

## Category Cable Cornucopia

It's been awhile since we've done a technical article about networking, and as with most things in technology, times have changed a bit.

In this article, we are going to focus on the various "levels" of Category Cable (more commonly known as Ethernet cable or, broadly, networking cable), what defines these levels, and how they are most commonly used. We'll also debunk a few myths and marketing claims about Category Cable.

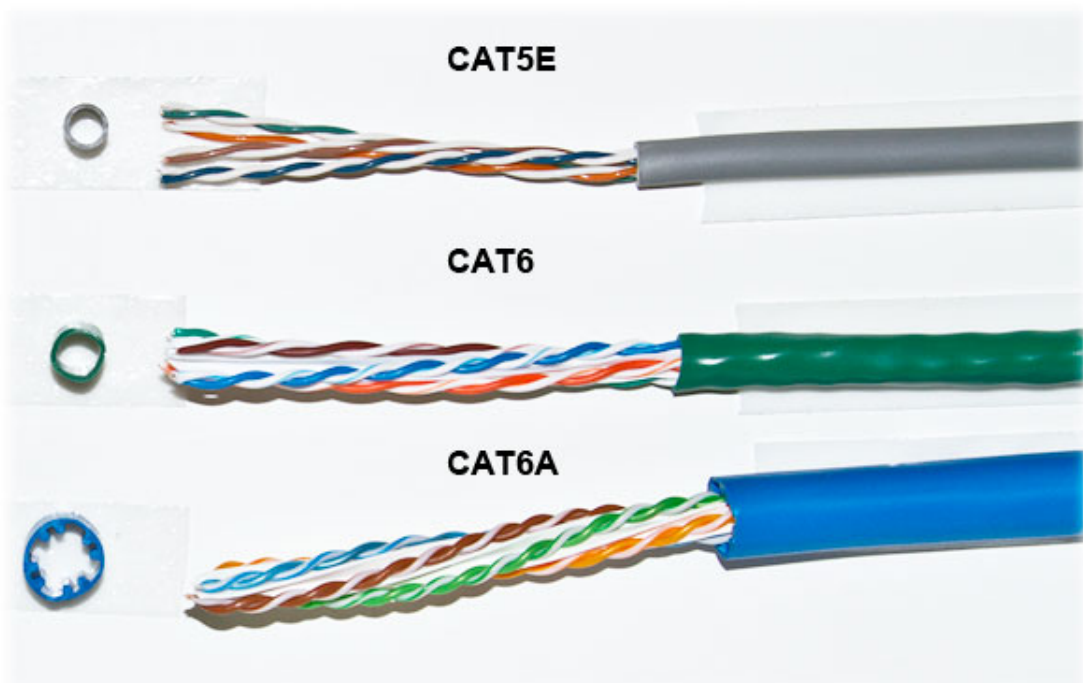
First, let's review the commonly used types of networking cable out there. The following networking cable types are defined by the Telecommunications Industry Association (TIA), the standards body most commonly recognized in the United States. These cable types are defined in the TIA/EIA-568-C standard, published in 2009 (superseding the "TIA/EIA-568-B" standard, which was published in 2001). Among many other things, the standard specifies certain electrical and performance properties at given frequencies for the various levels (categories) of cabling.

### Category 3 Cable

You will not find this much in the context of networking these days. Category 3 cable can support frequencies of up to 16 MHz and is rated for a 10 megabit-per-second (mbps) connection, which is about the speed of a typical home DSL internet connection. Many network professionals think of category 3 cable as telephone cable, since in the real world that is about all it would be considered useful for, and no new networking installations would specify it. (As a matter of fact, it is still included as a recognized standard cabling type in the TIA/EIA-568-C standard for voice applications.) However, there are still plenty of buildings with older network installations using category 3 cable. Most of these are being rewired.

### **Category 5 Cable**

This was the first cable to offer 100 mbps speeds and was widely deployed in the late '90s and early 2000s. As recently as two years ago most new computers that had built-in network cards had 100 mbps network cards and existing Category 5 wiring was adequate. However it is no longer recognized in the latest TIA/EIA-568-C standard as a valid cabling type; thus no new network installations should use Category 5 cable. For historical reasons the standard does mention the performance requirements for Category 5 cable up to 100 MHz frequencies.



