



TEST DATA OF LHA150F-12

Regulated DC Power Supply
August 29, 2019

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Tomoyuki Sakuma Design Engineer

COSEL CO.,LTD.

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Model		LHA150F-12		Temperature 25°C																																																				
Item		Input Current (by Load Current)		Testing Circuitry Figure A																																																				
Object		_____																																																						
1.Graph		<div><div><div>—△—</div>Input Volt. 100V</div><div><div>---□---</div>Input Volt. 200V</div><div><div>-·-○-·-</div>Input Volt. 230V</div></div> <p>Note: Slanted line shows the range of the rated load current.</p>		2.Values																																																				
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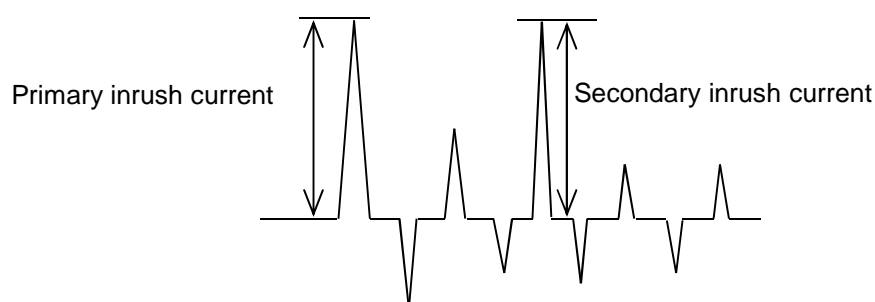
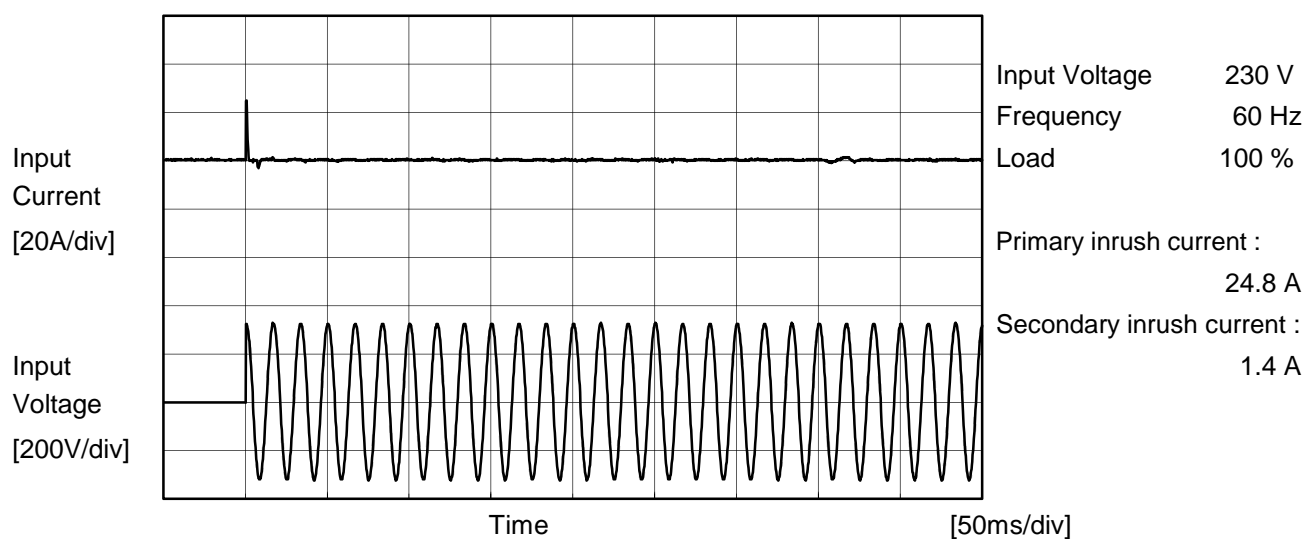
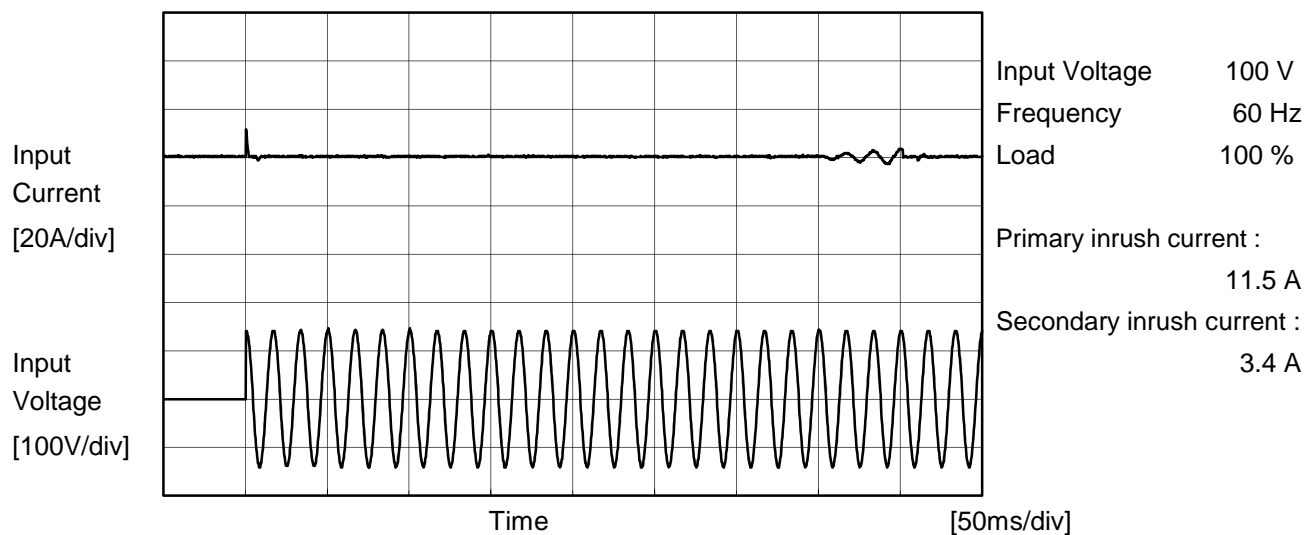
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Item		Inrush Current	
Object		_____	





