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The importance of understanding wiring reliability and circuit performance

BY WAYNE D. MOORE

I don’t know anyone concerned about the design, installation, and approval of fire alarm systems who would accept a less than reliable system. Even so, the definition of system reliability does not appear in NFPA 72®, National Fire Alarm and Signaling Code®.

In fairness, the 2019 edition of the code mentions reliability several times, beginning in Chapter 1, Section 1.2.1: “The purpose of this Code is to define the means of signal initiation, transmission, notification, and annunciation; the levels of performance; and the reliability of the various types of fire alarm systems, supervising station alarm systems, public emergency alarm reporting systems, fire warning equipment, emergency communications systems, and their components.”

Nevertheless, the code does not define reliability per se. We must rely on the purpose statement above to infer the meaning of reliability, which, in my opinion, serves us well.

Chapter 14, Inspection Testing and Maintenance, in Section 14.2.1.4, states that the purpose of periodic testing intends to “statistically assure operational reliability.” However, the Annex A commentary for that section reminds us that “periodic testing contributes to the assurance of operational and mission reliability but does not ensure either.” That said, ensuring compliance with design documents through acceptance testing helps ensure both operational reliability and mission reliability.

In actual installations, the recurring misapplications and misused requirements revolve around wiring methods, not the testing of systems. In determining the class of a circuit used, we must consider the seven influences on the integrity and reliability of the circuits found in Section 23.4.3.2: transmission media used; length of the circuit conductors; total building area covered by, and the quantity of initiating devices and notification appliances connected to, a single circuit; effect of a fault in the fire alarm system that would hinder the performance objectives of the system that protects the occupants, mission, and property of the protected premises; nature of hazards present within the protected premises; functional requirements of the system necessary to provide the level of protection required for the system; and size and nature of the population of the protected premises.

Specifying the performance of a circuit, therefore, becomes most important to help all concerned ensure an acceptable level of system reliability. For example, after considering the seven influences listed above, we determine that we must use Class X wiring. However, our premises consists of a small grocery store, and we cannot really use Class X wiring—it would serve as a financial overkill.

That same analysis would serve for a hospital. In this case, using Class X wiring would likely prove more reliable and the occupancy would certainly warrant its use. Class X or Class A wiring provides a different performance and level of operation than a Class B wiring installation. But requiring a Class X or Class A for the wiring performance when the physical size of the facility, its complexity, or the nature of the hazards do not warrant such use simply raises the cost of the installation.

The key to the reliability discussion of fire alarm systems also revolves around the installation. Class A or Class X wiring, improperly installed, would significantly reduce the reliability of the installation. As stated in the Annex A for Section 23.6.1, "designers should carefully consider the potential that a single SLC short or open caused by a fire or inadvertent damage to the SLC could disable an entire SLC prior to the activation of an alarm condition along with the subsequent alarm signaling and emergency control functions."

Stakeholders should read all of the chapters that apply to wiring reliability and performance, and make sure they understand the level of reliability needed before designing, installing, or approving a new fire alarm system installation.

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