## [Category 5e Cable](#)

Category 5e cable is now the minimum recognized cable for data networking applications, as defined by the current standard. Like Category 5 cable, it also is rated for up to 100 MHz frequencies. Additional performance standards enable it to support transmission speeds of up to 1000 mbps ("gigabit Ethernet").

## [Category 6 Cable](#)

Category 6 cable, the standard for which was defined in 2002, raises the bandwidth limit to 250 MHz; as a practical matter, Category 6 cable, like Category 5e, currently supports gigabit Ethernet (speeds of up to 1000 mbps). When the standard was released, Category 6 cable was described as "being able to support future applications." In practice there are few areas in traditional networking environments where Category 6 cable would be required (as opposed to Category 5e cable). Shorter runs of Category 6 cable can even support speeds of up to 10 gigabits per second (10,000 mbps), a speed that would otherwise require Category 6a wire. Category 6 cable is also often necessary for some non-traditional uses; for example, converters that can transform HDMI video signals for transmission over network wire often require the additional frequency support found in Category 6 cable.

## [Category 6a cable](#)

This is the newest category standard recognized by the TIA (2008). Category 6a cable can support frequencies up to 500 MHz and speeds up to 10 gbps. Demand is still relatively low for Category 6a wire, as of this writing. This is, in part, due to fiber-optic cable already supporting 10 gigabit speed (often written as 10gE, for 10 gigabit Ethernet), rather than by twisted-pair copper cable.

## **Category 7 and 7a Cable**

As mentioned at the beginning of this article, the TIA/EIA-568-C standard, as developed by the Telecommunications Industry Association, is the primary standard used in the United States. However, in Europe, Africa, and Asia, the ISO/IEC 11801 standard, as defined by the International Standards Organization, is followed. It has similar standards for cabling up through Category 6a (referred to as "Class EA"), but also specifies standards for "Class F" and "Class FA" cabling, with frequency ratings of 600 MHz and 1000 MHz, respectively.

## **Common Myths about Networking Cables**

Now that we've presented the actual defined standards for networking cable, it is worth taking a few minutes to look at some common marketing claims, myths, and other oddball statements floating around out there.

### **The Mysterious Category 6E Cable**

This is one of our favorites here at CableWholesale. Many manufacturers out there have taken to producing a "superior" Category 6 cable, which they refer to as Category 6E. Generally, this product claims to perform at up to 500 MHz, 550 MHz, or 600 MHz frequencies (the Category 6 standard is 250 MHz). Although it is often a high quality cable, the fact remains that there is no such cable in any defined standard. Clearly, in spite of the frequency claims, it is not a Category 6a cable, or else it would be so labeled (and priced accordingly; true Category 6a cable does not come cheap!). We at CableWholesale feel that marketing such a dubious product does nothing but confuse the marketplace, while not doing anything to improve your network. We have even heard of some vendors trying to distinguish between Category 6 "Big E" and Category 6 "little e" (as well as using similar designations on Category 5e cable). When in doubt, refer back to the standards.

### **"I need Cat 6 cable for my home!"**

Many home users believe that they need Category 6 cable run in their homes to support their high-speed internet connection. In fact, even Category 5e is technically overkill for today's high-speed internet services. A "typical" high-speed internet service to the home is anywhere from 1 mbps to 10 mbps; a few lucky folk have been able to get 50 mbps to their homes. Category 5e cable can support gigabit Ethernet. That's 1000 mbps. So, for the home, don't waste money on Category 6 cable (or components!).

### **"I need Category 6 cable for gigabit Ethernet!"**

As we stated above, a properly installed Category 5e network will support gigabit Ethernet. We do have to emphasize "properly installed." It (hopefully) goes without saying that in order for any system (network or otherwise) to achieve its rated performance, it must be properly installed.

