NFPA 79
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White Paper

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Save Time and Money by Meeting the NFPA 79 Cable Requirements

NFPA-79 is the section of the National Electric Code® (NEC) that focuses on the electrical wiring standards used with industrial machinery. NFPA-79 applies to the electrical equipment used within a wide variety of machines, as well as groups of machines working together in a coordinated manner. Examples of industrial machinery include, among others: machine tools, injection molding machines, woodworking equipment, assembling machinery, material handling machinery and inspection and testing machines. The scope of NFPA-79 includes all electrical and electronic elements of the machinery operating at 600V or less.

In 2007, the NFPA-79 code underwent significant revisions. The main goal of the revision was to harmonize NFPA-79 with its European counterpart, IEC-60204. This involved reorganizing the NFPA-79 chapter structure to follow IEC-60204 while adopting less restrictive, more progressive requirements without sacrificing the equipment safety.

As of January 2007, one of the major changes in the NFPA-79 is the cable selections required under **section 12.2.7.3.** This section states that single conductor or multi-conductor AWM shall not be permitted, unless the completed assembly has been listed prior for such use. Machine Tool Wire (MTW) is one of the wire and cable permissible options.

While 10 to 15 years ago little attention was paid to cable selection, today with the ever increasing occurrences of lawsuits and insurance liability issues, proper cable selection is now more important than ever. Perhaps one of the most overlooked items concerning installation of equipment and machines in an industrial or commercial building is the selection of the proper cable. This is primarily due to the high expenses surrounding the actual purchasing price of the machines, equipment, hardware (conduits, trays, raceways etc.) and costs for personnel that are necessary to complete the installation. Intentional or not, selection of cable seems to be given a secondary degree of attention in the installation process. Unfortunately, this can prove to be very costly to the building contractor, machine builder, manufacturing occupant, and all others involved in the process.

With the expansion of technology, many overseas companies are now supplying machinery for use in manufacturing facilities in the United States. As there are different codes and regulatory requirements that affect machine electrical installations both in the USA and overseas, insuring proper cable selection becomes increasingly more involved. Additionally, overseas manufacturers will sometimes include European or Asian cables along with their machines which further complicate the selection of the correct cable. These types of wiring methods do not apply in the USA and can cause many problems for the installer and end user. There are many manufacturers that use low cost materials with thin insulation to provide a lucrative cable price for the end user. In the long run these cable types end up being replaced at the end users facility. **One of the largest companies in the USA, listed on the Fortune 10, recently had 2.5 million units recalled due to faulty cables. The cables contained materials that were very fragile which subsequently caused fires resulting in several million dollars in liability and damage.** Machine manufacturers are generally given two options when their products fail in the end user facility; take the machine back and replace it with a new one (recall) or replace the faulty cables and be billed for the material and labor rate.

*** NEC is a registered trademark of the National Fire Protection Association**

Applications involving wire and cable for industrial machines and electrical/electronic equipment can be used in an assortment of applications including, but not limited to, power circuits, lighting and control circuits, programmable input/output controllers, and motor circuits. With the omission of AWM in the new NFPA-79 standard, AWM will no longer be incorrectly used during the installation of machines in the USA. In several instances where the incorrect use of AWM has occurred, on-site inspectors have shut down operations until the cable was replaced. Compounding this problem was the overseas equipment manufacturers who were supplying AWM with their machines as part of a "complete package" for installation in US factories. The omission of AWM will now prevent any misinterpretation and will also put an end to the reoccurrence of these scenarios. Please read below for the various reasons why the decision was made to omit AWM from the NFPA 79 Standard:

1. AWM was being incorrectly used during installation of industrial machinery as part of the building infrastructure. For example, incorrectly running AWM from the main source of power (circuit breaker or fuse box) to the control panel of the machine

2. The National Electrical Code does not recognize AWM as an acceptable method for wiring installation; therefore, it does no test monitoring or regulation of electrical (voltage, current), physical (flammability, environmental), and mechanical requirements (wall thickness, materials) of AWM.

3. The flame rating of AWM can vary greatly. In certain instances, AWM can meet the bare minimum flammability (UL Horizontal) or maximum flammability (FT6 plenum test). Under specific conditions, certain types of AWM will catch and spread fire; as an example, what can happen to certain AWM types when the maximum current is exceeded in a bundle located in a high temperature type of environment

4. The mechanical characteristics of AWM can also vary greatly; wall thickness can be run as thin as .002" in certain instances providing virtually no mechanical protection where the slightest abrasion will expose conductors, creating hazardous and possibly life threatening conditions.

