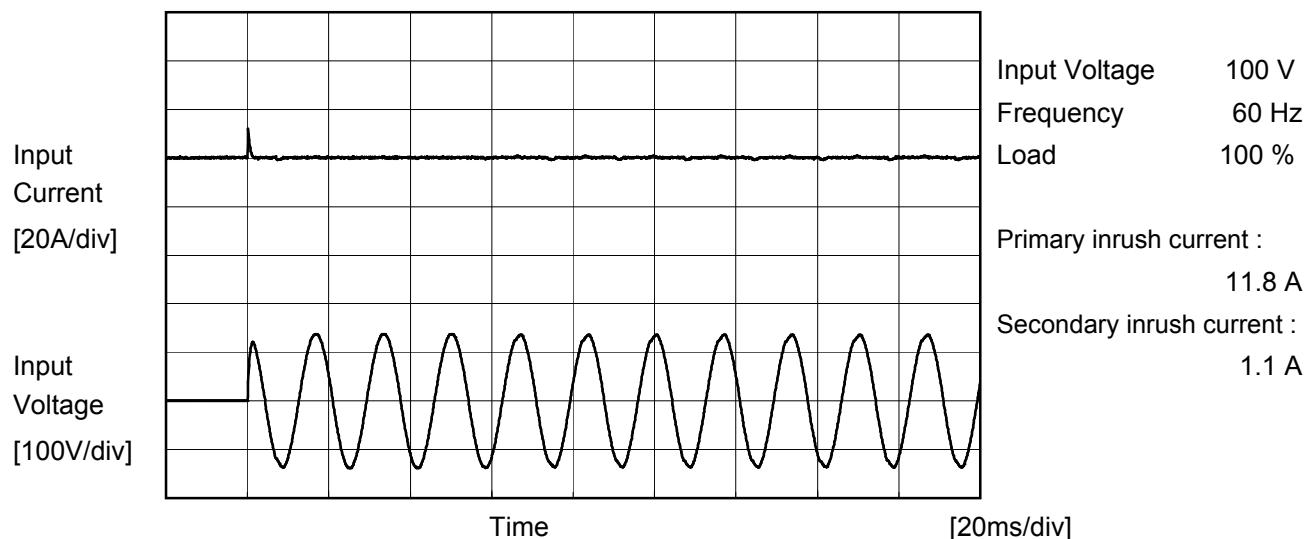
2. Values

Input Voltage [V]	Power Factor	
	Load 50%	Load 100%
75	0.557	0.613
85	0.537	0.591
100	0.510	0.564
120	0.483	0.534
200	0.411	0.456
230	0.394	0.437
264	0.378	0.417
280	0.371	0.410
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Model	TUHS10F24	Temperature Testing Circuitry Figure A	25°C
Item	Inrush Current		
Object	_____		





Model	TUHS10F24	Temperature Testing Circuitry	25°C Figure B
Item	Leakage Current		
Object	_____		

1. Results

Standards		Input Volt.			Note
		100 [V]	200 [V]	230 [V]	
DEN-AN	Both phases	0.005	0.008	0.008	Operation
	One of phases	0.004	0.010	0.011	Stand by
IEC60950-1	Both phases	0.003	0.006	0.007	Operation
	One of phases	0.004	0.009	0.010	Stand by