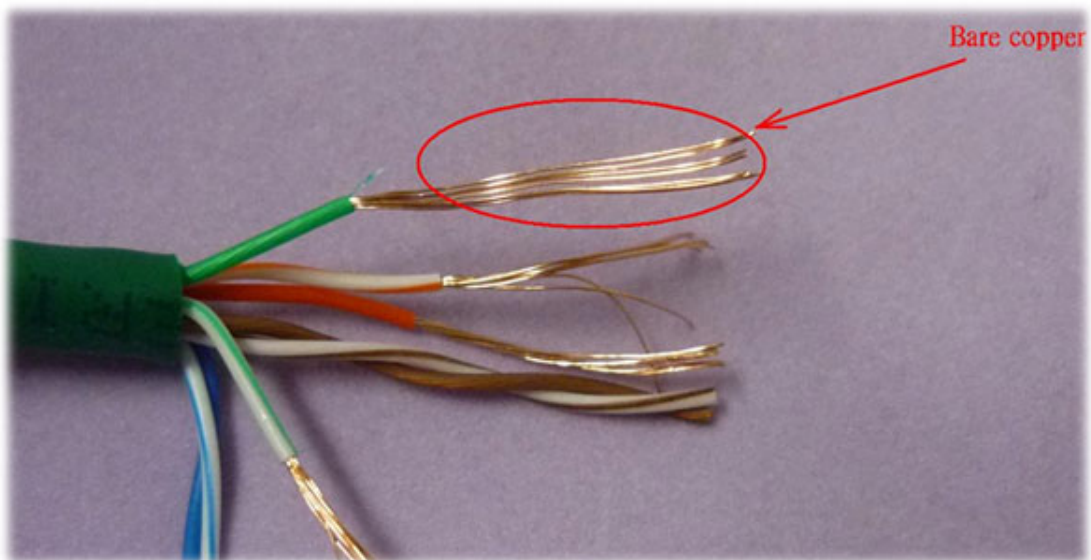
## **Network Cable Quality Traps**

In recent years there have been a few trends in our industry that are putting the pinch on quality. One reason is rising raw materials costs. Networking cable is made from copper and some form of plastic insulation (typically PVC), which is made from oil. As both copper and oil prices have climbed so has the cost of properly manufactured network cable. At the same time there has been more and more pressure from customers at various levels to keep prices competitive. The result is that more and more lower-quality networking cable is being produced that does not actually perform as it should. The following are a few examples of quality issues that we've seen in the wild.

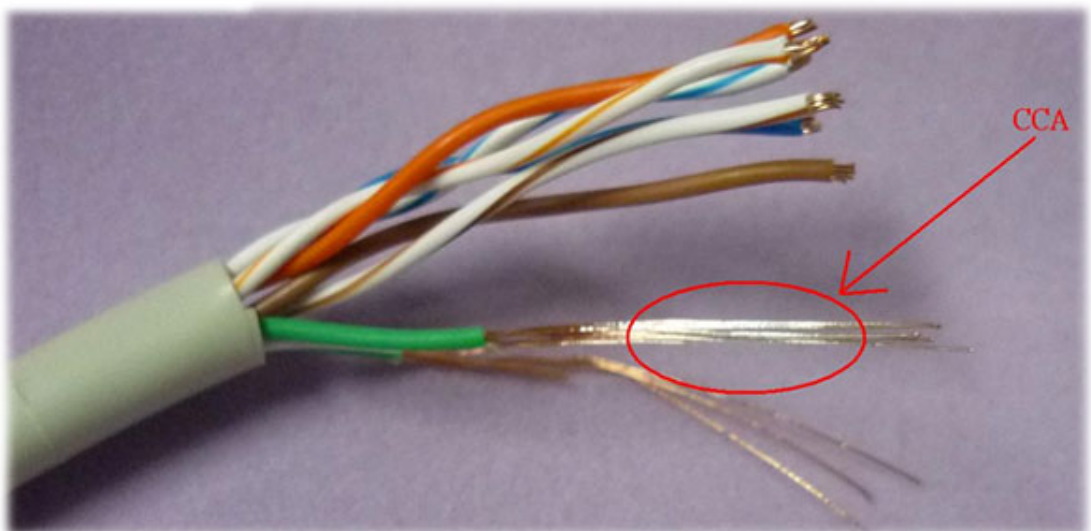
### **Copper-clad aluminum wiring**

Network cable wires should be made out of pure copper wires. However some manufacturers, in order to shave costs, have been making network cable out of copper-coated aluminum wires. On the surface they look the same. However you can scrape away the

copper coating with a sharp blade to expose the aluminum wire underneath, as shown in this picture:



