

Recommendations for Re-Energizing Flood-Damaged Electrical Equipment

Safety Considerations

Working with Water-Exposed Equipment

Littelfuse, Inc. reminds electricians and managers of industrial facilities and large commercial buildings of the hazards associated with working around electrical equipment that has been exposed to flood water, and provides instructions for a safe restoration. Flood waters are generally contaminated and leave conductive and/or corrosive residues inside equipment that can produce shock and fire hazards. Affected equipment should be replaced or refurbished to avoid risk of fire and shock.

Replace all Fuses that were Submerged

Workers should replace any fuses that were submerged, even if they look dry on the outside. Fuses contain filler materials such as sand to quench the arcs that form when the fuse elements open. The filler material may absorb water and compromise the fuse's ability to safely interrupt an overload or short circuit. Because of the fuse's body design, the filler material will not dry out, so all fuses need to be replaced to ensure they function properly and are safe to use.

Protection relays that have been submerged should also be replaced or factory inspected if feasible. Applying control voltage to a protection relay with residue left behind in the flooding may completely destroy the relay and constitute a safety risk. This is the case even for conformally-coated protection relays. Conformal coating is intended to improve performance in high-humidity environments but typically not condensing moisture or submersion, and often conformally-coated circuits have sections where the coating is not applied such as board interconnects.

Avoid Mixing Fuse Brands

Littelfuse advises users to avoid mixing fuse brands in a three-phase application. Replace all three fuses with the UL Class and rating from the same manufacturer as performance between fuses can vary slightly.

Safety and Performance Improvements

To enhance safety, performance and reliability, replace

Checklist for Electrical System Restoration

all non-current limiting fuses such as old style UL Class H or Class K5 with class RK5 or current-limiting RK1 fuses. Class RK1 fuses have the same physical dimensions as UL Class H, K5, and RK5 fuses, but provide better protection for personnel and equipment. Restart is simplified as contract electricians now only need to stock one type of fuse.

Be sure of the Source of Equipment

In the hurry to get operations back on line, only buy equipment from a manufacturer's authorized distributor. This ensures you will be receiving authentic equipment and not counterfeits. Even unknowingly receiving and having counterfeit equipment installed will lead to equipment damage and personnel injury with no support from the manufacturer. Any manufacturer's customer service team or web site will list the proper sources.

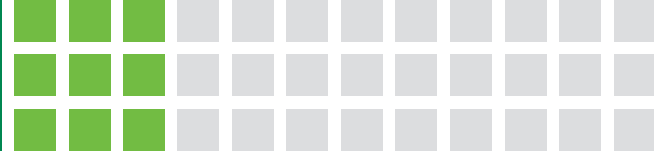
1. Make sure the power is actually off.

Before evacuation, power should have been shut off at the main service switch. If the switch was left in the "on" position and the utility disconnected power outside the building, have the facility inspected by an electrician to make sure that the power is actually "off", before other workers enter the premises. After power has been shut off by the power utility, the utility will need written authorization before restoring electrical service.

2. Inspect the surrounding area for standing water.

Flood cleanup usually begins when locations are still wet. Because water conducts electricity, using an appliance such as a wet vacuum or power saw at the clean up location may be hazardous. To protect workers, companies should use a portable ground-fault circuit interrupter (GFCI).

For single-phase, low-voltage applications, companies should use a portable GFCI. For three-phase low-voltage applications, companies should use a UL 943C certified Special-Purpose GFCI.



3. Identify electrical equipment that was or may have been submerged.

It is hazardous to simply allow equipment to dry and then re-energize it. Some equipment can never be reused, and must be replaced (see below). Any reusable electrical equipment or appliances that have been wet should not be used until they have been serviced by an electrician or a service center authorized by the equipment manufacturer.

4. Inspect electrical equipment that was not submerged.

Even if electrical equipment was not submerged, it should be inspected by a qualified person to determine whether moisture has entered the enclosures.

5. Replace or refurbish large electrical equipment that did get flooded:

- Switchgear
- Panelboards
- Motor control centers
- Motors
- Transformers

6. Replace small components of wiring infrastructure:

- Receptacles
- Switches
- Light fixtures
- Dimmers

7. Replace circuit protection devices and power distribution devices:

- Fuses
- Disconnect switches
- GFCIs
- Protection relays
- Surge protection devices
- Molded case circuit breakers

8. Examine busways and replace or recondition them.

Busways with powder coated bars may be reconditioned and reused. Busways with Mylar* wrapped bars must be replaced, since water and corrosive contaminants cannot be removed effectively from beneath the wrapping.

9. Inspect motor control equipment and replace or refurbish.

Components containing semiconductors and transistors must be replaced. This includes electronically-controlled and solid-state contactors and starters. Overload relays must also be replaced. Some motor control equipment can be refurbished and reused. Adjustable speed drives (not the electronic kind) can often be saved, as well as manual and magnetic controllers and motor control centers.

10. Inspect power equipment.

Electronic trip units of low-voltage power breakers must be replaced. High-voltage circuit breakers (ac), low-voltage power circuit breakers, protective relays, meters, and current transformers may be refurbished and reused, as may low-voltage and medium-voltage switchgear.

11. Replace dry-type transformers and analyze liquid-filled transformers.

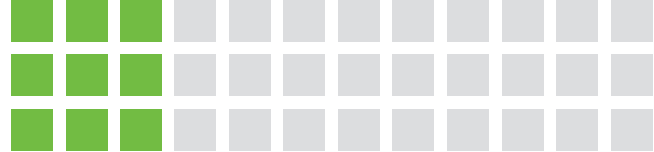
All dry-type transformers regardless of kVA ratings, all dry-type control circuit transformers and all cast-resin transformers must be replaced. For liquid-filled transformers, analysis of the insulating medium is required for evaluation.

12. Replace wire, cable or flexible cord.

Wire or cable listed for dry locations (such as NM-B) must be replaced. Wire or cable that is suitable for wet locations may be refurbished and reused, provided the ends of the wire or cable have not been exposed to water and the wire is not damaged.

13. Replace or refurbish other devices.

Signaling, protection and communications systems must be replaced. Cable trays (replace damaged labels), fire pump controllers and motors may be refurbished and reused.



NEMA Guidelines

More detailed information on what equipment may be refurbished and reused and what must be replaced is available in a set of NEMA guidelines entitled “Evaluating Water-Damaged Electrical Equipment.” The full text is available from NEMA at:

www.nema.org/stds/water-damaged.cfm#download

Summary

Littelfuse would like to stress the importance of following these and other necessary safety precautions when working on flood-damaged electrical equipment. Given the conditions this environment presents, it is important to be fully aware of all related safety procedures. Following this checklist for electrical system restoration will reduce hazards for both equipment and personnel.

Littelfuse 24-Hour Emergency Hotline

Emergency 24 Hour Support is available at

1-800-227-0029

Option 1 Fuses, then Option 5

Technical Support

1-800-TEC-FUSE (1-800-832-3873)

For more information on replacing water-damaged fuses, call the Littelfuse Technical Support line.

For more information on any of Littelfuse circuit protection devices or to cross-reference fuse part numbers, visit the Littelfuse website at littelfuse.com.

* Mylar is a trademark of its respective owner

Additional Information

Founded in 1927, Littelfuse is the global leader in circuit protection with advancing platforms in power control and sensor technologies. The company serves customers in the electronics, automotive and industrial markets with products that include fuses, semiconductors, polymers, ceramics, relays and sensors. Littelfuse has more than 11,000 employees in more than 50 locations worldwide. For more information, please visit littelfuse.com.