5. Even if installed in conduit, the NEC does not recognize the use of AWM for installation within a building. The NEC does not permit AWM installations in conduit for the reasons stated above. As the NEC does not regulate AWM, they cannot verify the electrical, physical, and mechanical properties and therefore cannot substantiate usage of these wire and cables.

6. Unless listed previously with the equipment, AWM cannot be run within control panels. There have been instances where AWM has been used in these types of applications where fires have occurred, causing irreparable damage of equipment and/or destruction of the expensive electronic components within the panel box.

Cables that are used in machinery must be printed on the jacket surface with a **(**UL) Listed marking symbol instead of the Recognized Cable Component (RU) logo more commonly known as AWM (Appliance Wiring Material). It is also important to remember that the local inspector is the authority having jurisdiction in the area and their interpretation of NEC code regulations is the final decision. They will not knowingly permit a non-listed product for use in an installation. When an inspector shuts down a facility, no further installation work is permitted and all progress is left at a virtual standstill. The interpretation of the NEC code amongst inspectors can vary greatly; for example, what is considered acceptable in New York State may not be acceptable in New York City and vice-versa.

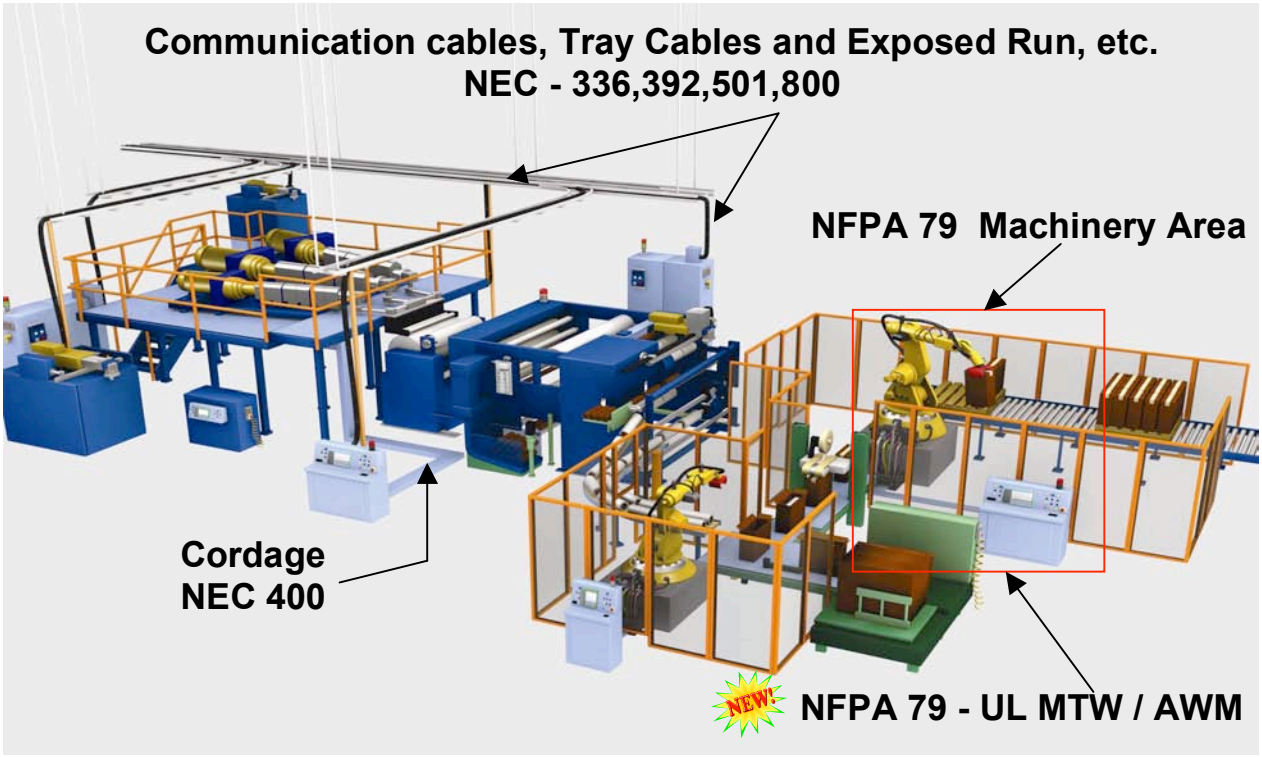

Diagram 1

Another key section in the 2007 NFPA is section 13.1.5.1 which indicates that exposed cables installed along the structure of the equipment or system, or in the chassis of the machinery shall be permitted. Exposed cables shall be installed to closely follow the surface and structural members of the machinery. This section permits the cable to be installed without the use of conduit or raceways, thereby aiding for a fast installation that requires no tools. During installation, the cable is also permitted to be dressed along the existing machine structures without the use of any additional special hardware. The amount of time saved with machine installation combined with reduced labor quickly turns into a huge cost savings over the traditional type of installation that requires conduit and/or special mounting hardware. Certain UL Listed cables meet Exposed Run (-ER) requirements which provide an additional level of protection for these types of applications. Cables meeting –ER requirements have been subjected to the same crush and impact tests as armored type or Metal Clad (MC) cables and allow the cables to leave the machine area and into a cable tray without conduit. (See Diagram 1)

The UL Listed MTW cable that is also permitted under the NFPA 79 is well known in the industry for its high standard regarding superior flexibility, oil resistance, flame retardency and overall ruggedness. When the cable product is UL dual rated with both cable approvals, the customer will be allowed to use one cable to meet all application requirements.

