

High-resistance grounding and wye or delta SPDs

Overview

In today's manufacturing facilities, ground faults can wreak havoc on production and process equipment. These manufacturing facilities may have a high-resistance grounding (HRG) system. In an HRG system, a resistance connected between the neutral of the transformer secondary and earth ground is used, which effectively limits the fault current to a low value current (typically 10 A or less) under ground fault conditions. As a result, the system will continue to operate normally, even under the ground fault condition.

System scenarios

Figure 1 depicts a resistance grounding scheme. Where surge suppression is required for a three-phase, four-wire wye system with a neutral ground resistance, a three-phase, three-wire delta surge protective device (SPD) will want to be specified and used.

In a wye system, the neutral and ground are both located at the center, as shown in **Figure 2**. If the neutral is bonded to the ground, the system will remain unchanged under fault conditions. In the case where the neutral is not bonded to ground and a fault condition is present, the ground will "move" toward the phase that has the fault.

Figure 3 shows a fault condition on phase C. The result is phase A to ground and phase B to ground are now at line-to-line voltage instead of line-to-neutral voltage. If a three-phase, four-wire wye SPD was installed in

an application where the neutral was not bonded to ground and a fault condition occurred on one of the phases, the result would be SPD failure.

This is most commonly found in applications where installers don't run the neutral conductor to the motor control center (MCC) because in theory there are no line-to-neutral loads. Ensuring that the neutral is solidly bonded to ground along with a delta (three-phase, three-wire) SPD will best protect this scenario.

In today's electrical systems, with many different grounding systems and various voltages, determining which SPD voltage configuration to specify can be confusing. Following are several helpful guidelines to follow when specifying SPDs:

- Only apply a wye (three-phase, four-wire) configured SPD if the neutral is physically connected to the SPD and if the neutral is directly and solidly bonded to ground
- Use a delta (three-phase, three-wire) configured SPD for any type of impedance (resistive, inductive) grounded system
- Use a delta (three-phase, three-wire) configured SPD for a solidly grounded wye system where the neutral wire is not pulled through to the SPD location; this scenario is often found in MCC applications
- Use a delta (three-phase, three-wire) configured SPD if the presence of a neutral wire is not known

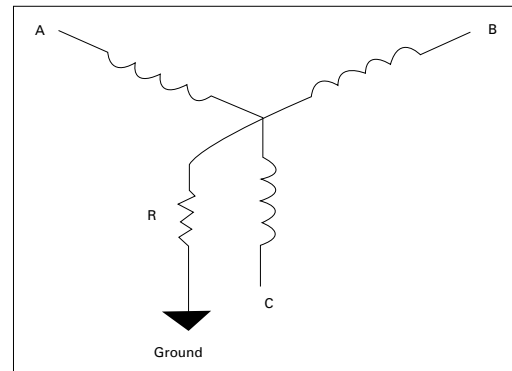


Figure 1. Resistance grounding scheme

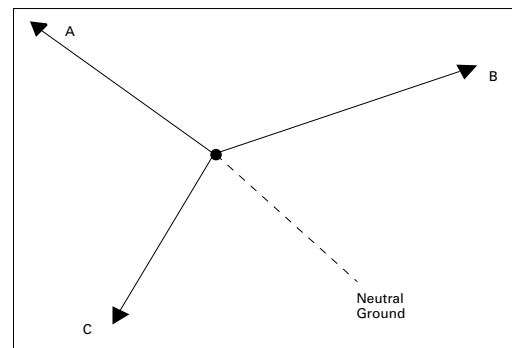


Figure 2. Wye system

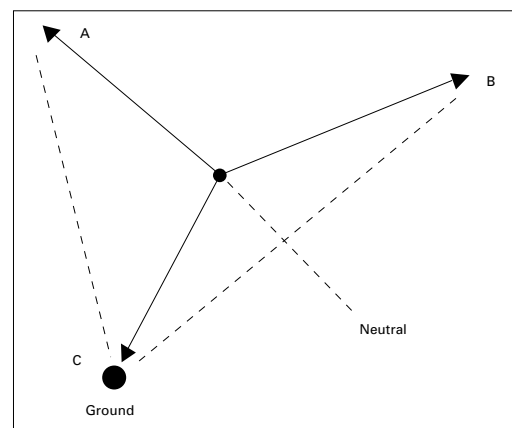


Figure 3. Phase C fault condition

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