LOREL		Temperature 25°C Testing Circuitry Figure B
Model	LHA150F-12	
Item	Leakage Current	
Object	_____	

1.Results

Standards	Testing Circuitry	Measuring Method	Input Volt.			Note
			100 [V]	230 [V]	240 [V]	
DEN-AN	Figure B-1	Both phases	0.16	0.39	0.41	Operation
		One of phases	0.27	0.69	0.72	Stand by
IEC62368-1	Figure B-2	Both phases	0.16	0.38	0.39	Operation
		One of phases	0.27	0.67	0.70	Stand by
	Figure B-3	Both phases	0.16	0.38	0.39	Operation
		One of phases	0.27	0.66	0.70	Stand by

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

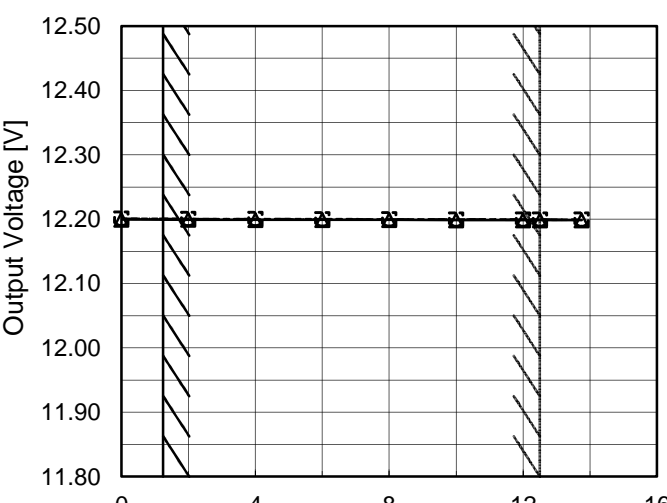
2.Condition

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



Model		LHA150F-12	Temperature		25°C
Item		Line Regulation	Testing Circuitry		Figure A
Object		+12V12.5A			
1.Graph			2.Values		
<div><div><div><div><div></div><div></div></div><div></div></div><div><div></div><div></div></div><div>Load 50%</div></div><div><div><div><div></div><div></div></div><div></div></div><div></div></div><div>Load 100%</div></div> <div><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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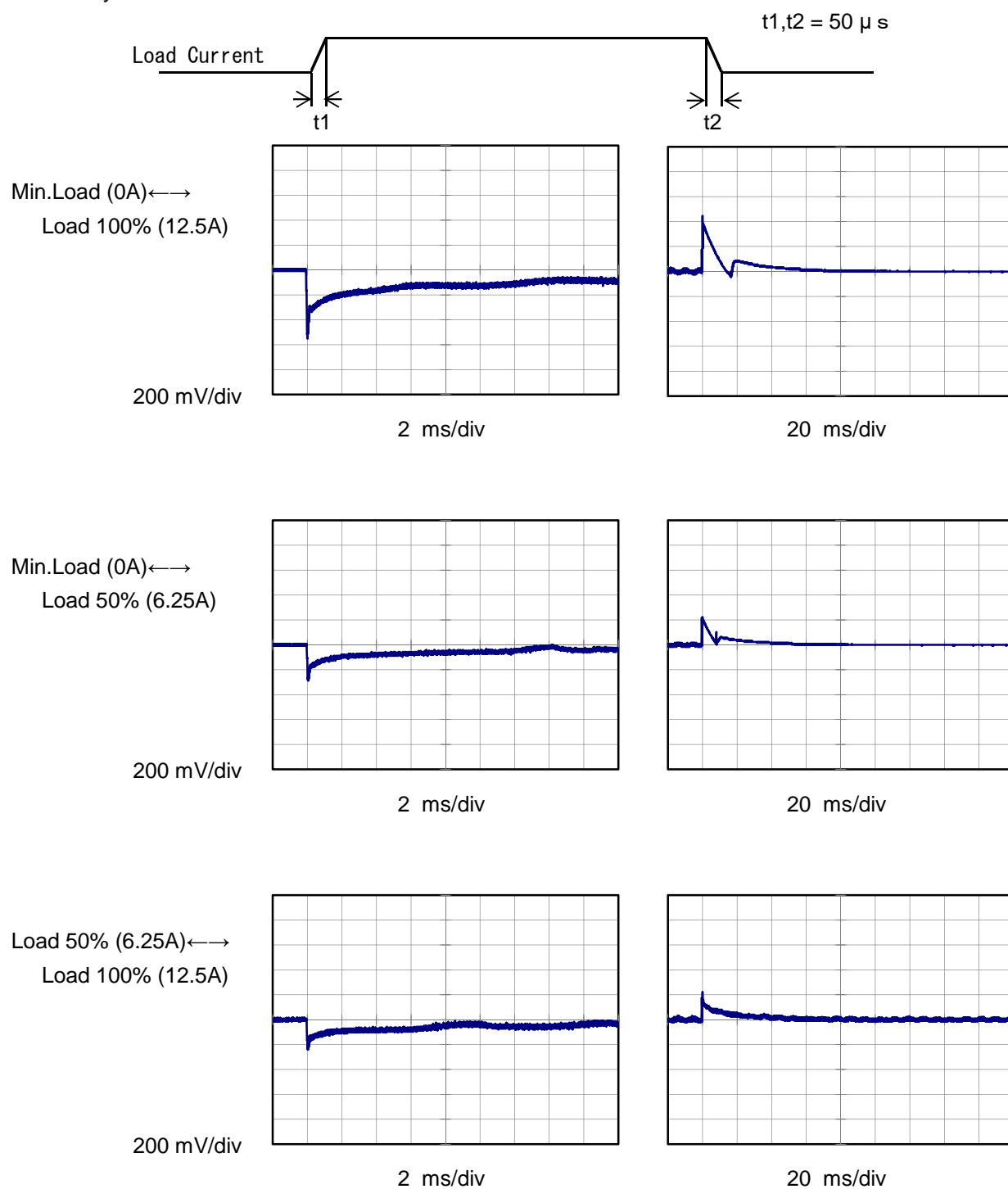


Model		LHA150F-12		Temperature Testing Circuitry	25°C Figure A																																																			
Item		Load Regulation																																																						
Object		+12V12.5A																																																						
1.Graph				2.Values																																																				
