

## Breaking News

# Low-ESR Aluminum Electrolytic Failures Linked to Taiwanese Raw Material Problems

**O**n September 13, 2002, it was reported to *Passive Component Industry Magazine* by contacts in Japan that an unusually high rate of failures of low-ESR aluminum electrolytic capacitors produced in Taiwan by Lelon Electronics, Luxon Electronics, and other aluminum capacitor manufacturers had been traced to a problem with an aqueous electrolyte that had been used throughout the Taiwanese electrolytic capacitor industry.

Reportedly, the problem developed after a materials scientist working for Rubycon Corporation in Japan left the company and began working for Luminous Town Electric in China. The scientist then developed a copy of the Rubycon P-50 type water-based electrolyte, used in

low-ESR aluminum electrolytic capacitors developed by Luminous and equivalent to the Rubycon ZA and ZL series. Subsequently, the scientist's staff members defected with the formula, and began to sell an electrolyte at a low price to many of the major aluminum electrolytic houses in Taiwan, including Luxon Electronics, Lelon Electronics, and other aluminum capacitor manufacturers. (IBM has stated that five companies were affected, while other sources in Taiwan suggest that as many as 11 companies were affected.)

Unfortunately, the staff members who defected from Luminous Town Electric with the formula copied only the partial formula, and the subsequent electrolyte produced was unstable when packaged in a finished alu-

minum capacitor. The instability of the electrolyte in the low-ESR aluminum electrolytic capacitors using this water-based electrolyte leads to the build-up of excess hydrogen inside the aluminum can, which results in either a rupture of the can itself or destruction of the rubber end-seal. Either failure is potentially catastrophic due to the leaking electrolyte. According to top material scientists in the aluminum capacitor industry, if the correct amount of additives is not mixed into a water-based electrolyte, electrolysis will occur, releasing a high amount of hydrogen gas in the can and resulting in catastrophic failure.

Subsequent lifetime tests

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**Taiwanese Aluminum Electrolytic Capacitor Production**

Manufacturer	Monthly Output (Million Pieces)	Yearly Output (Million Pieces)	Source
Lelon	610	7,320	Actual
Luxon	450	5,400	Actual
Taiwan Capacitor*	180	2,160	Actual
Teapo**	155	1,860	Actual
Kamei/Jamicon	150	1,800	Estimated
Other	330	3,960	Estimated
Total	1,875	22,500	—

\*Taiwan Capacitor produces 80 million pieces per month in Taiwan, and 100 million pieces per month in China.

\*\*Teapo produces 105 million pieces per month in Taiwan and 50 million pieces per month in China.

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on low-ESR aluminum electrolytic capacitors produced in Taiwan by Japanese aluminum capacitor houses revealed the occurrence of catastrophic failures of the Taiwanese aluminum electrolytic capacitors after 2000 hours of operation on parts rated for 4000 hours of operation. Intel has stated that the aluminum capacitors with the poor electrolyte may fail after only 250 hours of operation.

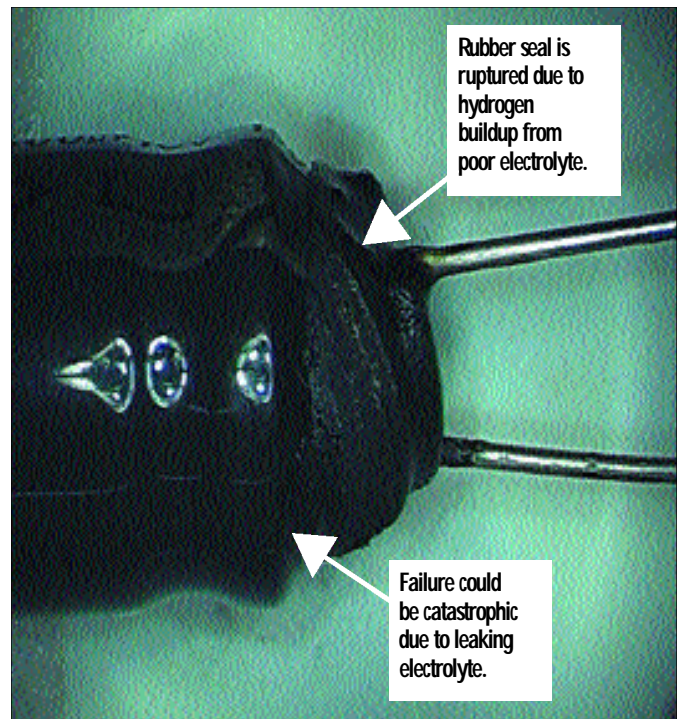
Industry sources have further revealed that many top companies in the computer motherboard and telecom infrastructure businesses have been scrambling to obtain low-ESR parts from aluminum electrolytic capacitor suppliers who did not have plants in Taiwan. Subsequent reports suggest that Rubycon Corporation, Nichicon, and Nippon Industries (NIC Components) have been inundated with orders for low-ESR aluminum capacitors, as more customers shy away from Taiwanese-produced parts. Rubycon, Nichicon, and Nippon Industries (NIC Components) do not have plants in Taiwan, and thus were not exposed to the bad electrolyte in their low-ESR aluminum capacitors. Further intelligence has revealed that lead times for low-ESR aluminum capacitors are now increasing, and price increases are imminent as Japanese suppliers prepare to fill the void left by this unfortunate incident.

Many industry insiders note that some major Japanese aluminum capacitor houses also have offshore production plants in Taiwan, including both Nippon Chemicon (Hsien plant) and Matsushita (Nantou Hsien Plant). However, our research has concluded that many of these companies obtain their electrolytes directly from Japan and were probably not affected by the tainted supply. Other Taiwanese suppliers, such as Jamicon (Kamei), apparently were not affected because they obtain their electrolytes from Japan. Teapo has stated that it also gets its electrolytes from Japan, and was not affected or disqualified.