Bare Copper

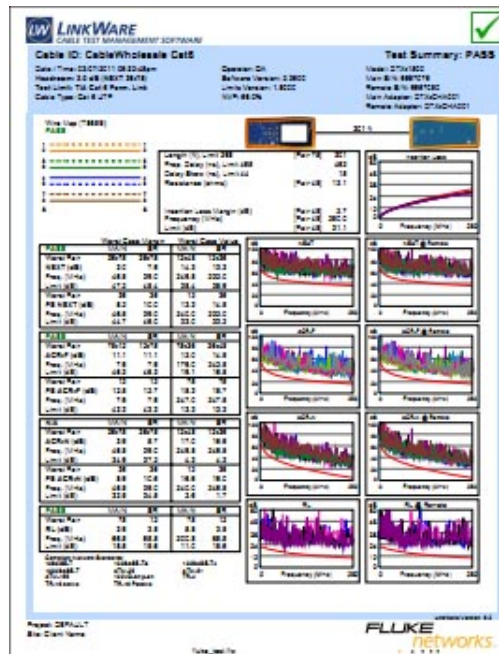


Copper Clad Aluminum

### **Incorrect Safety Rating on Jackets**

Network cable generally needs to adhere to certain electric code or fire code safety ratings. Broadly speaking, in the United States, these are defined by the National Electric Code and certified by 3rd party labs such as Underwriters Laboratories (UL) or Intertek. Unfortunately there has been a trend to label network cable jackets as meeting certain flame ratings when they do not. The certification labs do not test every single unit; they test a sample, give the manufacturer a certificate, and then trust the manufacturer to keep producing the same product as the sample. Recently Underwriters Laboratories has been stepping up enforcement efforts to prevent unscrupulous manufacturers from supplying non-conforming product, but "caveat emptor" is still the word of the day. It is often difficult for the end consumer of a product to know the difference.

So how should you guard yourself against this product? One way is to always have a qualified installer to help manage your network install. Ask them to provide a performance test result that certifies the rated performance of a network run. Testing tools such as Fluke Networks DTX series and Agilent's WireScope series are excellent performance testers.



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Also ensure the wire that is used comes from a reputable source that stands behind their product.

### Glossary of Common Networking Terms

**UTP** - *Unshielded twisted pair*, which refers to network wire that does not contain any inner shielding. Most network cable fits into this category.

**STP** - *Shielded Twisted Pair*, refers to network cable that has inner shields. In the USA, this tends to be a generic designation for any shielding present in network cable; true STP cable refers to a product with individual aluminum foil shields around each of the four pairs of wire. Most cable marketing in the USA as STP cable should properly be called FTP, "Foil Twisted Pair" or ScTP, "Screened Twisted Pair" which refers to a single foil shield around all eight wires.

**Twisted Pair** - All modern network cable is made from eight color-coded wires that are twisted in pairs. (show image /mailimages/networkwire.jpg) The term twisted pair refers to this construction. Wires are twisted to help eliminate crosstalk (the "bleeding" of signal from one wire to another), thus improving data transmission performance.

**CM** - One of many cable jacket fire safety ratings as defined in the National Electric Code. It refers to a jacket type that is rated for in wall use for multi-story residential buildings or single-story commercial buildings. For more information check out "[Jowling about Jackets](#)" a previous technical article.

**CMR** - One of many cable jacket fire safety ratings as defined in the National Electric Code. It refers to a "riser" rated cable; meaning, one that can be installed between floors of a multistory commercial building.

**CMP** - One of many cable jacket fire safety ratings as defined in the National Electric Code. It refers to a cable that is suitable for installation within a plenum space.

**Plenum** - A space in buildings that is used for air circulation / air return from HVAC (heating and air-conditioning) units. Because air from plenum spaces circulates rapidly through a building, it is important that any cable laid in this protected area be constructed in such a way that it will minimize toxic smoke.