<div><div><div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div>—△—</div><div>Input Volt.</div><div>100V</div></div><div><div>---□---</div><div>Input Volt.</div><div>200V</div></div><div><div>---○---</div><div>Input Volt.</div><div>230V</div></div></div><p>Note: Slanted line shows the range of the rated load current.</p></div>				<table><tr><th rowspan="2">Load Current [A]</th><th colspan="3">Output Voltage [V]</th></tr><tr><th>Input Volt. 100[V]</th><th>Input Volt. 200[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>0.00</td><td>12.200</td><td>12.201</td><td>12.201</td></tr><tr><td>2.00</td><td>12.199</td><td>12.200</td><td>12.200</td></tr><tr><td>4.00</td><td>12.199</td><td>12.200</td><td>12.200</td></tr><tr><td>6.00</td><td>12.199</td><td>12.200</td><td>12.200</td></tr><tr><td>8.00</td><td>12.199</td><td>12.200</td><td>12.200</td></tr><tr><td>10.00</td><td>12.199</td><td>12.200</td><td>12.200</td></tr><tr><td>12.00</td><td>12.199</td><td>12.199</td><td>12.199</td></tr><tr><td>12.50</td><td>12.198</td><td>12.199</td><td>12.199</td></tr><tr><td>13.75</td><td>12.198</td><td>12.199</td><td>12.199</td></tr><tr><td>--</td><td>--</td><td>--</td><td>--</td></tr><tr><td>--</td><td>--</td><td>--</td><td>--</td></tr></table>		Load Current [A]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.00	12.200	12.201	12.201	2.00	12.199	12.200	12.200	4.00	12.199	12.200	12.200	6.00	12.199	12.200	12.200	8.00	12.199	12.200	12.200	10.00	12.199	12.200	12.200	12.00	12.199	12.199	12.199	12.50	12.198	12.199	12.199	13.75	12.198	12.199	12.199	--	--	--	--	--	--	--	--
Load Current [A]	Output Voltage [V]																																																							
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Model	LHA150F-12	Temperature	25°C
Item	Dynamic Load Response	Testing Circuitry	Figure A
Object	+12V12.5A		

