

# design Protect Equipment from Earth Leakage and Ground Faults

# FAQs

## FREQUENTLY ASKED QUESTIONS

**Q: What is a ground fault and why is it a concern?**

**A:** A ground fault is when the current leaving a power source and the power returning, through the ground loop (neutral wire), back to the power source are different. This situation can either cause a system failure due to the overcurrent and/or an electrical safety hazard for those working with the equipment—because they become part of the circuit. Other types of faults can occur in a system, such as phase-to-phase faults, but it is widely accepted that 98% of all electrical faults are ground faults.

**Q: How much variation in current is considered enough to cause a fault?**

**A:** Small amounts of current leakage in an electrical system are okay and naturally occur due to wire resistance, component variations, and operating conditions. But once this leakage exceeds a certain amount (such as 5 to 10 mA) it can easily damage sensitive circuitry or shock a user when in a household appliance, but with industrial equipment ground faults can accumulate and eventually cause a system shutdown.

**Q: Why can't I just use a circuit breaker?**

**A:** You are correct in assuming that a circuit breaker is designed to de-energize your electrical system due to short circuits, lightning strikes, or other large variations in current—

basically catastrophic events. But they are not equipped to handle low currents, intermittent and repeated current arcs due to insulation breakdowns, or other slowly changing variations that can be caused by component degradation. In these cases, your breaker should have supplemental ground fault sensing and protection to warn of a possible problem.

**Q: What does a ground-fault protection device do?**

**A:** Mainly, ground-fault protection devices contain a mechanical or solid-state relay that either warns the user

or de-energizes the whole circuit once it senses the ground fault. Because protection relays are designed to sense smaller and slower changes in current, they are better equipped to protect your equipment from changes that may otherwise go unchecked.

**Q: What if my system or device is ungrounded?**

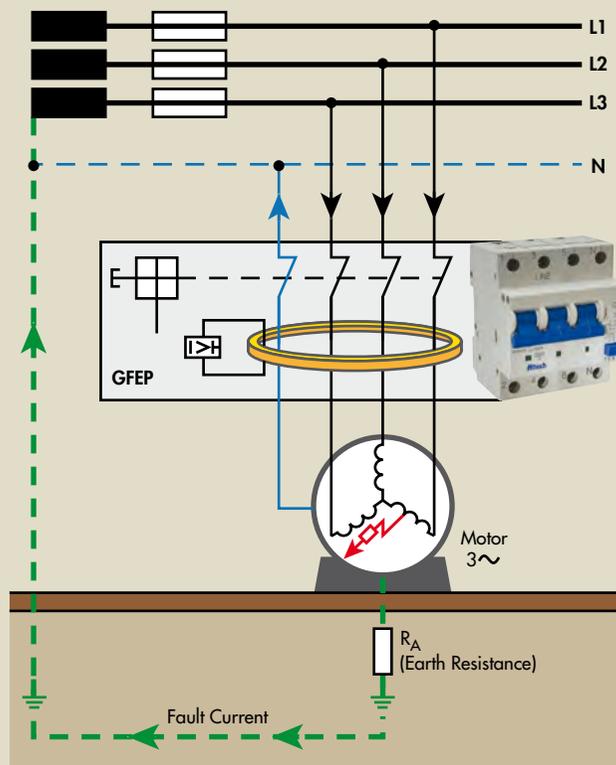
**A:** This is not a problem. As with grounded systems and devices, an ungrounded system is still susceptible to ground-fault problems—differences between outgoing and returning currents—which means that protection is necessary.

**Q: What are the most prevalent uses for ground-fault protection devices?**

**A:** There are four main reasons why ground-fault protection might be needed: regular and constant wire insulation surveillance; motor winding failure detection; production equipment that must remain online; and pre-short circuit detection, all of which are touched on in this piece.

**Q: Could you suggest an example where ground fault protection would warn an operator of a potential problem?**

**A:** Let's go with two examples, based on the four reasons given above: Example one would be when a company is using an open-winding heating



1. Ground-Fault Protection Equipment in Motor Circuit

unit to maintain temperature in a cold environment. Continual vibration from the machine can cause the heater winding to vibrate to a point where it gets close enough to the enclosure that a small arc would occasionally spark. This, in itself, might not be enough to concern maintenance right away, and could easily go undetected because there would not be enough of a current draw to trip a breaker. The problem occurs when arcing does get to a point where a short occurs. If maintenance had been warned earlier that there was a ground fault, a system shutdown could have been prevented. In fact, an early warning would allow the user to schedule maintenance when there was time to solve the problem.

A second example might be one where a system is running smoothly even though there may be some degradation in a specific component. Let's say a motor winding is becoming stressed due to environmental variations and a winding begins to weaken (see Fig. 1). There is a shift in the power needed for the motor to run properly, but it doesn't create enough of a variation to cause a breaker to trip. Once again, small amounts of leakage can continue until the motor exhibits a massive breakdown, which would cause a major system shutdown. Also, by incorporating ground-fault protection circuitry, maintenance would have been warned of the impending failure early enough to provide time in their schedule to replace the failing component.

**Q: What industries most commonly need ground fault protection devices?**

**A:** In today's market where electronics equipment is getting more sensitive to minor disruptions, most industries become susceptible, notably chemical plants, refineries, semiconductor facilities, pharmaceutical plants, waste water treatment plants, and others. Managing your electrical system has become a major concern. Companies are finding that if they don't pay attention to ground-fault issues, it can have long-term detrimental affects not only on their systems, but also their businesses. ■



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## UL 1077

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