Some industry insiders further speculate that many of the original equipment manufacturers in the computer industry may not be aware of the problem because visibility into component supply chains is limited due to the increased usage of contract electronic manufacturers in Taiwan. Other industry sources have commented that the movement of contract electronic manufacturers to Asia, coupled with a tendency to source low-cost components locally, opens up the potential for additional component problems in the future.

### Effects on The Market

Total Taiwanese production of aluminum electrolytic capacitors is approximately 22.5 billion pieces or 30% of global aluminum electrolytic capacitor unit shipments. Thus, the failure of these Taiwanese aluminum electrolytic capacitors could have a major impact on the prime



Typical failure mode for low-ESR aluminum electrolytic capacitor with poor electrolyte

industries that consume these products, namely computer motherboards and high-speed modems; although, depending on the number of parts sold and range of buyers, the problem may affect the power supply, monitor, and game console industries. It is important to emphasize, however, that the products that have been affected are only the low-ESR type aluminum capacitors, which account for less than 20% of Taiwan's aluminum electrolytic capacitor production volume.

### Potential Long-Term Effects

The effects of the bad electrolyte on the aluminum electrolytic capacitor supply chain are not known at this time. Two factors play an important role in determining the effects:

- How long have these electrolytes been in the field;
- Has the problem been contained to Taiwan, or have the electrolytes found their way to other nations?

As the industry becomes aware of the problem, it may experience a shift in the supply chain for aluminum capacitors. This could result in an increase of lead times and prices for low-ESR aluminum capacitors.

**Publisher's Note:** *Information about this story was obtained from multiple sources many of which wish to remain anonymous due to the ramifications to the entire supply chain for aluminum electrolytic capacitors. How-*

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ever, the story has been confirmed by a variety of sources including manufacturers of aluminum capacitors, as well as consumers of aluminum electrolytic capacitors in the computer industry. It is our intention to report this information so that companies subscribing to *Passive Component Industry Magazine* are aware of this situation and take steps to determine their exposure levels to this emerging problem.

At press time, IBM Corporation also confirmed the reports regarding failures of Taiwanese aluminum capacitors, stating that five Taiwan-based companies are involved, not just three. IBM further stated that it is not planning a recall. The problem is limited to desktop computers only—no laptops are affected. IBM further stated that the problem is universal, affecting most brand name computer manufacturers in North America and Japan. IBM has recorded some failures in the field, but plan on handling them under product warranty. IBM would not speculate on the effect this

may have on the aluminum electrolytic capacitor supply chain, but conceded that the effect may be substantial.

Intel also confirmed the story but suggested the problem might be more widespread and may have affected other aluminum product lines, not just the low-ESR parts.

Dell Computer also confirmed the story, but would not comment further because of existing secrecy agreements.

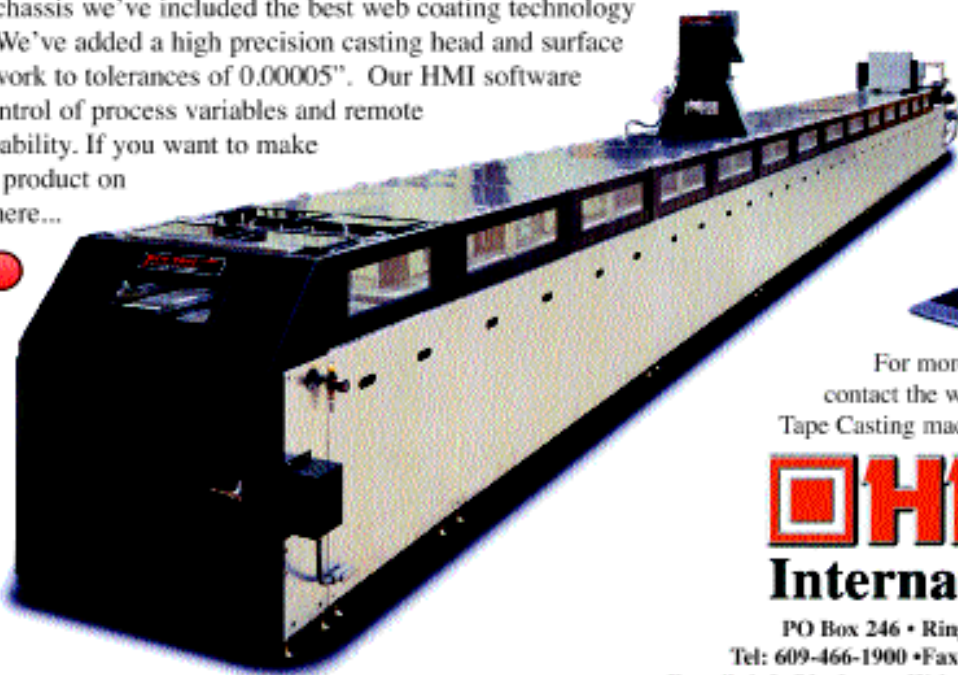
Further intelligence revealed that Kamei/Jamicon sources its electrolytes from Sanyo in Japan, and likely was not affected by the faulty electrolyte supply.

Teapo has stated that it obtains its electrolytes from Japan and was not affected. They also stated that the situation is isolated to a few suppliers in Taiwan, and is not characteristic of its product line or the Taiwanese aluminum capacitor market in general. Teapo suspects it is an attempt by Japanese aluminum capacitor suppliers to gain market share, and that the unfortunate incident involving a few companies will unfairly categorize the entire aluminum capacitor industry in Taiwan. □

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