Input Volt. 230 V
Cycle 1000 ms

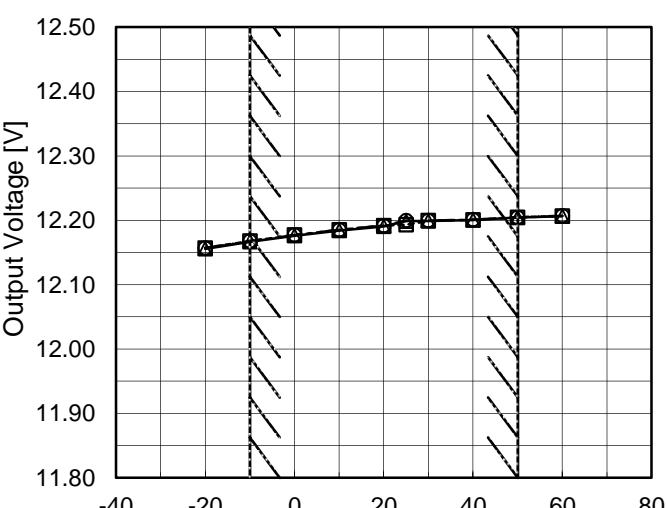


Model		LHA150F-12	Temperature 25°C Testing Circuitry Figure C																																			
Item		Ripple-Noise (by Load Current)																																				
Object		+12V12.5A																																				
1.Graph			2.Values																																			
<div><div><div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div>Input Volt. 100V</div><div>Input Volt. 230V</div></div></div><div><table><thead><tr><th>Load Current [A]</th><th>Input Volt. 100 [V]</th><th>Input Volt. 230 [V]</th></tr></thead><tbody><tr><td>0.00</td><td>30</td><td>30</td></tr><tr><td>2.00</td><td>40</td><td>40</td></tr><tr><td>4.00</td><td>50</td><td>50</td></tr><tr><td>6.00</td><td>50</td><td>50</td></tr><tr><td>8.00</td><td>60</td><td>60</td></tr><tr><td>10.00</td><td>60</td><td>60</td></tr><tr><td>12.00</td><td>80</td><td>80</td></tr><tr><td>12.50</td><td>80</td><td>80</td></tr><tr><td>13.75</td><td>90</td><td>90</td></tr><tr><td>--</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td></tr></tbody></table><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></div></div>				Load Current [A]	Input Volt. 100 [V]	Input Volt. 230 [V]	0.00	30	30	2.00	40	40	4.00	50	50	6.00	50	50	8.00	60	60	10.00	60	60	12.00	80	80	12.50	80	80	13.75	90	90	--	-	-	--	-
Load Current [A]	Input Volt. 100 [V]	Input Volt. 230 [V]																																				
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<div><div><div><div>T1: Due to AC Input Line</div><div>T2: Due to Switching</div></div><div><div>Ripple-Noise [mVp-p]</div><div>T2</div></div></div><div><p>Fig. Complex Ripple Wave Form</p></div></div>																																						

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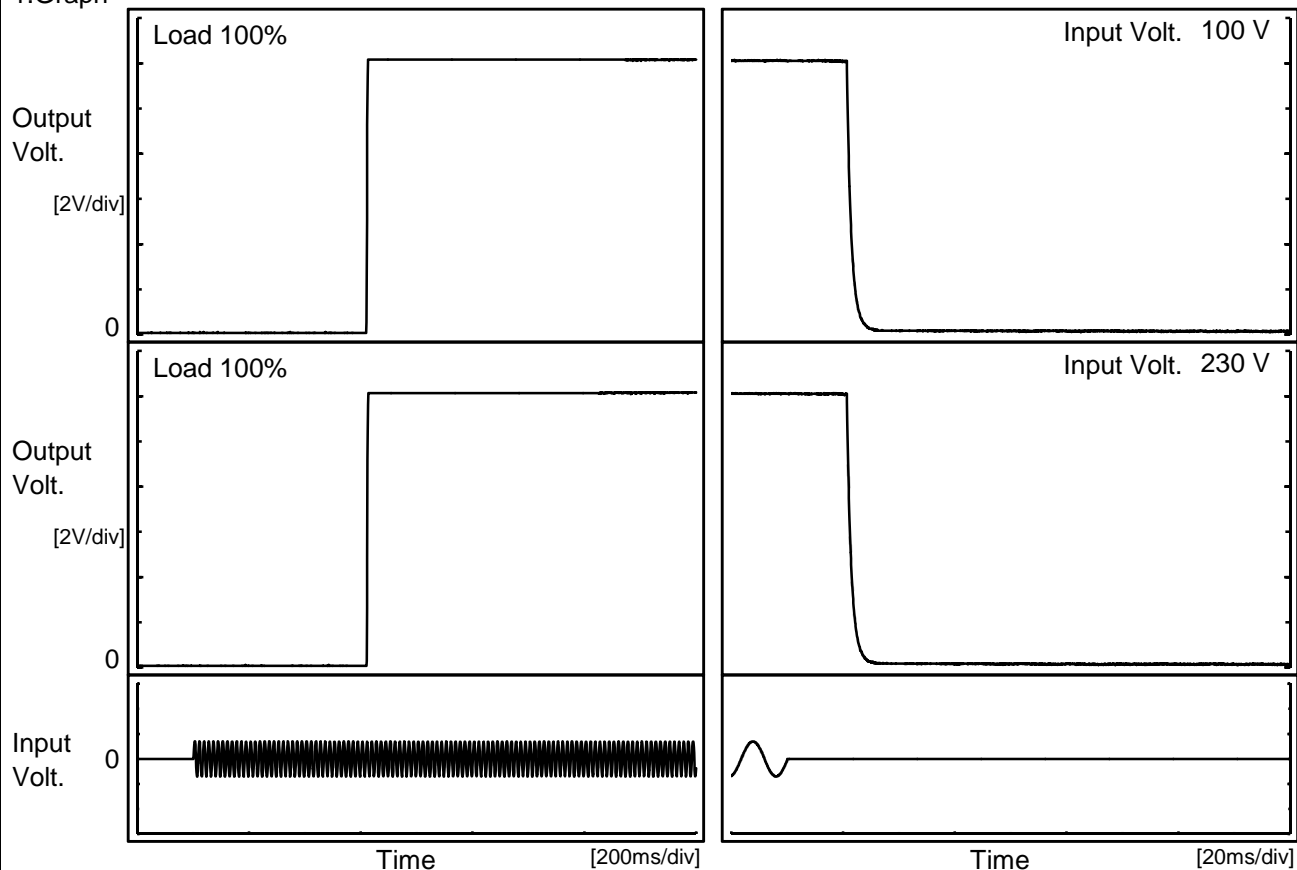


