



Top Ten Tips for Electrical Power Failure Investigations

1. Safety first

- Clear personnel from dangerous areas - building structures may be weakened
- Make sure all injuries are properly treated
- Make the area safe – electrical isolation needs to cover all possible sources including the less obvious ones – backfeeds, local generation and batteries
- Quarantine the area – for safety but also to preserve evidence
- Failures often weaken the mechanical integrity of the remains, with safety implications for in-situ examination and possible destruction of evidence during recovery and transportation



2. Wider reporting

- Are statutory authorities required to be informed?
- Could others learn from the incident? Consider industry-wide reporting*

3. Collect and preserve volatile information

- Witness statements from those present or nearby and emergency services
- Relay recordings and settings that may be lost once auxiliary supplies are lost and internal batteries run down
- Circumstances: weather – any lightning; switching events; what work was in progress; were others working nearby; record the location of ejected parts and collect them



4. Photography

- Photography is an easy and invaluable way to capture data – be systematic; give the wide view for context as well as the detail – photos are cheap, so record everything - things that don't appear relevant at first may be, once the investigation proceeds



5. Analysis tips

- The centre of the damage may not be where the root cause is – electrical arcs can travel, pushed away from the source by electromagnetic forces, and secondary arcs can strike in many places where a volume is filled with conductive gaseous arc products: Look for spots and trails of melted conductor that show where an arc moved along
- Comparison pieces are often invaluable – the energy going into a failure can easily destroy important evidence, but sometimes you can see the cause, less advanced, in the unaffected phases or in comparison components



5. Analysis tips - continued

- Electrical “trees” on surfaces and in bulk insulation is evidence of a degradation that can progress very slowly; as the degradation progresses the “Partial Discharge” would often have been detectable by ultrasonic, electrical or RF means before the actual failure
- Evidence of the quality of workmanship, for instance in joints and terminations, will often survive a failure – stripdown and comparison with the relevant instructions is often revealing
- Evidence can still survive when the damage is extensive
- Moisture effects are a common cause of insulation failure
- Fracture surfaces can reveal the cause of the break, but the evidence can be obscured by attempts to re-assemble the jigsaw



6. Method

- Think of and check all the possible causes – for instance, a breaker could fail to clear because of contact wear, overloading or slow opening and the result would look similar
- Think through where the initial event could have occurred – how could it progress and account for all the effects observed (or does some evidence remain from previous events?)



7. Reporting

- Photographs are invaluable in explaining what happened
- Put together a credible timeline from beginning to end
- Include the things you checked that were not at fault

8. Thoroughness

- Background information should include checking whether a similar incident has happened elsewhere*; manufacturer’s engineering changes application; maintenance history; fault level and other design specifications; operating history including overloading
- Balance pressure for rapid restoration against the future benefits of a thorough investigation



9. Application

- Understanding the root cause or causes is the first step, the network management value comes from applying the knowledge: Is the failure a one-off or the beginning of the wear-out phase for the affected model of equipment, and might life extension be safely possible? Improved maintenance and condition monitoring are potential ways to keep assets in service

10. Consider expert help

- Is internal expert support enough?
- Are time pressures against an adequate investigation?
- Are special investigation facilities required?
- Do injury, liability or other issues require independent investigators?
- Demonstrate commitment to thorough investigation

* EA Technology uses the National Equipment Defect Reporting System (NEDeRS®) which gives access to a database of electrical equipment defects from manufacturers worldwide.

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Power Forensics are here to help when you need us. Call 0151 339 4181, email us on sales@eatechnology.com or visit www.eatechnology.com

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