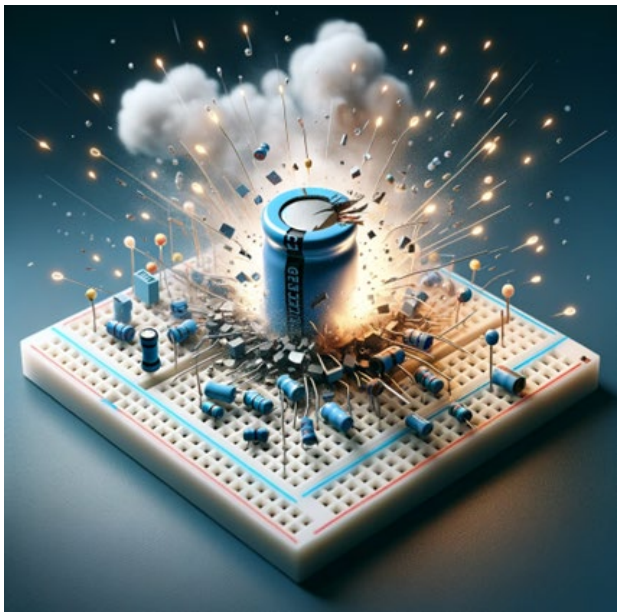
Safety Alert January 2024

Subject: Electrolytic Capacitor Explosion



Background: An incident occurred where an electrolytic capacitor exploded causing eye injuries. Electrolytic capacitors are electronic components used to store and release electrical energy. The person working on the capacitor had detected a burning smell and placed their face close to the electrical circuit to try to identify the source of the smell.

Investigation learnings:

- Ensure all users have been trained in the use and risks of capacitors.
- Substitute with a safer (ceramic) alternative where possible.

If electrolytic capacitors must be used:

- Check the polarity before applying power.
- Turn the power off immediately if you smell burning.
- Never put your head near a live electrical circuit (particularly if you smell burning).
- If you need to inspect the circuit, do so with the power off if possible.

Safety Guidelines for Using Electrolytic Capacitors:

1. **Identify the Polarity:** Electrolytic capacitors have a specific polarity, meaning they must be connected to the circuit with the correct orientation. Always check the capacitor's markings for positive (+) and negative (-) terminals and ensure proper connection. Reversing the polarity can lead to catastrophic failure e.g. the capacitor exploding.
2. **Discharge Before Handling:** Before working with electrolytic capacitors, make sure to discharge them completely. This can be done by connecting a resistor across the terminals or using a discharge tool designed for capacitors. Failure to discharge capacitors could result in electric shocks.
3. **Proper Voltage Ratings:** Verify that the capacitor's voltage rating is suitable for your application. Using a capacitor with a voltage rating lower than required can lead to electrical breakdown, causing the capacitor to explode or leak electrolyte.
4. **Use Safety Equipment:** When working with electrolytic capacitors, and particularly in high-energy circuits, ensure the use of models with safety features, such as perforations in the top (safety vent). Where electrolytic capacitors with a safety vent are not available and/or it is necessary to place your head near the circuit, safety glasses must be worn. The need for additional PPE, such as long-sleeved clothing and insulated gloves, should also be evaluated as part of the risk assessment process. All required safety equipment must be captured in your risk management form (RMF) and safe work procedure (SWP).
5. **Reduce the risk:** Whenever possible, consider alternatives to using high-energy electrolytic capacitors. For low-energy applications, opt for non-electrolytic capacitors (ceramic capacitors), reducing the risks associated with electrolytic capacitors. Familiarise yourself with the specific risks associated with the capacitors you are using.
6. **Store Safely:** If you have spare electrolytic capacitors, store them in a cool, dry place, and avoid subjecting them to physical stress, heat, or moisture, which can compromise their integrity. Capacitors that have been exposed to extreme conditions should be discarded.
7. **Inspect for Damage:** Always inspect capacitors for physical damage or leakage before use. Do not use damaged capacitors, as they can be hazardous. Dispose of damaged capacitors following proper electronic waste disposal procedures.
8. **Follow Circuit Design Best Practices:** Design circuits with capacitors in a way that minimises their exposure to excessive heat or voltage and follow best practices for circuit design and assembly. Avoid over-voltage conditions, which can cause capacitors to fail catastrophically.
9. **Training and Supervision:** Ensure that persons working with electrolytic capacitors are adequately trained and/or supervised by qualified instructors or technicians.
10. **Emergency Response:** Know the location of first aid kits, eye wash stations, fire extinguishers and emergency shut-off switches in your workspace in case of a capacitor-related incident. In case of a capacitor failure, move to a safe location, and report any accidents immediately to your supervisor and online via Salus.

Remember, the safe use of electrolytic capacitors is essential for maintaining a secure and productive learning and research environment. By following these guidelines, we can reduce the risks associated with these components and ensure the safety of all members of our university community.

If you have any questions or concerns regarding the safe use of electrolytic capacitors, please do not hesitate to contact your local Health & Safety Coordinator, or reach out to safety@unsw.edu.au.