# Plenum and Riser Communications Cables – The Importance of Certification by a Nationally Recognized Testing Laboratory (NRTL)

# Introduction

In the second half of the 20th century, changes in high-rise-building construction methods, materials, furnishings and interior decorative finishes caused changes in fire loading and fire load distributions.[1] This includes an evolution and proliferation of voice and data communications systems as well as an increase in the routing of voice and data cable within air handling plenums.[2] Purchasers, specifiers, installers and inspectors of telecommunication cables placed in risers or plenums during building construction or upgrade must be aware that cables that do not meet safety requirements present a significant risk of hastening the spread of fire. This represents an unacceptable risk — and avoidable hazard — to building occupants and owners.

Cables with counterfeit certification marks or surfaces printed as plenum or riser rated without certification marks (self-declaration of compliance) that have been distributed and installed have created confusion in the marketplace. It has become difficult for installers to differentiate these from certified cables.

This is important because, as noted in a report by the New York Board of Fire Underwriters in 1975 following a fire at One World Trade Center, if cables are not constructed with proper materials, a mass of such cables used to supply power and data to communications equipment in many offices can sustain a substantial fire. Cables placed in plenums and riser shafts are a potentially serious fire risk. Selection and installation practices must be followed to properly manage this risk.

Manufacturers marketing and selling communications cables with counterfeit certification marks or without certification marks face a potential fire risk, especially when the cable is rated for plenum or risers.[3] Counterfeiters, in their attempts to maximize profit, use inferior materials and mislead people, ultimately creating risk. Loss of property and/or occupant life is the ultimate price paid when a fire occurs where non-compliant cable has been installed.

[1] *The Evolution of Plenum Cable Fire Standards and the Impact of Those Standards on Material Specification, Stanitis and Dohmann.*
[2] *Ibid.*
[3] *Potential Liability for Contractors Installing or Manufacturers Marketing Falsely Labeled Copper Clad Aluminum Cable, CCCA, October 2012.*

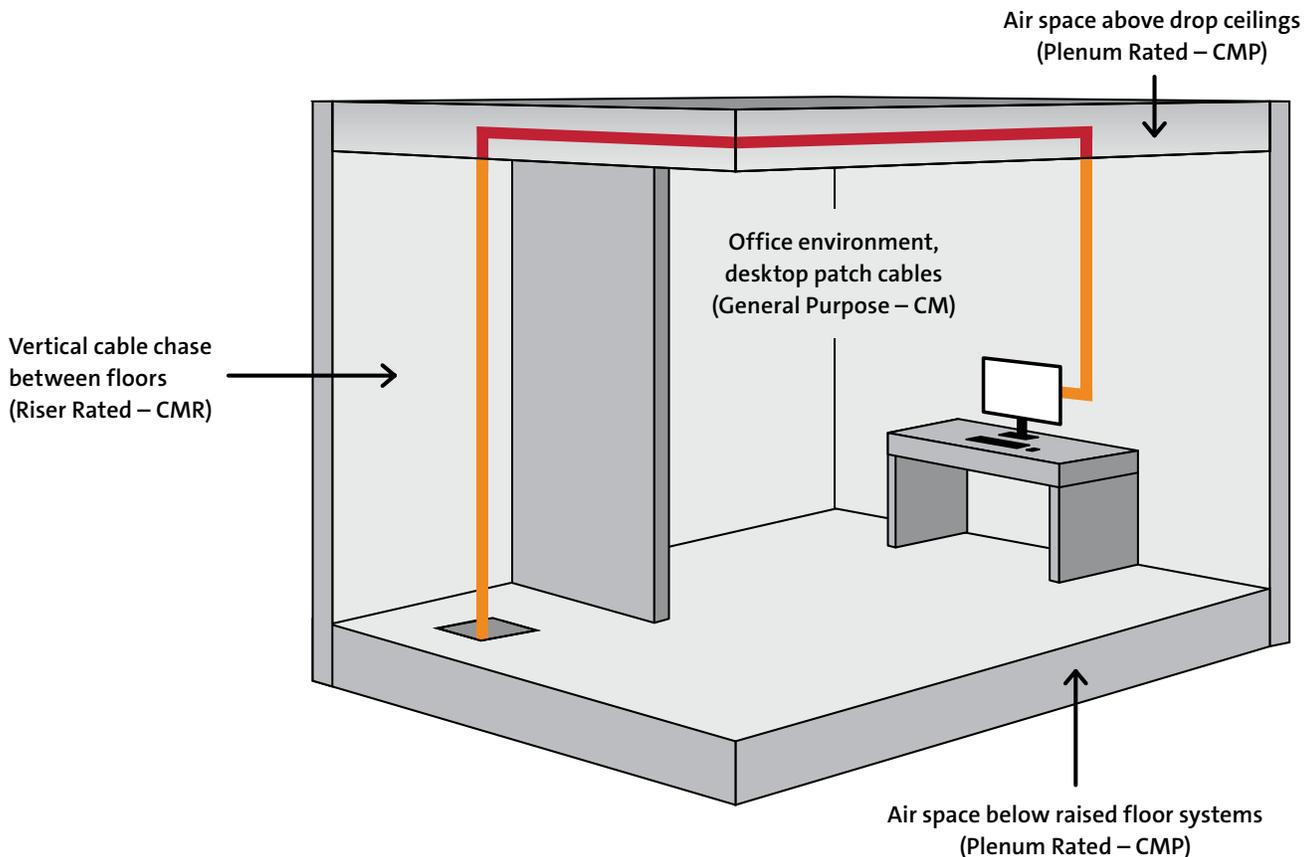# National Fire Protection Association (NFPA) 70, National Electrical Code®

