WHITE PAPER

Industrial Ethernet Standards and Codes

Answers to your most frequently asked questions

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LEVITON®

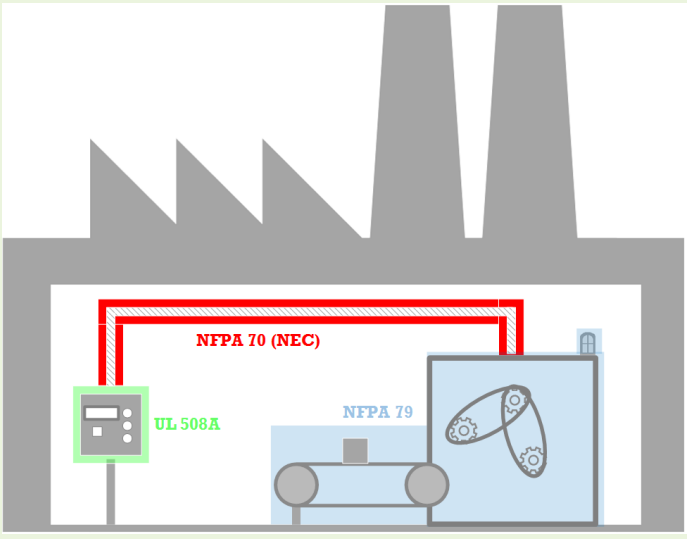
INTRODUCTION

Manufacturers are accelerating the implementation of Industrial Internet of Things (IIoT) and Industry 4.0 tools and processes to maximize profitability. This transformation, sometimes referred to as the Fourth Industrial Revolution, is encouraging manufacturers to migrate from legacy Fieldbus systems to the modern Industrial Ethernet, which is becoming the network of choice in harsh industrial environments for its simplicity, scalability, diagnostic capabilities and high performance.

Industrial Ethernet is still a relatively new technology in the manufacturing world. As such, it generates a lot of questions, particularly regarding codes and standards, installation practices, and harsh and outdoor applications. This document will explore some of the most commonly asked questions that Leviton Industrial Solutions has been hearing from customers.

STANDARDS AND CODES: DEFINITION AND PURPOSE

What codes and standards should I be concerned about when installing cables in an industrial factory environment?
A critical consideration to make when selecting cables is what code regulates the environment where the cable is installed. The picture below depicts the three zones of a typical factory and associated codes/standards.



NFPA 70: Known as the *National Electric Code (NEC)*. This applies to field wiring in-transit to the machine or control panel and terminated at the manufacturing site. This is the "building" wiring installed in the tray and communication raceway environments.

NFPA 79: Known as the *Electrical Standard for Industrial Machinery*. This applies to the wiring of electrical/electronic equipment, apparatus, or systems of industrial machines operating from a nominal voltage of 600 volts or less. This is the wiring that is used in/on machines.

UL 508A: Provides the requirements for industrial control panels operating at nominal voltages of 1,000 volts or less and in ambient temperatures that do not exceed 40°C (104°F).

What is the purpose of the NFPA 70 (NEC)?
The purpose of NFPA 70, also known as the National Electrical Code (NEC), is to provide practical protection of people and property when using electricity. It covers the installation and removal of conductors, equipment and pathways for electricity, signaling and communications. The code is usually invoked when one of the aforementioned services (electrical, signaling or communications) leaves a room or area. It typically isn't applied within a piece of equipment. In general, it applies to private and public buildings, but not ships, rail yards and underground mines. It is referenced in the laws of each state, which results in different states adopting different editions (2017, 2014, 2011, etc.) or modifying it as their prerogative dictates. The requirements of the code are enforced by the authority having jurisdiction (AHJ) as determined by the applicable law. This is often an inspector, fire marshal or other official and it is common for more than one person or group to be acting as an AHJ.

What is the purpose of NFPA 79?

The purpose of NFPA 79 is similar to that of the NEC, in that it promotes safety to life and property in reference to electrical/electronic equipment, apparatus or systems supplied as part of industrial machines operating at nominal voltages of 600 volts or less. Its application begins at the point of connection to the supply circuit conductors. It is not applicable to fixed or mobile tools complying with the requirements of a test laboratory recognized by the AHJ. NFPA 79 is also not applicable to machines used in dwelling units or hazardous (classified) locations. For anything not specifically addressed in NFPA 79, the requirements revert back to the NEC.

What is the purpose of UL 508A?

UL 508A provides the requirements for industrial control panels operating at nominal voltages of 1,000 Volts or less and in ambient temperatures that do not exceed 40°C (104°F). It covers equipment intended for general industrial uses and installed in ordinary locations in accordance with the NEC. UL 508A applies to two or more power circuit components (motor controllers, circuit breakers, control circuit components, etc...) with associated wiring and terminals. An industrial control panel does not include an evaluation of loads connected to power circuits such as motors, lighting, etc. It also does not cover fire pump controllers or equipment connected to/installed in hazardous (classified) locations. For fire pump controllers or hazardous (classified) locations, see UL 218 or UL 1203 and UL 698A respectively.

APPLIANCE WIRING MATERIAL (AWM)

What is AWM?

It stands for Appliance Wiring Material. An AWM cable is considered a UL-recognized component, evaluated for specific use. A usage statement is provided on one of the many UL Style Pages and will outline several guidelines, including the voltage rating. An AWM cable is intended for installation in, or on, an overall listed product and is not intended for field wiring. The NFPA 70/NEC does not permit an AWM cable to be installed in the environment it regulates, unless that cable is also identified as a listed building type, such as a Communications cable. This is the reason that Leviton' Industrial Ethernet cables are both AWM recognized and also UL listed as one of the various types of communication cables (CM, CMX, CMR, etc). In the case of this dual rating, the cable can be installed in accordance with NFPA 79 and NEC guidelines.

