INTRODUCTION

As you know, Arc Fault Circuit Interrupters (AFCIs) are now required for installation in residences under the National Electrical Code (NEC). AFCIs protect circuits from dangerous arcing conditions that can sometimes result in a fire. The change in the code caused a lot of interest and some controversy. Square D recently published a data bulletin, “The Truth About AFCIs” (data bulletin 0760DB0201).

This document explains why the practice of sharing neutrals in wiring is not a good general wiring practice and why it is incompatible with the use of SQUARE D AFCIs.

Shared Neutrals

The practice of sharing neutrals, in which one three-conductor cable is used as the homerun of two single-phase circuits, remains common. Shared neutrals are seen by some as a labor-saving technique, in which two separate circuits are handled by one cable.

The circuit begins in the load center, where either two one-pole circuit breakers or one two-pole circuit breaker feeds the three-conductor homerun cable. The circuits are split in a junction box from which two-conductor cables are run to each single-phase circuit. Cables with red conductors connected to circuit breakers feeding 15 A or 20 A, 120 V loads help to identify potential shared neutrals.

Simply put, some see a cost advantage in having as a single-cable homerun cable for two circuits. It is felt to be a labor saver. However, labor is all that is saved, as there is very little difference in the net material cost of using a shared neutral with a two-pole shared neutral AFCI or conventional wiring with two single-pole AFCI circuit breakers. We know this based on the typical net prices of AFCI circuit breakers and NM-B cable. Thus, any possible savings are found only in labor costs.
Disadvantages of Shared Neutrals

There are several significant disadvantages to be found in the practice of sharing neutrals:

• On two-pole common-trip circuit breakers, both circuits are interrupted during any type of fault. If a shared neutral circuit feeds many rooms, then all rooms lose power if a fault occurs in any one room. If a shared neutral circuit feeds receptacles and lights, both will lose power with a fault on either one.

• If the homerun neutral is lost, the connected loads are subject to voltages varying from 0 V to 240 V (line-to-line). The likely result from this is severe damage to any connected devices due to extreme under- and over-voltage conditions.

• On two-pole independent-trip circuit breakers, one may find hot wires in a junction box that was presumed dead. One cannot overemphasize how dangerous this would be. If one of the shared neutral circuits were to trip due to a short-circuit or overload, the other circuit would remain hot. Anyone servicing any device in that junction box may be exposed to live conductors.

Moving Forward

There is a need for the two-pole device in retrofit and 240 V applications. As code requirements expand to these applications, Square D will offer a 120/240 V two-pole device. It will be specifically intended for 240 V and shared neutral applications, where shared neutrals exist and running new cable is not practical.

Before understanding all of the facts, one may believe that sharing neutrals is economical. The savings, if any, are not as large as one may think. In a typical residential application, two 75-foot-long (22.8 m) home runs could be wired with one cable, instead of two, by sharing neutrals. The typical cost of the three-conductor cable is about twice that of the two-conductor cable. Thus the money saved in cable cost is negligible. Compared to two one-pole AFCIs, the cost of a two-pole AFCI is only slightly higher.

To reduce the difficulties found in pulling two cables for the homerun rather than one, several cable and wire manufacturers have introduced new four-conductor plus ground cables. These new cables offer independent neutrals, thus eliminating the potential problems associated with shared neutrals.

For more information about the disadvantages of shared neutrals, call Square D Cedar Rapids Application Support at (319) 369-6650.