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

2. Condition

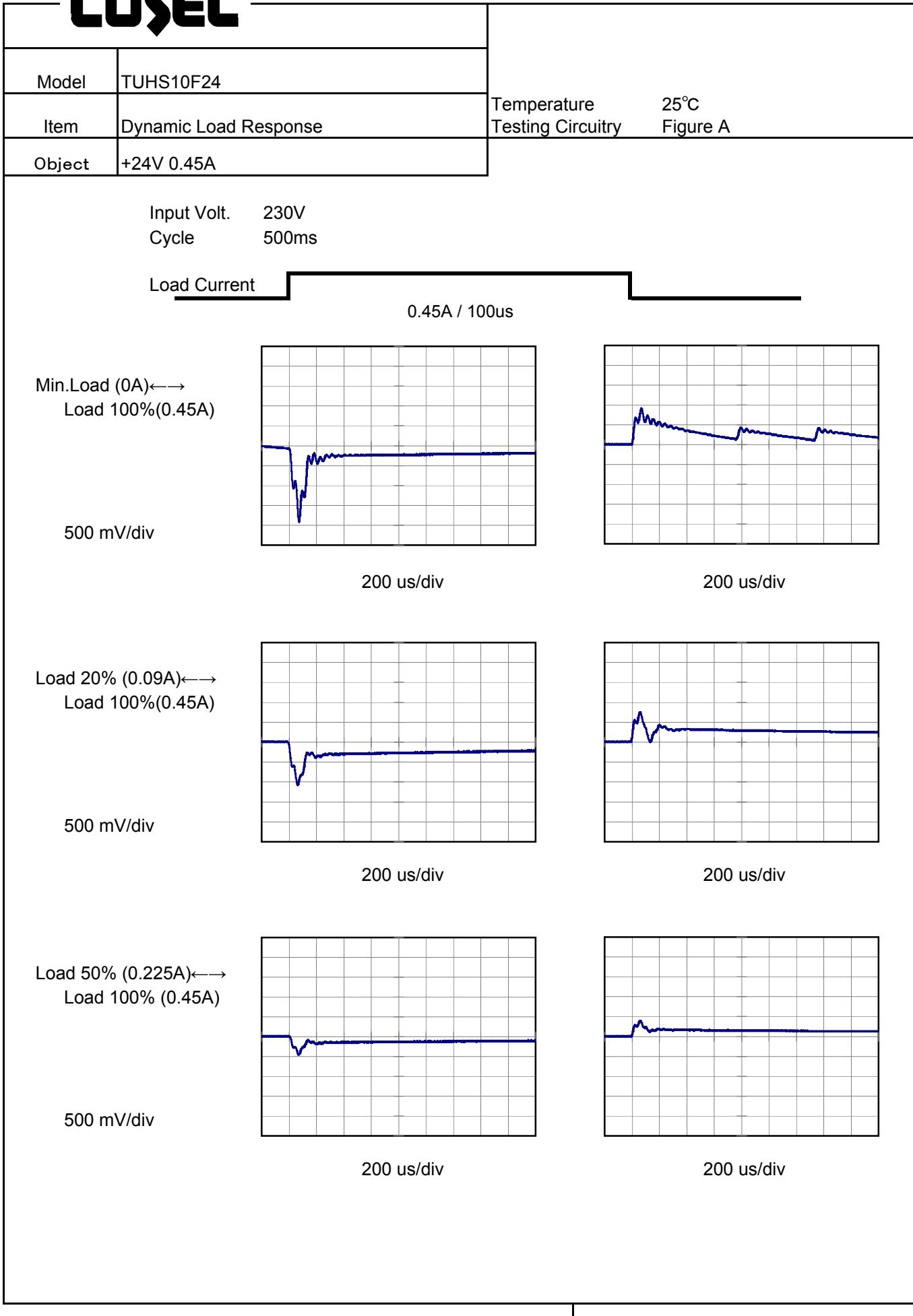
Leakage current value is concluded after measuring both phases of AC input and by choosing the larger one.
 There is no FG in TUHS series and it is a reinforced insulation power supply of the class 2.

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Item	Line Regulation	Temperature Testing Circuitry 25°C Figure A																																
Object	+24V0.45A																																	
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<p>The graph plots Output Voltage [V] on the y-axis (23.75 to 24.45) against Input Voltage [V] on the x-axis (50 to 300). Two horizontal lines represent the output voltage at different loads: a dashed line for Load 50% and a solid line for Load 100%. Both lines are nearly flat, indicating high line regulation. A slanted line on the graph indicates the range of the rated input voltage.</p>																																		
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Model	TUHS10F24	Temperature Testing Circuitry 25°C Figure A																																																		
Item	Load Regulation																																																			
Object	+24V0.45A																																																			
1.Graph	<p>—△— Input Volt. 100V - - -□--- Input Volt. 200V - - -○--- Input Volt. 230V</p> <table border="1"> <caption>Data points estimated from Graph 1</caption> <thead> <tr> <th>Load Current [A]</th> <th>Output Voltage [V] (100V)</th> <th>Output Voltage [V] (200V)</th> <th>Output Voltage [V] (230V)</th> </tr> </thead> <tbody> <tr><td>0.00</td><td>24.25</td><td>24.25</td><td>24.25</td></tr> <tr><td>0.10</td><td>24.25</td><td>24.25</td><td>24.25</td></tr> <tr><td>0.20</td><td>24.25</td><td>24.25</td><td>24.25</td></tr> <tr><td>0.30</td><td>24.25</td><td>24.25</td><td>24.25</td></tr> <tr><td>0.40</td><td>24.25</td><td>24.25</td><td>24.25</td></tr> <tr><td>0.50</td><td>24.25</td><td>24.25</td><td>24.25</td></tr> </tbody> </table>	Load Current [A]	Output Voltage [V] (100V)	Output Voltage [V] (200V)	Output Voltage [V] (230V)	0.00	24.25	24.25	24.25	0.10	24.25	24.25	24.25	0.20	24.25	24.25	24.25	0.30	24.25	24.25	24.25	0.40	24.25	24.25	24.25	0.50	24.25	24.25	24.25																							
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Note: Slanted line shows the range of the rated load current.

