Selecting the Proper Cable Fire-Resistance Rating

Selecting the proper fire-resistance rating for an indoor cable installation is important from both a safety perspective and a code-compliance perspective. Cables with an incorrect listing installed in a space for which they were not intended can lead to the installation being rejected by the local authority having jurisdiction (AHJ) and subsequently, the removal of the incorrect cable and installation of the correctly listed cable. The information contained below is intended to assist in differentiating the various ratings and the applications for which they are suitable, according to applicable building codes.

Code Requirements

Local and national building codes, including NFPA 70 (National Fire Protection Association), more commonly known as the National Electric Code (NEC), dictate the cabling material that may be installed in certain areas of a building in the USA. These rules are imposed to minimize the spread of flame, smoke or other dangers in the event of a fire. Listed in the chart below are the most common ratings utilized for communications copper and fiber cable, along with relevant information. Also included is a description of permitted installation locations according to the NEC. Other national or local codes may vary. Always consult with the local AHJ for final approval before the installation of the cables.

Acronyms

- Communications general-purpose cable (CM)
- Communications riser cable (CMR)
- Communications plenum cable (CMP)
- Low smoke, zero halogen (LSZH)
- Nonconductive optical fiber general-purpose cable (OFN)
- Conductive optical fiber general-purpose cable (OFC)
- Nonconductive optical fiber riser cable (OFNR)
- Conductive optical fiber riser cable (OFCR)
- Nonconductive optical fiber plenum cable (OFNP)
- Conductive optical fiber plenum cable (OFCP)

General Purpose Rating

General purpose (CM, OFN, OFC) cables must meet the UL 1581 flame resistance requirements which are less stringent than riser and plenum requirements. These cables are not permitted to be used in a vertical shaft or in an area used for environmental air.

Riser Rating

Riser rated (CMR, OFNR, OFCR) cables incorporate halogens in the PVC (polyvinyl chloride) sheath in order to meet the UL 1666 flame resistance requirements. While these halogens perform well at minimizing flame spread, they release hydrogen chloride if burned, which can be hazardous.

Riser rated cables are permitted to be installed between floors and routed through vertical shafts which are not used for environmental air. Riser cables may also be used in other applications with lower or no fire-resistance requirements. For more information on fire resistance hierarchy, see **Copper Wire and Cable NEC Fire Resistance Ratings** and **Optical Fiber Cable Fire Resistance Ratings** at **SuperiorEssex.com**.

Plenum Rating

Plenum rated (CMP, OFNP, OFCR) cables use halogens in the PVC sheath and Fluorinated ethylene propylene FEP insulating materials in order to meet the more stringent NFPA 262 flame resistance and smoke generation requirements. NFPA 262 requires that the flames spread no more than 5 feet from the ignition flame and have a peak optical density of 0.5 maximum (33% light transmission) and a maximum optical density of 0.15 (70% light transmission). Along with being an extremely efficient electrical conductor, FEP can withstand heat of 800 degrees Fahrenheit before it breaks down.

Plenum rated cables are permitted to be installed in spaces defined as air plenums. Plenum cables may also be used in other applications with lower or no fire-resistance requirements. For more information on fire resistance hierarchy, see **Copper Wire and Cable NEC Fire Resistance Ratings** and **Optical Fiber Cable Fire Resistance Ratings** at **SuperiorEssexCommunications.com**.

LSZH

Cables described as low smoke, zero halogen (LSZH, aka LSOH or LS0H or LSFH or OHLS) contain zero (or low) halogen compounds (e.g., chlorides) and therefore release only trace amounts of toxic and corrosive gasses while burning. They also release carbon monoxide into the air during combustion. LSZH is not a rating, but a description of the material properties. LSZH cables contain fillers with very high concentrations of inorganic flame retardants in the cable jacket in order to meet the requirements of the IEC 332-3 fire resistance test. Use of these flame retardants has a significant, adverse effect on the physical properties of the sheath. Among these negative effects are reduced mechanical and electrical properties, chemical resistance and water absorption.

LSZH cables are typically installed in shipboard applications, computer network rooms and other spaces where toxic or acidic smoke and fumes can injure people and/or damage equipment. Per the NEC, LSZH cables are only permitted to be installed in CM applications. Other jurisdictions however, require LSZH ratings in all indoor applications, preferring its low emission properties over the better smoke and flame spread properties of the halogenated compounds.

Comparison

The following table compares the principle attributes of Superior Essex riser, plenum and LSZH cables.

PARAMETER		SUPERIOR ESSEX LSZH	SUPERIOR ESSEX RISER	SUPERIOR ESSEX PLENUM
Common listings		LSZH/CM	CMR, OFNR, OFCR	CMP, OFNP, OFCP
Insulating material		Polyolefin	Polyolefin	Fluorinated ethylene propylene (FEP)
Sheath material		Highly filled polyolefin	Flame retardant, flexible PVC	Flame retardant, low smoke PVC
RoHS-compliant		Yes	Yes	Yes
Minimum sheath tensile strength, MPa		9.0	17.4	17.3
Flammability testing	Test	IEC 332-3	UL 1666 (Vertical Chamber)	NFPA 262 and UL910 (Steiner Tunnel)
	Rate of input energy	70k BTU/hr	527k BTU/hr	320k BTU/hr
	Test duration	20 minutes	30 minutes	20 minutes
	Maximum flame spread	2.5 m (8.2 ft)	3.5 m (12 ft)	1.5 m (5 ft)
Flammability		Low – Will self-extinguish when flame is removed	Low – Will self-extinguish when flame is removed	Low – Will self-extinguish when flame is removed
Toxicity		Releases carbon monoxide when burning	Releases hydrogen chloride when burning	Releases hydrogen chloride when burning
Cable uses and permitted substitutions[1]	Where permitted	CM applications	CM and CMR applications	CM, CMR and CMP applications
	Where not permitted	CMR and CMP applications	CMP applications	Permitted in all indoor applications.

[1]*See Figure 800-53 of the National Electric Code (NFPA 70) for additional information.*

Summary

In many jurisdictions, codes dictate which cabling may be installed in designated areas of a building in order to minimize the spread of flame, smoke or other dangers in the event of a fire. The NEC defines multiple levels of cabling based upon its installed location within a building. As indicated in the chart above, Plenum rated cabling meets the most stringent of the NEC requirement levels and may be installed in all building applications. It has the highest flame-resistance, and it is also tested for smoke density, which General Purpose and Riser rated cables are not subjected to. In comparison, Riser rated cabling meets lower fire-resistance requirements than Plenum and may be installed in fewer applications. General Purpose cabling, meeting the least stringent fire-resistance requirements, may be installed in the fewest applications.