For example, a cable that bears the AWM recognition, and is also listed as the appropriate type of communications cable, could leave the PLC installed on a factory machine (NFPA 79 regulated) and enter a communications cable tray (NEC regulated) that runs to a control panel located some distance away.

What about the AWM 600V requirement?

There is a confusion surrounding the topic of 600 volt rated cables and where/how they can be used. The AWM 600 volt rating refers to the withstand voltage.

of the cable. It does not imply that 600 volts can be applied to the conductors. In the case where a cable is identified as an AWM 600 volt cable, it is critical to understand that the design criteria and safety requirements for cables are significantly different between the NFPA 79 and the NEC, and that the NEC does not identify AWM cables as being a suitable wiring method. The 600 volt rating associated with the UL AWM recognition does not translate into suitability for that cable to be installed in an NEC environment that contains cables operating at 600 volts. In order for a cable to be used directly alongside a 600 volt power cable in the NEC regulated environment, it would need to be listed as a tray cable (Type TC).

TRAY CABLE

What is a Tray Cable (UL Listed as Type TC)?
A tray cable is intended to be installed directly alongside other cables operating at up to 600 volts. These cables can be very heavy and the potential of crushing becomes a concern. There are several requirements that must be accounted for in a tray cable. One of which, is the required minimum conductor size of 18 AWG. Ethernet cables are rarely available as a type TC, as there is no practical network connectivity readily available for conductors/cables of this size.

What is a Power Limited Tray Cable (UL Listed as Type PLTC)?
A PLTC cable is a Tray Cable that is intended to be installed directly alongside other cables operating at up to 300 volts. Additionally, a PLTC cable may be installed in a tray with power cables operating at up to 600 volts providing that the appropriate barrier is installed per NEC requirements. PLTC listed cables can also be used in Class I & II, Division II hazardous locations per the NEC. A PLTC cable is required to have a minimum conductor size of 22 AWG. One of the advantages of a Type PLTC listed data cable is that it can be utilized in many existing infrastructures where the previously installed cable trays have power-limited designated paths. Thus, there is no need to install a separate communications cable trays.

OUTDOOR APPLICATIONS

What is the difference between CMX Outdoor and OSP cables?
According to the NEC, an outside plant cable (OSP) is an unlisted cable that is used outside of a building. These cables do not have a flame rating or safety listing. Many OSP cables are made of sunlight resistant materials and contain some sort of water block underneath the jacket to prevent water intrusion.

Type CMX limited-use cables are used in dwellings and for use in raceway. A CMX cable must meet flame spread requirements of the VW-1 flame test from the UL standard 158.

According to UL 444, a CMX outdoor cable is one that meets the flame requirements of the VW-1 flame test, the weatherometer and cold impact test as described in clauses 7.12 and 7.13 of the UL 444.

In conclusion, the difference between OSP cables and CMX Outdoor cables is that CMX Outdoor cable is flame tested and safety listed according to the NEC and UL 444 while OSP cables are not. OSP cables also typically have some kind of water block material to keep water away from the cable core while CMX Outdoor cables typically do not have this water block material. Industrial CMX Outdoor cables are not intended to be used in any outdoor environment (wet or damp location).

Does CMX Outdoor mean that I can use the cable under slab in conduit or duct?
No. OSP cables are designed to be used under slab in conduit or duct and can be fully submerged in water.

How far can an OSP cable run inside the building?
Cables that are labeled “OSP” (outside plant) without any other listed flame ratings such as CMP, CMR, CM, OFNP, etc. cannot be installed in locations covered by the National Electrical Code (NEC) unless one of the following statements is true:

- The cable is coming into the building from outside and is 50 feet or less in length. If a primary protector is required, the NEC requires that it be placed as close as possible to where the cable enters the building. In this case, the OSP cable will be terminated much sooner than 50 feet into the building.

- The cable is coming into the building from the outside and is installed in rigid metallic conduit (RMC) inside the building.

Is sunlight resistance an additional attribute to CMX Outdoor's requirements?
Yes. Sunlight resistant cables are cables that have gone through a 720-hour test for sunlight resistance according to UL 444 7.22. A CMX Outdoor cable has only gone through a 300-hour test for sunlight resistance, but has completed testing for cold impact and VW-1 flame.

OIL RESISTANCE

What is the difference between Oil Resistance, Oil Resistance I and Oil Resistance II?
Oil Resistance is tested in accordance to UL 1581 Table 50.182 and is submerged in 60°C oil for 7 days. Oil resistance I cables are tested in accordance with UL1277 Table 12.2 and is submerged in 100°C oil for 4 days. Oil resistance II cables are tested in accordance with UL 1277 Table 12.2 and are submerged in 75°C oil for 60 days. An Oil Resistance II cable is considered the better oil resistant out of the three.

Today's networks must be fast and reliable, with the flexibility to handle ever-increasing data demands. Leviton can help expand your network possibilities and prepare you for the future. Our end-to-end cabling systems feature robust construction that reduces downtime, and performance that exceeds standards. We offer quick-ship make-to-order solutions from our US and UK factories. We even invent new products for customers when the product they need is not available. All of this adds up to the **highest return** on **infrastructure investment**.

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