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Model	TUHS10F24																																							
Item	Ripple Voltage (by Load Current)	Temperature 25°C Testing Circuitry Figure C																																						
Object	+24V0.45A																																							
1.Graph																																								
<p>Graph showing Ripple Voltage [mV] vs Load Current [A]. The Y-axis ranges from 0 to 400 mV, and the X-axis ranges from 0.00 to 0.60 A. Two curves are plotted: Input Volt. 100V (solid line with open triangles) and Input Volt. 230V (dashed line with open circles). Both curves show a minimum ripple voltage around 0.1A and then increase slightly as load current increases. A slanted line indicates the rated load current range from approximately 0.32A to 0.45A.</p>																																								
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<p>Measured by 100 MHz Oscilloscope. Ripple Voltage is shown as p-p in the figure below. Note: Slanted line shows the range of the rated load current.</p> <p>T1: Due to AC Input Line T2: Due to Switching</p> <p>Fig. Complex Ripple Wave Form</p>																																								

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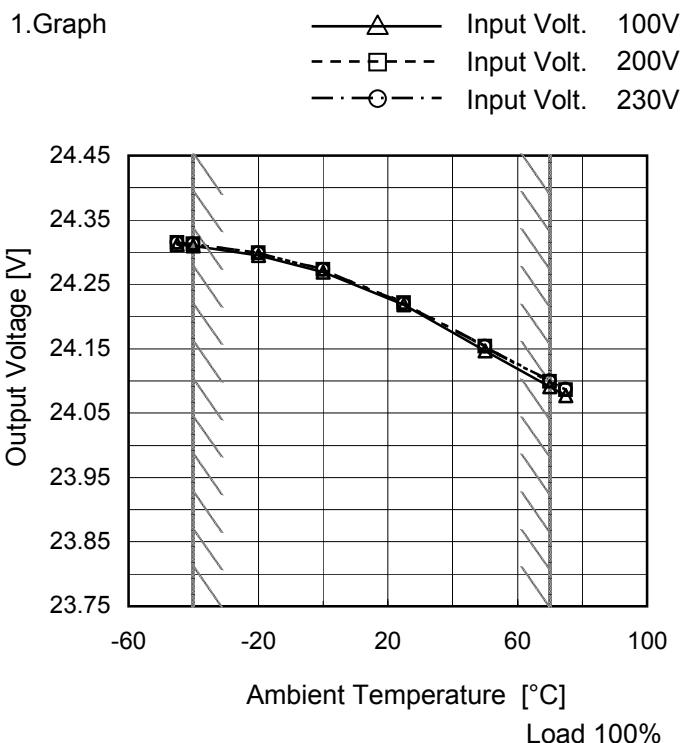
Model	TUHS10F24																																							
Item	Ripple-Noise	Temperature 25°C Testing Circuitry Figure C																																						
Object	+24V0.45A																																							
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<p>Measured by 100 MHz Oscilloscope. Ripple-Noise is shown as p-p in the figure below. Note: Slanted line shows the range of the rated load current.</p> <p>T1: Due to AC Input Line T2: Due to Switching</p> <p>Ripple-Noise [mVp-p]</p> <p>T1</p> <p>T2</p> <p>Fig. Complex Ripple Wave Form</p>																																								

Model	TUHS10F24	Testing Circuitry Figure C																																			
Item	Ripple Voltage (by Ambient Temp.)																																				
Object	+24V0.45A																																				
1.Graph		2.Values																																			
<p>Graph showing Ripple Voltage [mV] vs Ambient Temperature [°C] for TUHS10F24 at Load 100%.</p> <p>Legend:</p> <ul style="list-style-type: none"> - - - □ - - - Input Volt. 100V — △ — Input Volt. 200V <table border="1"> <thead> <tr> <th>Ambient Temperature [°C]</th> <th>Ripple Voltage [mV] (Input Volt. 100V)</th> <th>Ripple Voltage [mV] (Input Volt. 200V)</th> </tr> </thead> <tbody> <tr><td>-45</td><td>45</td><td>15</td></tr> <tr><td>-40</td><td>35</td><td>15</td></tr> <tr><td>-20</td><td>35</td><td>10</td></tr> <tr><td>0</td><td>30</td><td>10</td></tr> <tr><td>25</td><td>35</td><td>10</td></tr> <tr><td>50</td><td>40</td><td>10</td></tr> <tr><td>70</td><td>40</td><td>10</td></tr> <tr><td>75</td><td>45</td><td>15</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> </tbody> </table>		Ambient Temperature [°C]	Ripple Voltage [mV] (Input Volt. 100V)	Ripple Voltage [mV] (Input Volt. 200V)	-45	45	15	-40	35	15	-20	35	10	0	30	10	25	35	10	50	40	10	70	40	10	75	45	15	--	-	-	--	-	-	--	-	-
Ambient Temperature [°C]	Ripple Voltage [mV] (Input Volt. 100V)	Ripple Voltage [mV] (Input Volt. 200V)																																			
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<p>Measured by 100 MHz Oscilloscope. Note: Slanted line shows the range of the rated ambient temperature.</p>																																					