Model		LHA150F-12	Testing Circuitry Figure A																																																			
Item		Ambient Temperature Drift																																																				
Object		+11V12.5A																																																				
1.Graph																																																						
		<div><div><div>—△—</div><div>Input Volt.</div><div>100V</div></div><div><div>---□---</div><div>Input Volt.</div><div>200V</div></div><div><div>---○---</div><div>Input Volt.</div><div>230V</div></div></div>	2.Values																																																			
		<table><tr><th rowspan="2">Ambient Temperature [°C]</th><th colspan="3">Output Voltage [V]</th></tr><tr><th>Input Volt. 100[V]</th><th>Input Volt. 200[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>-20</td><td>12.156</td><td>12.157</td><td>12.157</td></tr><tr><td>-10</td><td>12.167</td><td>12.168</td><td>12.168</td></tr><tr><td>0</td><td>12.176</td><td>12.177</td><td>12.177</td></tr><tr><td>10</td><td>12.184</td><td>12.185</td><td>12.185</td></tr><tr><td>20</td><td>12.191</td><td>12.192</td><td>12.192</td></tr><tr><td>25</td><td>12.199</td><td>12.193</td><td>12.199</td></tr><tr><td>30</td><td>12.199</td><td>12.200</td><td>12.199</td></tr><tr><td>40</td><td>12.200</td><td>12.201</td><td>12.201</td></tr><tr><td>50</td><td>12.204</td><td>12.204</td><td>12.205</td></tr><tr><td>60</td><td>12.207</td><td>12.207</td><td>12.207</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr></table>	Ambient Temperature [°C]	Output Voltage [V]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	-20	12.156	12.157	12.157	-10	12.167	12.168	12.168	0	12.176	12.177	12.177	10	12.184	12.185	12.185	20	12.191	12.192	12.192	25	12.199	12.193	12.199	30	12.199	12.200	12.199	40	12.200	12.201	12.201	50	12.204	12.204	12.205	60	12.207	12.207	12.207	--	-	-	-	
Ambient Temperature [°C]	Output Voltage [V]																																																					
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]																																																			
-20	12.156	12.157	12.157																																																			
-10	12.167	12.168	12.168																																																			
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60	12.207	12.207	12.207																																																			
--	-	-	-																																																			
		Load 100%																																																				
Note: Slanted line shows the range of the rated ambient temperature.																																																						



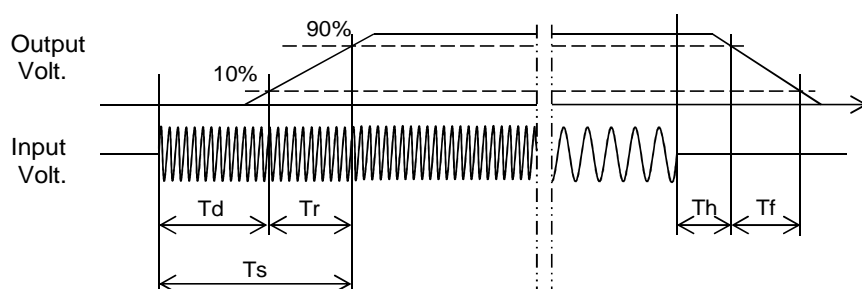
Model	LHA150F-12	Temperature	25°C
Item	Rise and Fall Time	Testing Circuitry	Figure A
Object	+12V12.5A		

1.Graph



2.Values

Input Volt.	Time	Td	Tr	Ts	Th	Tf
100 V		620.0	6.5	626.5	21.5	3.6
230 V		621.0	6.5	627.5	21.5	3.6





