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Technical Note

Reliability of CDE Lighting Capacitors Supported by Accelerated Life Testing

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INTRODUCTION

Lower cost sourcing of lighting capacitors can be attractive to reduce total cost of manufacturing. However, especially when sourced from outside the US, there can be an increased risk of failure due to product designs that are not well validated, use of materials that are not always compliant or manufacturing processes that are neither robust nor consistent. In fact, many low cost capacitors available from low cost regions typically fail within 12-24 months when 90+% should survive 8-10 years.

TIGHTLY CONTROLLED DESIGN & MANUFACTURING PROCESSES REDUCE RISK OF FILM CAPACITOR FAILURE

Aerovox has established rigorous manufacturing processes and standards that ensure all capacitors are produced at the same high quality level, whether made in our US, China or India facilities.

Capacitor design enhancements and process developments at Aerovox, including certain electrical characteristics of the metallized dielectric system, were combined with advancements to the very critical encapsulation process. These enhancements were achieved by utilizing comprehensive DOE's and validated by long term accelerated life testing at EIA RS-456A conditions, as well as SALT (Super Accelerated Life Testing) protocols developed by Aerovox to quickly and effectively eliminate variables.

This technical note describes accelerated life tests of Aerovox lighting capacitors manufactured in its China facility. These experiments were conducted at our R&D test laboratories in New Bedford, Massachusetts. The data provides proof of performance and long life in use.

ACCELERATED LIFE TESTING EXPERIMENTAL DATA

Table 1 shows a series of accelerated life tests performed on oil-filled metal case HID lighting capacitors made in China. The test hours multiplied by the test acceleration gives the total test hours or component life hours in the application.

This evaluation shows a total of 6.9 million component test hours without a single failure.

Table1: Accelerated Life Test

Test #	P/N	Rating	Test	# Tested	Results	Total Test Hours	Component Hours
8026	Z91S3007MN	7 μ F 300 VAC	100°C 375 VAC	10	10 OK at 4,000 hrs	40,000	1,200,000
8028	Z93S4024MN	24 μ F 400 VAC	375 VAC 500 VAC	10	10 OK at 2,500 hrs	25,000	750,000
8029	Z93S4024MN	24 μ F 400 VAC	375 VAC 500 VAC	10	OK OK at 2,500 hrs	25,000	750,000
8108	Z93S5226NN	26 μ F 525 VAC	375 VAC 670 VAC	10	OK OK at 2,000 hrs	20,000	600,000
8115	Z93S3226MN	26 μ F 330 VAC	375 VAC 415 VAC	10	10 at at 330 VAC	20,000	600,000
8116	Z93S3326MN	26 μ F 330 VAC	375 VAC 415 VAC	10	OK at at 3,000 hrs	30,000	900,000
8118	Z93S4015MN	15 μ F 400 VAC	375 VAC 500 VAC	10	10 at at 330 VAC	20,000	600,000
8119	Z91S3310MN	10 μ F 330 VAC	375 VAC 415 VAC	10	OK at at 3,000 hrs	30,000	900,000
8167	Z92S4010MN	10 μ F 400 VAC	375 VAC 500 VAC	10	OK at at 330 VAC	20,000	600,000
			Total	90		230,000	6,900,000

As shown in **Table 2**, at 90% confidence we calculate a failure rate of 0.034% per thousand hours or a Mean Time Between Failure (MTBF) of 3 million hours. This failure rate is far less than the EIA-456 design targets for maximum failure rate.

Table 2: Accelerated Life Test Statistics

Total test hours	230,000
Total component hours	6,900,000
Number of failures	0
Failure rate @ 60% confidence	0.013%/1000 hours
MTBF @ 60% confidence	7,500,000 hours
Failure rate @ 90% confidence	0.034%/1000 hours
MTBF @ 90% confidence	3,000,000 hours
EIA 456 failure rate target	0.16%/1000 hours

CONCLUSION

Quality and reliability issues have occurred in many Asian and European produced products that have caused significant problems in a number of applications.

Expert design and rigorous, standardized global manufacturing processes make Aerovox capacitors among the most consistently reliable in the world. Accelerated life testing data provides assurance of positive cost-performance for Aerovox capacitors manufactured outside the US.