Model TUHS10F24

Item Ambient Temperature Drift

Object +24V0.45A



Testing Circuitry Figure A

2.Values

Ambient Temperature [°C]	Output Voltage [V]		
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]
-45	24.311	24.315	24.315
-40	24.310	24.313	24.313
-20	24.295	24.298	24.299
0	24.269	24.273	24.273
25	24.219	24.222	24.221
50	24.147	24.153	24.154
70	24.091	24.099	24.100
75	24.077	24.086	24.087
--	-	-	-
--	-	-	-
--	-	-	-

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



Model	TUHS10F24	Testing Circuitry Figure A
Item	Output Voltage Accuracy	
Object	+24V0.45A	

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 : -40 - 70°C

Input Voltage : 85 - 264V

Load Current : 0 - 0.45A

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

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

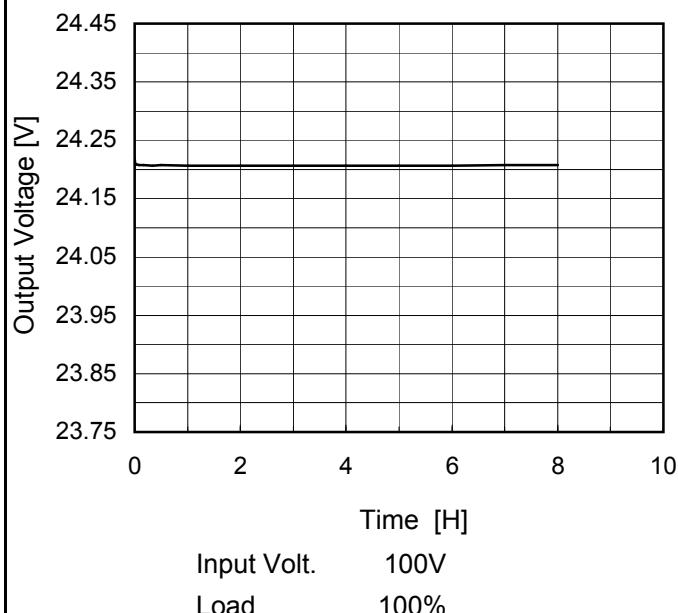
2. Values

Item	Temperature [°C]	Input Voltage[V]	Output		Output Voltage Accuracy	
			Current[A]	Voltage[V]	Value [mV]	Ration [%]
Maximum Voltage	-40	264	0	24.321	±115	±0.5
Minimum Voltage	70	85	0.45	24.091		

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Model	TUHS10F24
Item	Time Lapse Drift
Object	+24V0.45A

1.Graph



Temperature 25°C
Testing Circuitry Figure A

2.Values

Time since start [H]	Output Voltage [V]
0.0	24.219
0.5	24.207
1.0	24.207
2.0	24.207
3.0	24.206
4.0	24.206
5.0	24.206
6.0	24.207
7.0	24.207
8.0	24.207