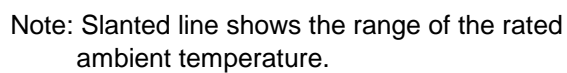
Model	LHA150F-12																																		
Item	Hold-Up Time	Temperature	25°C																																
		Testing Circuitry	Figure A																																
Object	+12V12.5A																																		
1.Graph		2.Values																																	
<div><div><div>---□---</div><div>Load 50%</div></div><div><div>—△—</div><div>Load 100%</div></div></div> <table><thead><tr><th rowspan="2">Input Voltage [V]</th><th colspan="2">Hold-Up Time [ms]</th></tr><tr><th>Load 50%</th><th>Load 100%</th></tr></thead><tbody><tr><td>85</td><td>42</td><td>-</td></tr><tr><td>90</td><td>42</td><td>21</td></tr><tr><td>100</td><td>42</td><td>21</td></tr><tr><td>120</td><td>42</td><td>21</td></tr><tr><td>200</td><td>42</td><td>21</td></tr><tr><td>230</td><td>42</td><td>21</td></tr><tr><td>264</td><td>43</td><td>21</td></tr><tr><td>280</td><td>43</td><td>22</td></tr><tr><td>--</td><td>-</td><td>-</td></tr></tbody></table>		Input Voltage [V]	Hold-Up Time [ms]		Load 50%	Load 100%	85	42	-	90	42	21	100	42	21	120	42	21	200	42	21	230	42	21	264	43	21	280	43	22	--	-	-		
Input Voltage [V]	Hold-Up Time [ms]																																		
	Load 50%	Load 100%																																	
85	42	-																																	
90	42	21																																	
100	42	21																																	
120	42	21																																	
200	42	21																																	
230	42	21																																	
264	43	21																																	
280	43	22																																	
--	-	-																																	
<p>This duration covers from Shut-off of input voltage to the moment when output voltage descends to the rated range of voltage accuracy.</p> <p>Note: Slanted line shows the range of the rated input voltage.</p>																																			



Model		LHA150F-12		Temperature 25°C																																																				
Item		Instantaneous Interruption Compensation		Testing Circuitry Figure A																																																				
Object		+12V12.5A																																																						
1.Graph		<div><div><div>—△—</div><div>Input Volt.</div><div>100V</div></div><div><div>---□---</div><div>Input Volt.</div><div>200V</div></div><div><div>---○---</div><div>Input Volt.</div><div>230V</div></div></div> <div><div>Instantaneous Compensation Time [ms]</div><div>Load Current [A]</div></div>		2.Values																																																				
		<table><tr><th rowspan="2">Load Current [A]</th><th colspan="3">Time [ms]</th></tr><tr><th>Input Volt. 100[V]</th><th>Input Volt. 200[V]</th><th>Input Volt. 230[V]</th></tr><tr><td>0.00</td><td>-</td><td>-</td><td>-</td></tr><tr><td>2.00</td><td>110</td><td>121</td><td>122</td></tr><tr><td>4.00</td><td>64</td><td>64</td><td>64</td></tr><tr><td>6.00</td><td>43</td><td>43</td><td>43</td></tr><tr><td>8.00</td><td>31</td><td>31</td><td>31</td></tr><tr><td>10.00</td><td>26</td><td>26</td><td>26</td></tr><tr><td>12.00</td><td>20</td><td>21</td><td>22</td></tr><tr><td>12.50</td><td>20</td><td>20</td><td>20</td></tr><tr><td>13.75</td><td>18</td><td>19</td><td>19</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr><tr><td>--</td><td>-</td><td>-</td><td>-</td></tr></table>				Load Current [A]	Time [ms]			Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]	0.00	-	-	-	2.00	110	121	122	4.00	64	64	64	6.00	43	43	43	8.00	31	31	31	10.00	26	26	26	12.00	20	21	22	12.50	20	20	20	13.75	18	19	19	--	-	-	-	--	-	-	-
Load Current [A]	Time [ms]																																																							
	Input Volt. 100[V]	Input Volt. 200[V]	Input Volt. 230[V]																																																					
0.00	-	-	-																																																					
2.00	110	121	122																																																					
4.00	64	64	64																																																					
6.00	43	43	43																																																					
8.00	31	31	31																																																					
10.00	26	26	26																																																					
12.00	20	21	22																																																					
12.50	20	20	20																																																					
13.75	18	19	19																																																					
--	-	-	-																																																					
--	-	-	-																																																					
Note: Slanted line shows the range of the rated load current.																																																								

Testing Circuitry Figure A

2.Values



Ambient Temperature [°C]	Input Voltage [V]	
	Load 50%	Load 100%
-20	62	62
-10	62	62
0	62	62
10	62	63
20	62	63
25	63	63
30	63	63
40	63	63
50	63	63
60	63	63
--	-	-



Model	LHA150F-12																																														
Item	Overcurrent Protection	Temperature	25°C																																												
Object	+12V12.5A	Testing Circuitry	Figure A																																												
1.Graph		2.Values																																													
<div><div><div></div><div>Input Volt. 100V</div></div><div><div></div><div>Input Volt. 230V</div></div></div> <p>Note: Slanted line shows the range of the rated load current.</p> <p>Overcurrent protection is Hiccup mode.</p>		<table><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><tr><td>12</td><td>18.50</td><td>18.50</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. 100[V]	Input Volt. 230[V]	12	18.50	18.50	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-	--	-	-
Output Voltage [V]	Load Current [A]																																														
	Input Volt. 100[V]	Input Volt. 230[V]																																													
12	18.50	18.50																																													
--	-	-																																													
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Model		LHA150F-12
Item		Overvoltage Protection
Object		+12V12.5A