Several important criteria are used to differentiate and classify communications cables described in the National Fire Protection Association (NFPA) National Electrical Code® (NEC).

When adopted by local jurisdiction, the NEC is a mandatory installation code enforceable by code authorities because the requirements have been adopted by state and local legislatures. The code acts as a practical safeguard against electrical hazards for both people and property.
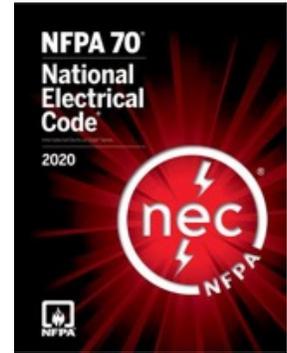
The NEC requires that communications cables comply with Chapter 8 – Communications Systems:

- The cable must be listed and certified by an organization that is acceptable to the code authorities concerned with the evaluation of products or services that maintains periodic production inspection of listed products and whose listing states that the product complies with the appropriate designated standard.

- UL Solutions is a Nationally Recognized Testing Laboratory (NRTL) under the Occupational Safety and Health Administration's (OSHA) Directives.
- The cables shall comply with the requirements outlined in ANSI/UL 444, the Standard for Safety of Communications Cables. UL 444 is a bi-national consensus standard for the U.S. and Canada.

**Air space above drop ceilings (Plenum Rated – CMP)**

**Office environment, desktop patch cables (General Purpose – CM)**

**Vertical cable chase between floors (Riser Rated – CMR)**

**Air space below raised floor systems (Plenum Rated – CMP)**

# The Problem

Once installed, cable infrastructure is typically out of sight. It is mostly installed behind walls, ceilings or floors, and can therefore easily be taken for granted. However, if the cables do not meet the national safety requirements described in ANSI/UL 444, the product's reaction in a fire event could lead to tragic loss of life and/or property.

At first glance, all communications cables might appear the same. However, cables manufactured using deficient manufacturing processes and substandard materials pose a safety threat. Without third-party certification, which includes such activities as evaluation of the materials and construction, as well as testing and surveillance, non-compliant cables running through a structure can accelerate the spread of smoke and flame.