For applications where the cables needed on a machine are not addressed in the NFPA 79, Section 1.4 allows the machine builder to follow NEC 70 and Article 670. For example: For communication applications, the UL Type CMG is allowed through the Article 800 but it has to meet the stranding criteria referenced in the NFPA standard. Not all UL listed cables meet the NFPA requirements, especially the typical lower priced commodity and rigid products.

In summary, it is of the utmost importance to pay as much attention to the cables that will be used in equipment and machines as all the other costs required for an installation. To ignore cable specific requirements or simply consider them as secondary can be a very costly mistake or in worst case scenarios a very hazardous or life threatening risk. In the areas of industrial machine manufacturing and installation, the NFPA has taken a major step in addressing these critical issues by the publishing of its latest document, the 2007 edition of the NFPA 79. By omitting the use of AWM machine manufacturers, installers, contractors, end users, etc. are now insured that only listed cables will be used and supplied with the machine. The only allowable exception for AWM is if the machine has been previously listed with it as a complete system. It is also crucial to remember inspectors or the authority having jurisdiction in the area are the only qualified individuals that can make the final decision regarding correct cable requirements for an installation. We at Lapp USA can provide our interpretation of NEC regulations, but we do not have any jurisdiction authority to provide a definitive answer. **We can however offer product solutions that meet the new requirements.**

Lapp UL Listed Products Conforming to NFPA 79 2007

Product	Application	Key Features
OLFLEX® TRAY II Shielded & Unshielded	Stationary Control	Tray rated for extended runs, no need for conduit. Highly flexible for ease of installation, saves time and money. Highly oil and chemical resistant. MTW all sizes
OLFLEX® TC 600	Stationary Control	Economical version of OLFLEX® TRAY II. MTW sizes 14 AWG and larger
OLFLEX® CONTROL TM	Stationary Control	Flexible and Oil resistant Tray and Machine Cable. MTW all sizes
OLFLEX® CONTROL M	Stationary Control	Flexible and Oil Resistant MTW Cable for PUR Jacketed Alternative. MTW all sizes
OLFLEX® 190 Shielded & Unshielded	Stationary Control	All advantages of 190 cable plus MTW rating
OLFLEX® Auto I	Stationary Control	Available in Blue and Red conductors to differentiate DC and AC Control Circuits. MTW sizes 16 & 18 AWG
OLFLEX® -FD 890 MTW Shielded & Unshielded	Continuous Flex Control	All the Time Tested Performance Advantages of 890 plus MTW rating
OLFLEX® Auto X	Continuous Flex Control	Designed for Continuous Flex Cable Tracks or Chains, Highly Oil and Chemical Resistant. MTW sizes 16 & 18 AWG
OLFLEX® VFD Slim	Stationary VFD Cable	Reduced diameter, flexible VFD cable with "Lapp Surge Guard" with UL and CSA TC Approval. MTW all sizes
OLFLEX® VFD	Stationary VFD Cable	Oil resistant 1000V VFD cable and Bus Drop MTW sizes 2 AWG to 14 AWG
OLFLEX® with Signal	Stationary VFD Cable	First CSA TC Servo cable in USA, contains a pair for brake. MTW all sizes
OLFLEX® SDP TC	Motor Supply Power and BUS Cable	Stationary Severe Duty Power Cable with Specially Formulated Oil and Chemical Resistant Elastomeric Alloy Jacket