1.Graph

—△—

Input Volt. 100V

---□---

Input Volt. 230V

Operating Point [V]

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]
-20	14.64	14.64
-10	14.76	14.76
0	14.76	14.76
10	14.87	14.87
20	14.93	14.93
25	14.93	14.93
30	15.05	15.05
40	15.05	15.05
50	15.17	15.17
60	15.29	15.29
--	-	-

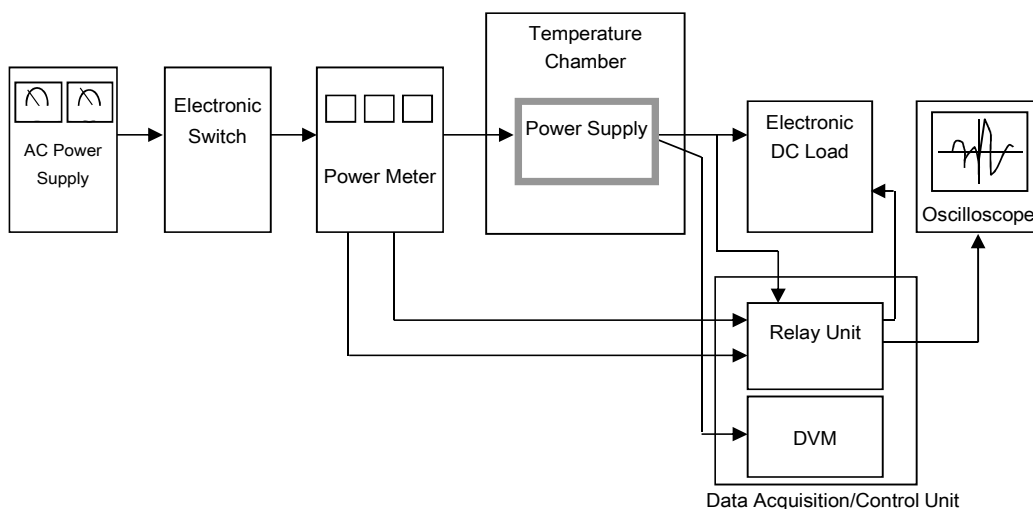


Figure A

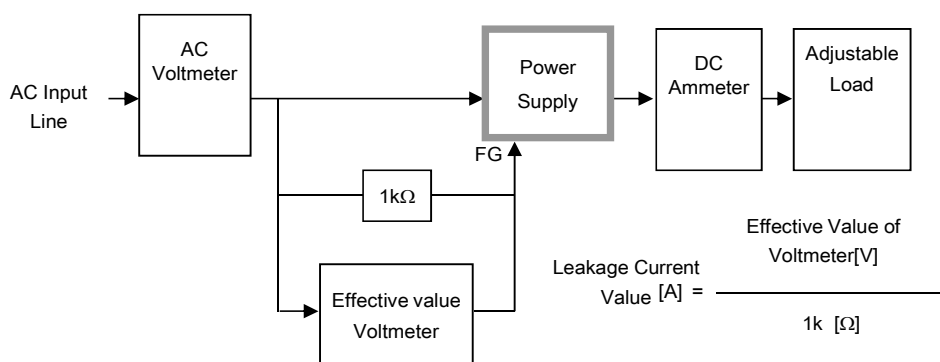


Figure B-1 (DEN-AN)

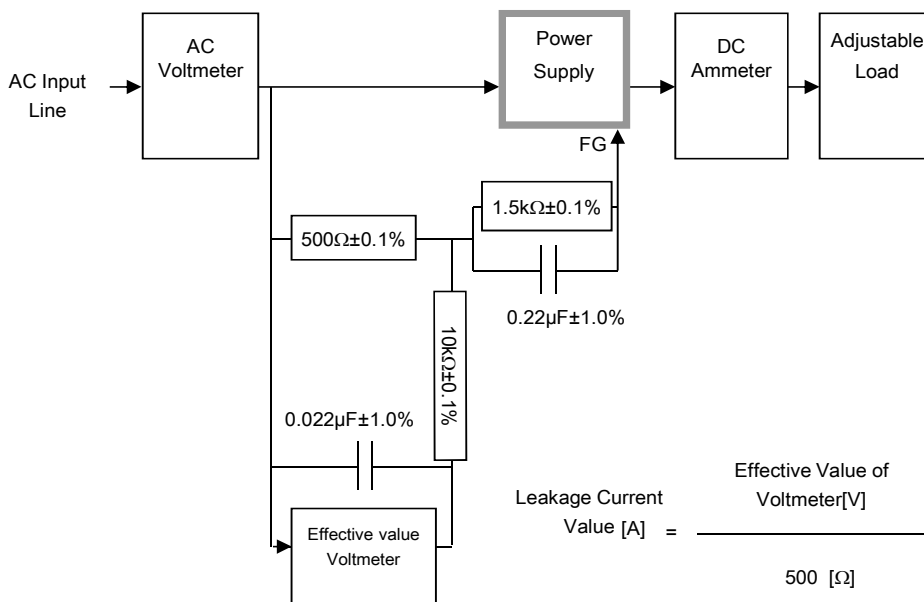


Figure B-2 (IEC62368-1 refer to IEC60990 Fig.4)