Plenum fire safety must be strongly emphasized, as the plenum can accelerate flame and smoke transport throughout a building structure. Cables placed in plenums are a potentially serious fire risk, and selection and installation practices must be developed to manage this risk properly. Similarly, cables placed in riser shafts can propagate flame between floors that may go unnoticed by occupants.

Communications cables intended for use in plenum spaces must be designed to meet rigorous requirements for fire resistance and limited smoke production. Safety test standard NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces, address these hazards. This standard is referenced in the NEC and NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems,

as a method to test that electrical wires and cables are required to comply for use in plenum spaces.

Cables intended for use in a riser shaft must be designed so that the flame propagation does not travel from floor to floor. Riser rated cables are required to be evaluated in accordance with UL 1666, the Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts. This Standard is also referenced in the NEC.

Identifying a properly labeled and certified cable is critical at every stage of the construction or upgrade process. Those that select, approve or install cable should be able to trust that it is properly tested and certified for its use within the walls and ceilings of a building.

When looking for properly labeled and marked cable, one must understand the information surface-printed on the cable as well as what is required to be included on a label, carton, reel box or smallest unit container.

In the case of the UL Mark, "the UL Solutions symbol on the product and the Certification Mark of UL Solutions, on the attached tag, reel or the smallest unit container in which the product is packaged, is the only method provided by UL Solutions to identify products manufactured under its Certification and Follow-Up Services."[4] Placing the UL Mark on a product is the manufacturer's declaration that the product has met UL Solutions requirements at the time of production. If one or both are missing, you should be suspicious. To help deter counterfeiters, all products in telecommunication cable categories certified by UL Solutions must bear a unique UL Solutions holographic label.

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[4] Webcast (Part 3): Non-compliant Communications Cable, May 30, 2012. https://www.youtube.com/watch?v=d40vbJ1AwNo.

# UL Solutions Market Survey

Market surveys are an integral part of UL Solutions overall surveillance program. Samples of UL Certified products are regularly purchased each year from e-tailers, distributors and retail outlets.

In the most recent market survey, UL Solutions surveyed the overall plenum and riser cable market. In addition to UL Certified cable, we purchased cables certified by other NRTLs as well as unlisted cables that did not bear any certification marks and had references on the surface printing and/or carton indicating the cables were suitable for use in a plenum or riser.

**Requirements**
For cables used in plenums, the pass/fail requirements for NFPA 262 are a maximum peak optical density (POD) of 0.50 or less, an average optical density (AOD) of 0.15 or less and a maximum flame spread distance of five feet or less.

For cables used in risers, the pass/fail criteria for UL 1666 are that the flame propagation height of each set of cable shall not equal or exceed 12 feet, 0 inches (3 m, 66 cm) and that the temperature of any thermocouple in the second floor slot shall not exceed 850 degrees F (454.4 degrees C).

**Plenum Cable Results**
A significant non-conformance (SNC) for plenum cables is defined by UL Solutions as when the flame spread distance exceeds 6 feet, the AOD exceeds 0.20 and the POD exceeds 0.60.

UL Solutions market survey yielded the following data on SNCs:
  - 100% of the self-declared (unlisted) cables had significant non-conformance; in fact, the flame spread distance exceeded 19 feet for all the cables tested
  - 70% of cables with other NRTL marks had significant non-conformance
  - 0% of the UL Certified cables had significant non-conformance
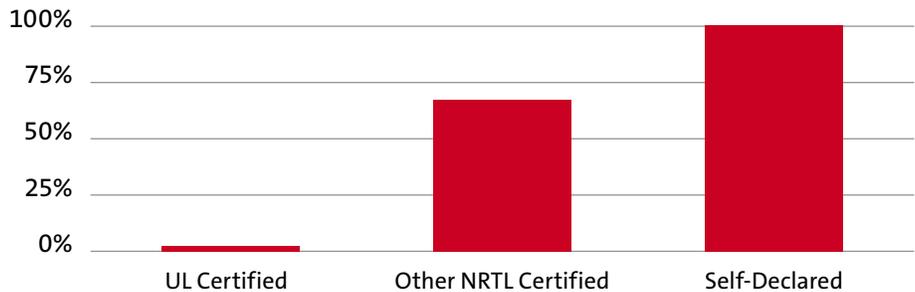


In addition to large scale flame testing, analytical testing consisting of cone calorimeter and X-ray fluorescence (XRF) were conducted.