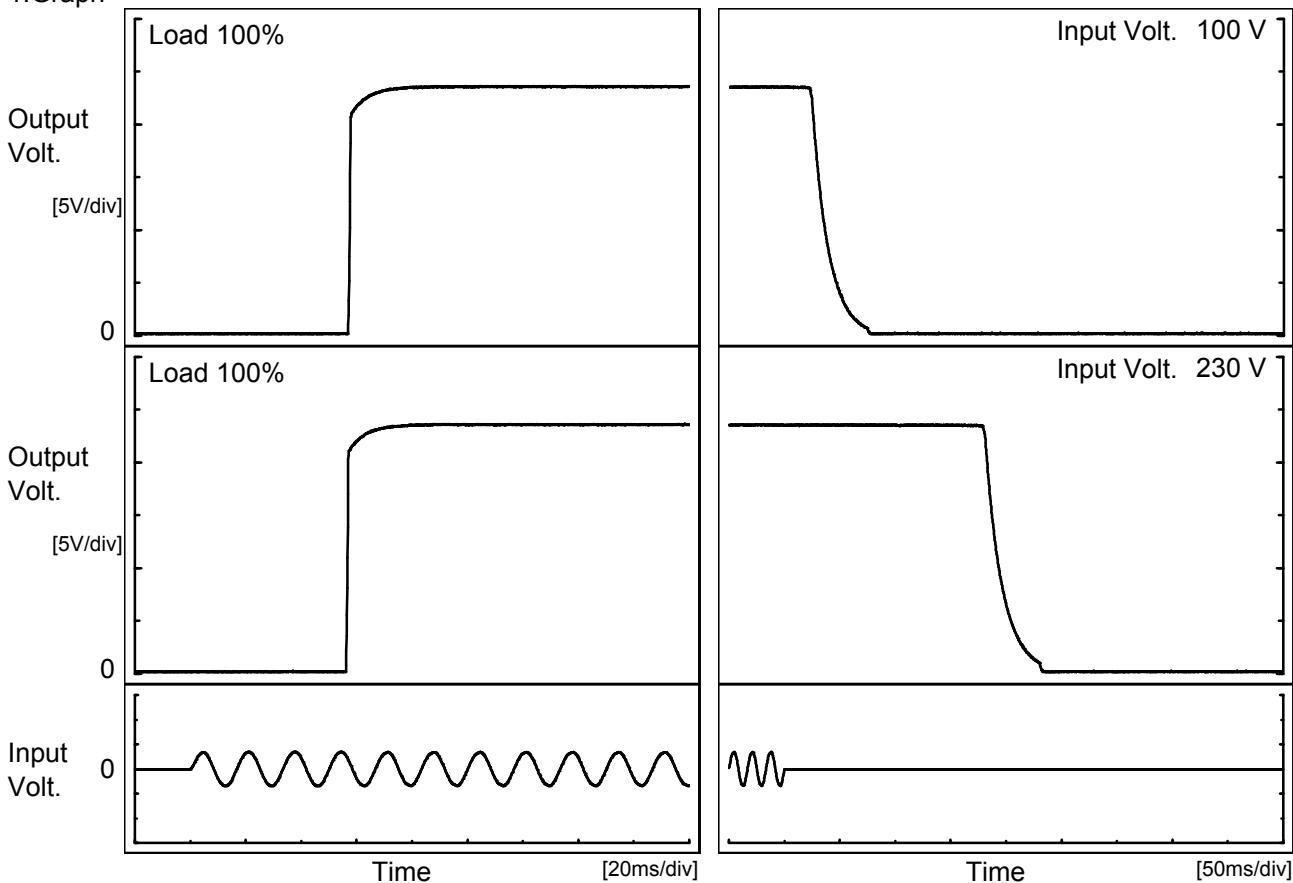
* The characteristic of AC230V is equal.

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Model	TUHS10F24
Item	Rise and Fall Time
Object	+24V0.45A

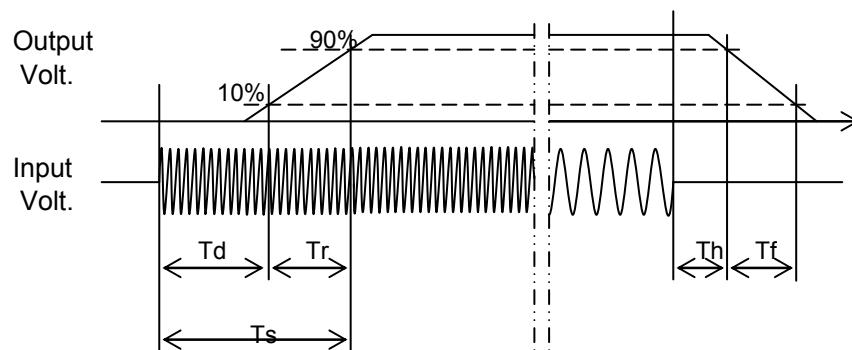
Temperature 25°C
Testing Circuitry Figure A

1. Graph



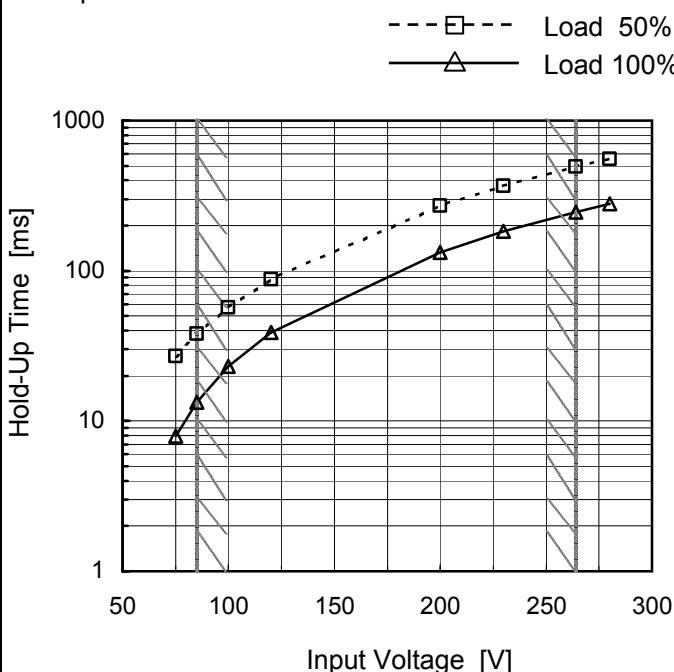
2. Values

Input Volt.	Time	Td	Tr	Ts	Th	Tf	[ms]
100 V		57.2	3.1	60.3	22.8	30.8	
230 V		56.4	2.7	59.1	182.5	33.0	



