

# GROUND FAULT PROTECTION TESTING



Educational Series: Why Test?

## Overview

The following will explain:

- Purpose of ground fault protection (GFP) testing
- Why GFP is necessary
- How GFP measures work
- Recommended and required tests
- Potential GFP failure conditions

## Why Test Ground Fault Systems?

Performance testing of ground fault systems is required by National Electrical Code (NEC) sections 230-95 (C) and 517-17 (D).

About 15 percent of ground fault protection systems tested by InterNational Electrical Testintg Association (NETA) firms are improperly installed, contain defective components, or do not operate correctly.

## Why Have Ground Fault Protection?

A low level arcing ground fault can destroy switchgear in seconds, before the main service overcurrent protection will operate.

A 480/277-volt solidly grounded system has sufficient voltage to maintain an arc between one phase and a ground, but not enough current to cause a large main breaker or fuse to clear the fault quickly. The resulting arc is similar to an electric weld, consuming large amounts of metal in the seconds it takes the breaker or fuse to operate.

A properly installed and operating ground fault protection system will detect and clear the fault in milliseconds, fast enough to limit damage to acceptable levels.

Ground fault protection is required by the NEC and is usually installed only on circuits and services of 480/277 volts, 1,000 amps and larger.

## How Do They Work?

The several different types of systems all operate under the current balance principle. They monitor that the current going out any one phase is coming back on another phase or neutral. If current is going out on a phase but is coming back on the ground path (conduit, piping, earth or building steel), a ground fault has occurred.

All systems with ground fault protection include:

- Current transformers (CTs) to detect ground fault current
- A relay or logic box to determine tripping current value and time
- An operating mechanism to trip the breaker or switch

Some systems have a test panel for simulating a ground fault signal to trip test the breaker and a monitor panel indicating system status.

## Which Tests Should Be Performed?

- Complete field acceptance testing as required by the NEC
- Inspect neutral main bonding connection

- Verify proper installation of sensor(s) and grounding connections
- Inject current through the current sensor and verify pickup and timing characteristics of the relay
- Test operation with control voltage supply reduced to 277 volts instead of 480 (one phase could be at 0 volts during a ground fault)
- Check operation of special features like zone interlocks

## What Problems Are Found?

- Neutral grounded downstream which can defeat ground fault protection or cause inadequate tripping
- Incorrect current sensor installation and wrong polarity which can cause false tripping
- Inadequate or loss of control power or connections which causes protective devices not to trip
- Failure to trip within manufacturer's tolerance which can cause inadequate protection

## Why Not Just Use Test Pushbutton?

This does not comply with the NEC requirements, does not detect many of the problems previously listed, and does not comply with most manufacturers' instructions, or recommendations from Underwriters Laboratories (UL) and the National Electrical Manufacturers Association (NEMA).