For cables with significant non-conformance, the XRF results indicated no flame-retardant elements or smoke suppressants were found in the jacket compound.

**Riser Results**

A significant non-conformance (SNC) for riser cables is defined by UL Solutions as when the flame propagation reaches the second floor in less than 5 minutes.

UL Solutions market survey yielded the following data on SNCs:

- 75% of the self-declared (unlisted) cables had significant non-conformance; in fact, for all samples tested, the flame propagated to the second floor in less than 2 minutes
- 53% of cables with other NRTL marks had significant non-conformance
- 14% of the UL Certified cables had significant non-conformance
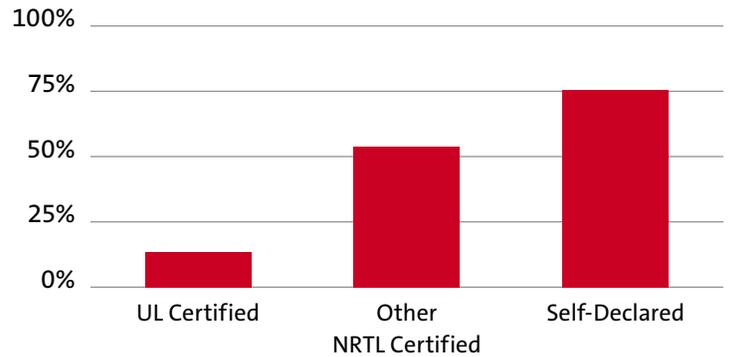
For those UL Certified cables which produced SNCs, UL Solutions issued public notices and removed the authorization for those cables to be used in riser construction.

**Summary**

The data shows that self-declared (unlisted) cables could pose a serious safety risk and should not be used. Self-declared (unlisted) cables have surface printing that indicates they are plenum or riser rated, i.e., marked as CMP or CMR. They also are commonly found on cartons marked as "Plenum" or "Riser," which can be confusingly similar to the cartons used for certified plenum or riser cables. These unlisted cables, once imported into the U.S., now find their way into installations claiming to be NEC-compliant. In fact, UL Solutions has been approached by installers asking about the use of these self-declared (unlisted) cables for their installations. One of the cables shown to UL Solutions was simply marked as "LAN" cable.

Currently, manufacturers looking to take advantage of the perception that communications cables are a commodity bring cables to market that include markings resembling a certified cable but are actually missing key elements, e.g., the UL Certification Mark. The manufacturers will mark the cables as plenum- or riser-rated without being certified.

No current federal regulations require third-party certification. These self-declared cables are brought into the U.S. for installations outside of the NEC, such as in patch cords.

**Examples of Fire Events**

The following events occurred prior to the development of appropriate safety and installation requirements. Riser and plenum cables that do not comply with applicable requirements could cause similar events to occur in the future.

**With plenty of unfamiliar cable brands available at reduced cost and purported to have fire safety listing and standards compliance, staying informed and maintaining a degree of due diligence can ultimately make or break your reputation in the ICT industry.**

The 1980 fire at the MGM Grand Hotel and Casino (now Bally's) in Las Vegas helped usher in many of today's building code changes and safety measures.



**One World Trade Center, New York, NY – February 1975**

"The worst and most hazardous condition is when wires and cables with combustible insulation are run through plenums to service the floor above. This provides a double hazard by introducing combustibles into the air conditioning… It should be noted that the mass of cables to supply communication equipment in many office occupancies is sufficient to sustain a substantial fire. While an individual cable is extremely difficult to ignite, a group of cables lying parallel will burn intensely, similar to the situation that exists with a group of logs in a fireplace."