Model	TUHS10F24
Item	Hold-Up Time
Object	+24V0.45A

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.

Temperature 25°C
Testing Circuitry Figure A

2. Values

Input Voltage [V]	Hold-Up Time [ms]	
	Load 50%	Load 100%
75	27	8
85	38	13
100	57	23
120	88	39
200	272	133
230	366	183
264	492	245
280	557	280
--	-	-

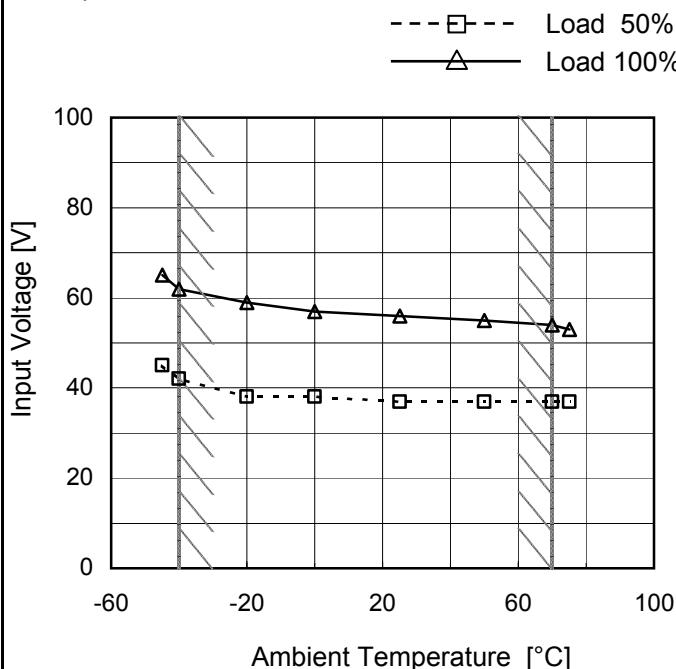
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Item	Instantaneous Interruption Compensation																																																				
Object	+24V0.45A																																																				
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0.32	43	212	288																																																		
0.40	31	166	226																																																		
0.45	23	133	183																																																		
0.50	16	103	143																																																		
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Note: Slanted line shows the range of the rated load current.

Model	TUHS10F24
Item	Minimum Input Voltage for Regulated Output Voltage
Object	+24V0.45A

Testing Circuitry Figure A

1.Graph



2.Values

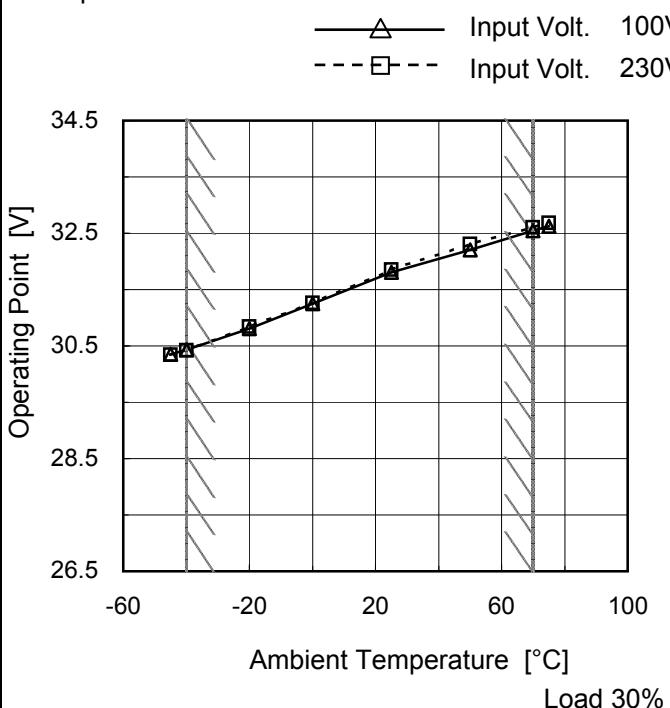
Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-45	45	65
-40	42	62
-20	38	59
0	38	57
25	37	56
50	37	55
70	37	54
75	37	53
--	-	-
--	-	-
--	-	-