Key: Definitions of Regulatory Agencies and Functions

NFPA - The National Fire Protection Association (NFPA) acts as the sponsor of the National Electrical Code. The NFPA has no power, nor does it undertake, to police or enforce compliance with the contents of the National Electrical Code. The NFPA also does not list, certify, test or inspect products, designs, or installations for compliance with the NEC. The NFPA also makes no guarantee or warranty as to the accuracy or completeness of any of the information published in the National Electrical code.

NEC - The National Electrical Code (NEC) is considered purely advisory as far as the NFPA is concerned. It is made available for a wide variety of both public and private uses in the interest of life and property protection. These include both use in law and for regulatory purposes and use in private self-regulation and standardization activities as insurance underwriting, building and facilities construction and management and product testing and certification. **Registered trademark of the NFPA.**

(UL) - Underwriters Laboratories Inc. (UL) is an independent, not-for-profit product-safety testing and certification organization. There are no laws specifying that a UL Mark must be used. However, in the U.S. there are many municipalities that have laws, codes or regulations which require a product to be tested by a nationally recognized testing laboratory. UL does not, however, maintain a list of the jurisdictions having such regulations.

Authority Having Jurisdiction - The organization, office, or individual responsible for approving equipment, materials, an installation or a procedure.

Listed - Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that the equipment, material, or services either meets appropriate designated standards or has been tested and found suitable for a specific purpose.

Labeled - Equipment or materials to which a label, symbol, or other identifying mark of an organization has been attached that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Frequently asked questions (FAQs) by customers about NFPA 79:

1. Does UL dictate what cables are being installed out in the field?
No, they control the construction and testing requirements of the cables, insuring that all electrical, physical, and environmental parameters are in compliance.

2. Who controls the cables that are being installed in the field?
National Electrical Code regulations cited by the authority having jurisdiction in the area generally the local electrical inspector.

3. Does a machine have to meet NFPA -79?
Depending upon your application and if your product is being installed in building, the machine must meet NFPA-79. If you are not sure of the final destination of the machine, it is advisable to comply with NFPA 79 for purposes of compliance and safety **and** to avoid any unnecessary litigation.

4. If the cable is UL listed is it allowable for use on a machine?
No, not necessarily. There are machines that use listed cordage incorrectly as these cable types are only intended for temporary applications. Even if your cables have a UL Listing, the minimum stranding count required by NFPA 79 must be met.

5. Is the NFPA-79 a law?
No, it is a standard used by the machinery industry in the USA as the benchmark in safety compliance.

6. What about FD products?
Depending on specific flexing applications, there are different types of material blends that meet the NFPA-79 requirements and hold up well in this type environment.

7. Is the industry going to become standardized with the 2007 edition of the NFPA-79?
In the long run yes, due much in part to issues surrounding liability and safety. In short, no one will purchase a machine that does not comply, potentially resulting in a liability.

8. If my cable is MTW, can it be run into building infrastructure?
No, it has to be dual marked with another UL Listing such as "TC" which indicates the cable complies with a very high flammability rating. MTW requirements mandate that a cable only meet a minimal type of flame test, VW-1.

9. Can the cable be left exposed when going from the machine to the cable tray?
No, unless the cable has an Exposed Run approval such as TC-ER.

10. Are MTW cables required to be oil resistant?
Yes, all MTW cable must meet the requirements of the Oil Res I test due to the demanding requirements that are associated with industrial machine environments. In those applications requiring more severe exposure the Oil Res II test is also a permitted option for cable manufacturers which provides extra durability.

11. What is unique about the MTW approval?
The approval requires that the cable be flexible and yet have a high degree of mechanical durability so it can maintain performance under the challenging conditions surrounding the everyday use of an industrial machine.