**— Report by New York Board of Fire Underwriters**
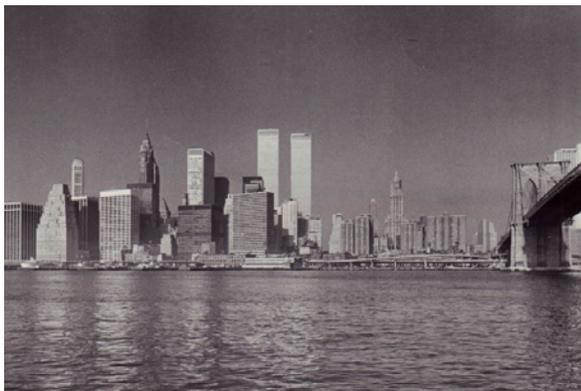


**United Airlines Operations Control Center, Elk Grove, IL – August 1999**

Combustible materials in the plenum spread smoke and flames through the building. As a result of this fire, all electronic equipment was either damaged or destroyed.

**UL Solutions Certification, Factory and Market Surveillance**
On Feb. 7, 1978, UL Solutions issued a fact-finding report of our investigation comparing flame propagation and smoke development tests on communications cables in various test geometries. The report was used to develop a test method for determining adequate fire resistance and low smoke-producing characteristics of cables to be adopted by the NEC. The test method is now described in NFPA 262.[5]

However, even after a telecommunications cable has been tested and certified, ongoing monitoring must continue. Factory and market surveillance conducted by UL Solutions includes random sampling of products, analytical testing of materials and large-scale fire tests critical to determining the cables continue to meet applicable requirements. Any non-compliant products would be subject to corrective action as necessary, including public notice and withdrawal of certification.

To maintain UL Solutions certification, UL Solutions field engineers must visit a manufacturer site a minimum of four times per year or more, based on the manufacturer's production levels. Production samples are tested at

the factory along with additional testing conducted by UL Solutions and the purchasing of cables from the market.

Continued education of the telecommunication cable supply chain regarding safety compliance is critical. UL Solutions works with code authorities, engages with distributors, publishes articles in trade publications and participates in speaking opportunities to help the industry understand the depth and breadth of the issue of non-compliant telecommunication cables.

To distinguish between authorized and unauthorized cables, UL Solutions introduced a holographic label for each manufacturer whose cable has been tested and certified. The holographic label is required on every box of UL Certified cable. It includes security features such as color-changing ink with a unique code that can be verified using an authenticator. An authenticator has a window on it that, when moved across the special UL Mark made with the color-changing ink, shows a change in the background.

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[5] *The Evolution of Plenum Cable Fire Standards and the Impact of Those Standards on Material Specification, Stanitis and Dohmann.*

# Conclusion

The hazards associated with non-compliant plenum and riser cable present significant risks regarding the nature and scale of a fire event. Installation codes, including the NEC, mitigate this risk by requiring compliance with critical safety standards. UL Solutions robust safety certification program for cables brings trust and confidence that such safety issues have been assessed.

The holographic UL Mark is the first point of reference for all suppliers, installers and end-users to know the cable has been tested and is certified for safety. Look for the UL Solutions holographic label on the box of cable as well as the letters "UL" on the surface print. You can also consult the UL Product iQ® website.

Do not buy or install cables that are not certified and remain skeptical of unlisted cables that are self-declared to be compliant. Do your due diligence in regard to NEC installation requirements, and verify the labeling on packaging and cable jackets. Only specify and purchase cabling that has demonstrated compliance with the applicable standards and includes the UL Solutions holographic Mark to support that compliance. Above and beyond knowing the risks, understand your responsibility in supporting this issue and how you can also help reduce the problem by making sure to alert industry agencies and associations any time you suspect use of non-compliant or counterfeit cable.[6]

You may very well save lives and property.

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[6] *Risk, Responsibility and Reputation: What You Need to Know about Non-Compliant Cable, CCCA,*
  *https://cccassoc.org/resources/risk-responsibility-and-reputation-what-you-need-to-know-about-non-compliant-cable/*

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