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

Model	TUHS10F24	Temperature Testing Circuitry Figure A	25°C																																																					
Item	Overcurrent Protection																																																							
Object	+24V0.45A																																																							
1. Graph		2. Values																																																						
<p>Output Voltage [V]</p> <p>Load Current [A]</p> <p>Note: Slanted line shows the range of the rated load current.</p>		<table border="1"> <thead> <tr> <th rowspan="2">Output Voltage [V]</th> <th colspan="2">Load Current [A]</th> </tr> <tr> <th>Input Volt. 100[V]</th> <th>Input Volt. 230[V]</th> </tr> </thead> <tbody> <tr><td>24.0</td><td>0.62</td><td>0.76</td></tr> <tr><td>--</td><td>-</td><td>-</td></tr> </tbody> </table>		Output Voltage [V]	Load Current [A]		Input Volt. 100[V]	Input Volt. 230[V]	24.0	0.62	0.76	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-
Output Voltage [V]	Load Current [A]																																																							
	Input Volt. 100[V]	Input Volt. 230[V]																																																						
24.0	0.62	0.76																																																						
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Model	TUHS10F24
Item	Oversupply Protection
Object	+24V0.45A

1. Graph



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. 100[V]	Input Volt. 230[V]
-45	30.35	30.34
-40	30.43	30.42
-20	30.81	30.84
0	31.25	31.26
25	31.81	31.85
50	32.21	32.31
70	32.55	32.61
75	32.63	32.68
--	-	-
--	-	-
--	-	-

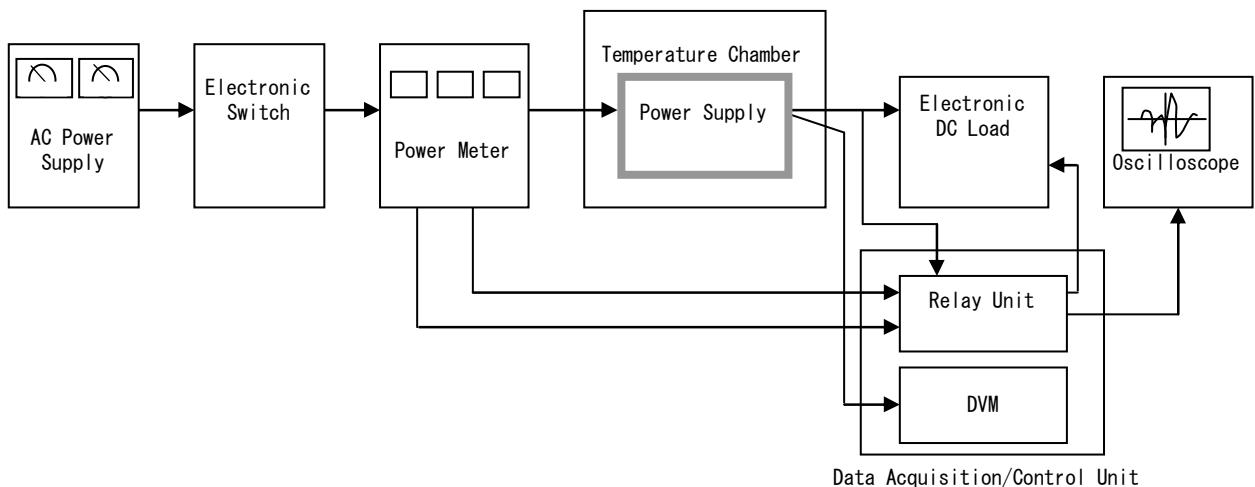


Figure A

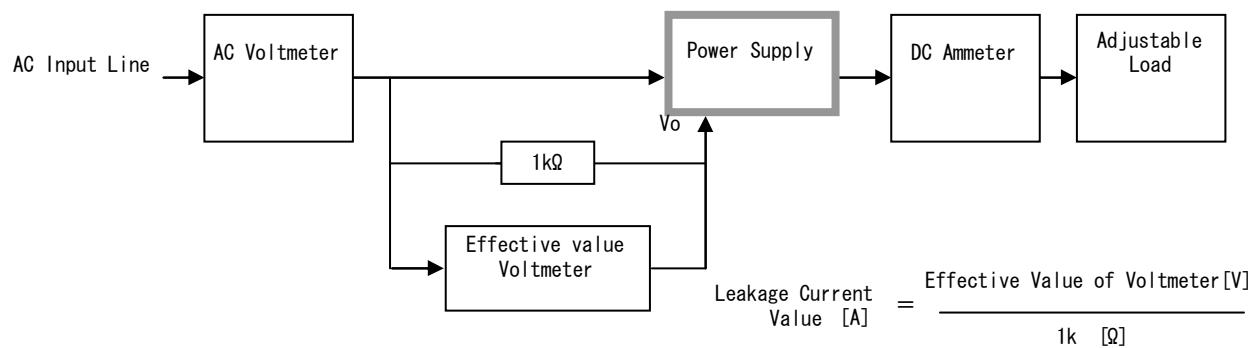


Figure B (DEN-AN)

