

APPLICATION NOTE #102

The various specifications that relate to IEC 555-2 imply that to fully test any product operating from a single phase AC supply to IEC 555-2, the test AC power source must be able to provide 16A rms., approximately 42A peak and, under worst case load conditions (i.e., the load barely passes the specification), the AC source must not exhibit voltage harmonics greater than those defined in the standard. These are:

Even Harm	Limit (% of Vrms)	Odd Harm	Limit (% of Vrms)
2	0.2 %	3	0.9 %
4	0.2 %	5	0.4 %
6	0.2 %	7	0.3 %
8	0.2 %	9	0.2 %
10	0.2 %	11 - 39	0.1 %
12 - 40	0.1 %		

Table 1: IEC 1000-3-2 Voltage harmonics

The only way to adequately evaluate the performance of an AC source is to construct a dummy load that draws harmonic current close to the limit of the standard, then measure the voltage harmonic distortion when the AC power source is driving this load.

Because there are several different levels of harmonics, the load is complex, and made from several diode/capacitor/resistor networks to approximate to the worst case load. It is also important that the load draws 16A rms. and 42A peak, because this represents the worst case condition.

The load test circuit schematic is shown in Figure 2 (call/fax for complete schematic and parts list). Whether the AC source is able to pass this critical test depends on the bandwidth and dynamic output impedance of the source (see California Instruments' -555 Application Note nr. 101).

TESTING AC POWER SOURCES TO DETERMINE THEIR EFFECT ON IEC 1000-3-2 MEASUREMENTS

Many high performance AC sources will not meet these stringent requirements. Viable candidate AC sources should be fully evaluated with this complex load to determine their suitability for use in IEC 555-2 applications.

The attached data, Figure 1, covers the California Instruments Model 4500L-1PT-555 and a similar 4.5 kVA product from a different manufacturer (Brand X).

Notice that even the *No Load* voltage harmonic distortion is significantly better using the California Instruments' product.

Under load conditions, Brand X is out of the specification range at the following harmonics.

<u>Harmonic #</u>	<u>Data</u>	<u>Specification</u>
2	0.34 %	0.2 %
5	0.42 %	0.4 %
11	0.22 %	0.1 %
13	0.19 %	0.1 %

Also note the comparison of the passing standard margin, at several harmonics, compared to the California Instruments (**) 4500L-1PT-555.

AC Power Sources For IEC 1000-3-2 Testing

Evaluation under worst case load conditions.