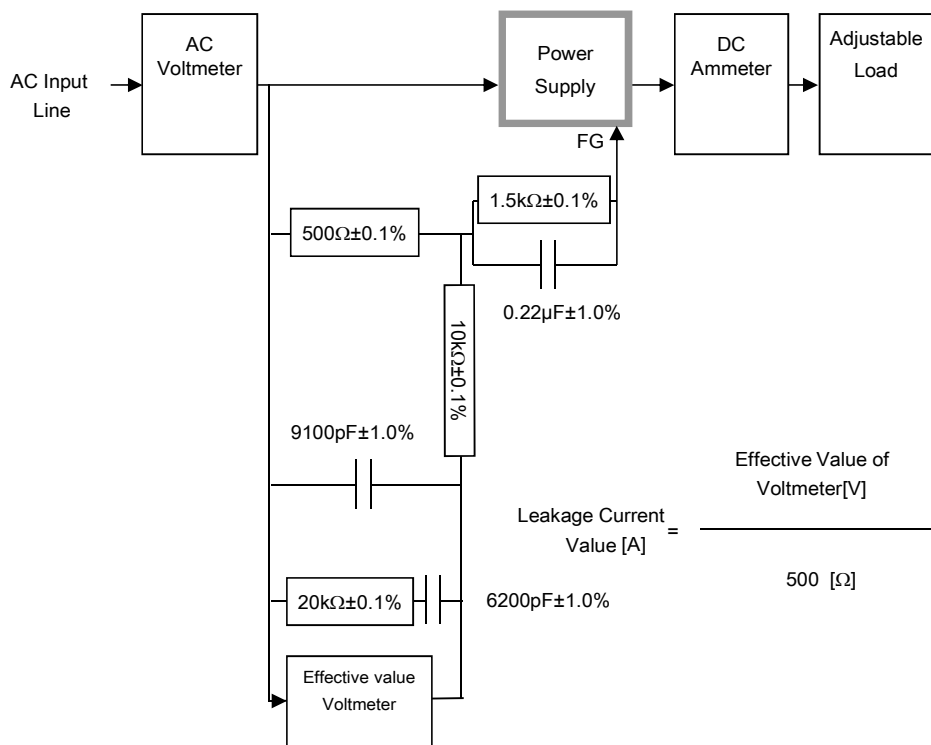


Figure B-3 (IEC62368-1 refer to IEC60990 Fig.5)

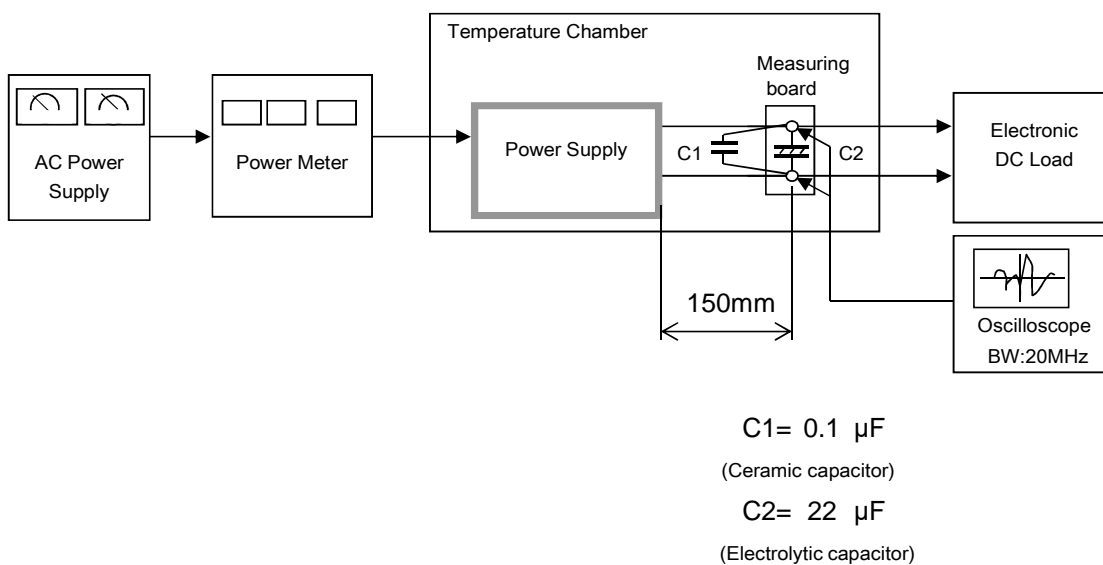


Figure C