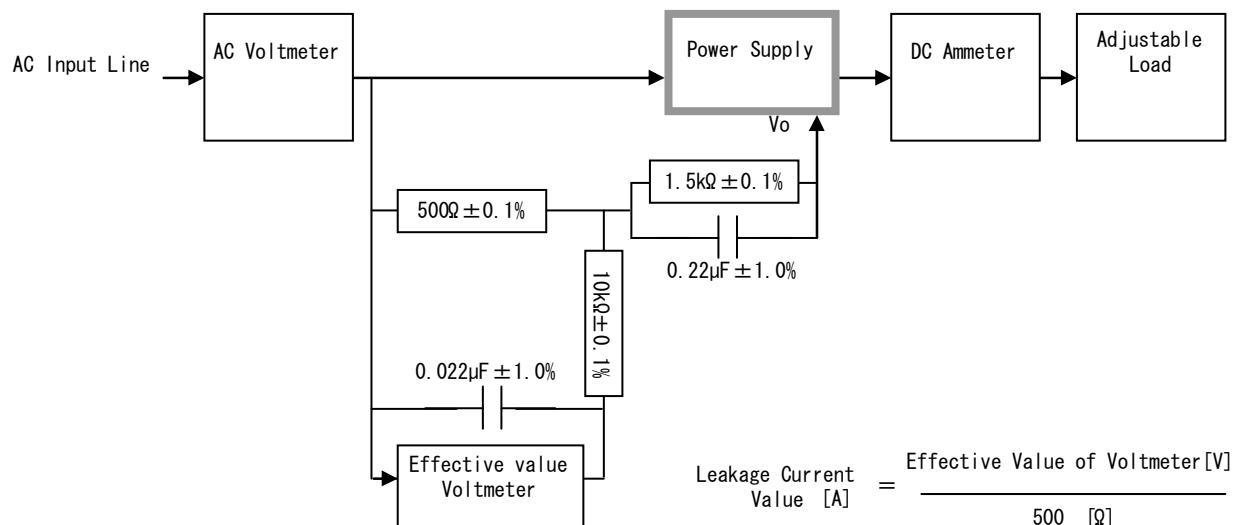


Figure B (IEC60950-1)

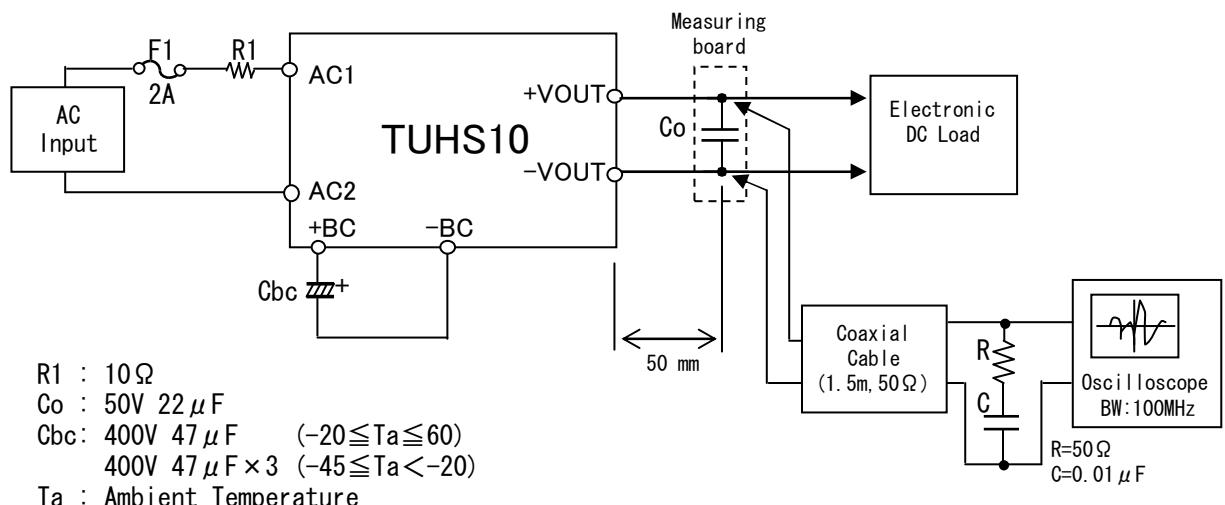


Figure C