Harmonic #	Voltage Harmonic Distortion					Load Current A*	Class A Amps	Class B Amps
	CI 4500L No Load	Brand X No Load	CI 4500L Loaded	Brand X Loaded	Spec. Limit			
1	230.2V	230.0V	229.6V	229.5V	230V	14.230		
2	0.06%	0.11%	0.12%	0.34%	0.20%	1.700	1.080	1.620
3	0.01%	0.29%	0.14%	0.76%	0.90%	3.800	2.300	3.450
4	0.01%	0.03%	0.04%	** 0.13%	0.20%	1.070	0.430	0.650
5	0.02%	0.03%	0.03%	0.42%	0.40%	2.160	1.140	1.710
6	0.01%	0.01%	0.05%	0.08%	0.20%	0.436	0.300	0.450
7	0.02%	0.01%	0.03%	** 0.26%	0.30%	1.060	0.770	1.160
8	0.01%	0.01%	0.01%	** 0.11%	0.20%	0.139	0.230	0.350
9	0.01%	0.01%	0.05%	** 0.18%	0.20%	0.782	0.400	0.600
10	0.01%	0.00%	0.02%	** 0.14%	0.20%	0.229	0.180	0.280
11	0.01%	0.00%	0.08%	0.22%	0.10%	0.781	0.330	0.500
12	0.00%	0.01%	0.03%	** 0.13%	0.10%	0.368	0.150	0.230
13	0.01%	0.00%	0.07%	0.19%	0.10%	0.653	0.210	0.310
14	0.01%	0.01%	0.06%	0.08%	0.10%	0.440	0.130	0.200
15	0.03%	0.01%	0.10%	0.10%	0.10%	0.473	0.150	0.230
16	0.01%	0.01%	0.06%	0.05%	0.10%	0.402	0.114	0.175
17	0.01%	0.00%	0.08%	0.08%	0.10%	0.407	0.132	0.203
18	0.00%	0.01%	0.06%	0.06%	0.10%	0.339	0.101	0.156
19	0.01%	0.01%	0.08%	0.07%	0.10%	0.338	0.118	0.182
20	0.01%	0.01%	0.08%	0.05%	0.10%	0.326	0.091	0.140
21	0.00%	0.00%	0.07%	0.05%	0.10%	0.243	0.107	0.164
22	0.01%	0.00%	0.09%	0.03%	0.10%	0.330	0.083	0.127
23	0.01%	0.00%	0.05%	0.05%	0.10%	0.199	0.098	0.150
24	0.00%	0.00%	0.08%	0.05%	0.10%	0.293	0.076	0.117
25	0.01%	0.00%	0.06%	0.05%	0.10%	0.202	0.090	0.138
26	0.00%	0.01%	0.07%	0.02%	0.10%	0.212	0.070	0.108
27	0.01%	0.00%	0.06%	0.04%	0.10%	0.185	0.083	0.128
28	0.01%	0.01%	0.05%	0.02%	0.10%	0.130	0.065	0.100
29	0.02%	0.00%	0.05%	0.03%	0.10%	0.149	0.078	0.119
30	0.00%	0.00%	0.03%	0.02%	0.10%	0.082	0.061	0.093
31	0.01%	0.00%	0.04%	0.04%	0.10%	0.115	0.073	0.111
32	0.01%	0.02%	0.02%	0.01%	0.10%	0.056	0.057	0.088
33	0.01%	0.01%	0.03%	0.03%	0.10%	0.076	0.068	0.105
34	0.01%	0.01%	0.02%	0.02%	0.10%	0.036	0.054	0.082
35	0.01%	0.01%	0.02%	0.02%	0.10%	0.039	0.064	0.099
36	0.01%	0.01%	0.01%	0.02%	0.10%	0.021	0.051	0.078
37	0.01%	0.01%	0.03%	0.03%	0.10%	0.031	0.061	0.093
38	0.01%	0.00%	0.01%	0.03%	0.10%	0.015	0.048	0.074
39	0.01%	0.00%	0.03%	0.03%	0.10%	0.043	0.058	0.088
40	0.01%	0.00%	0.02%	0.01%	0.10%	0.008	0.046	0.070
41	0.01%	0.01%	0.03%	0.03%	0.10%	0.041	0.055	0.084
42	0.01%	0.01%	0.01%	0.01%	0.10%	0.003	0.043	0.067
43	0.00%	0.01%	0.02%	0.03%	0.10%	0.040	0.052	0.080
44	0.00%	0.00%	0.01%	0.01%	0.10%	0.005	0.041	0.064
45	0.00%	0.00%	0.02%	0.02%	0.10%	0.033	0.050	0.077
46	0.01%	0.01%	0.01%	0.03%	0.10%	0.003	0.040	0.061
47	0.00%	0.01%	0.02%	0.01%	0.10%	0.015	0.048	0.073
48	0.01%	0.10%	0.01%	0.02%	0.10%	0.007	0.038	0.058
49	0.01%	0.00%	0.01%	0.01%	0.10%	0.011	0.046	0.070

* Measured at 23- V rms.

Figure 1

IEC555-2 16 Amps RMS / 42 Amps Peak Harmonic Crest Factor Test Load

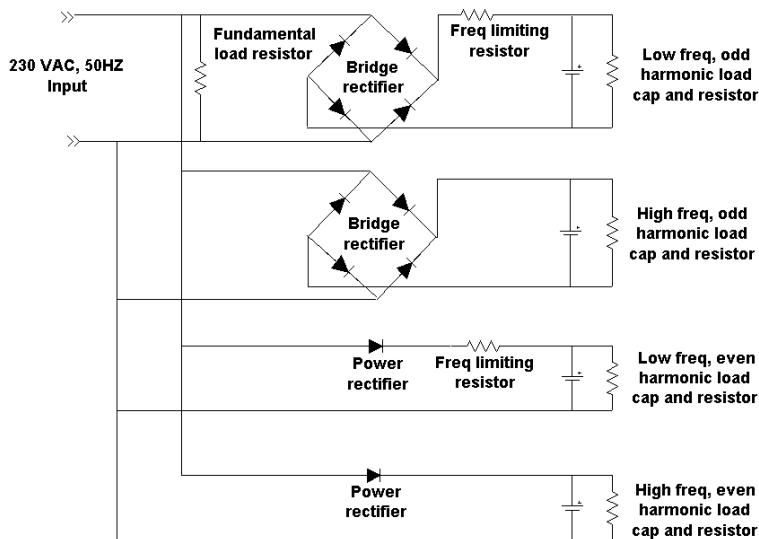


Figure 2

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