



Why Pay More: The Differences in Cable Assemblies

The differences can be summarized in these five categories:

1. Fire Ratings and insulation
2. Wire Gage (AWG) and construction
3. Connector Impedance
4. Mechanical Strength, quality and testing
5. Look and Feel

Each contributes to costs and quality so it's reasonable for a cable of similar connectors and length to vary in cost dramatically.

Fire Ratings and Insulation

Fire ratings and their enforcement are a cooperative effort of fire marshals, building inspectors, local building codes, the National Electric Code and certification laboratories including Underwriters Laboratories (UL), Intertek Testing Services (ETL) and other organizations. As a result it is important to understand the exceptions in many locales to the general statements below. Check your local building codes to understand the requirements in your area. Usually exceptions are stricter than the NEC®.



There are many cables available that do not have a fire certification or have a fake certification. You can determine the certification of the cable in several ways:

1. Certified cables all have an "E" number imprinted on the cable. The UL website can cross reference that "E" number with the manufacturer for verification.
2. Plenum constructions rarely have jackets thicker than .020 inches so they are noticeably smaller and stiffer than the PVC non-plenum cables. Also because of patent restrictions, it is extremely rare to find a plenum cable or assembly that was made in Asia.
3. Use a reputable and established manufacturer. The liabilities for fraudulently representing a cable are much too severe for a manufacturer to take a chance by saving some money by using the wrong plastics.

As an installer, specifier or vendor of cables, you are liable for installing the right cable. Fire Marshals or Building inspectors may force you to remove and replace all non-compliant cable – at your expense. Building owners are becoming more aware of the regulations and may also enforce the rules. Last but not least, the wrong cable could kill someone if there is a fire. The long term risks don't match the short term rewards of saving a little money. Do the right thing.

Wire Gage (AWG)

The second significant cost factor for wire is the amount and quality of the copper. More copper conducts better. It is heavy. It reduces the flexibility of the cable as it gets thicker. Finally, it is expensive.

In high frequency circuits for video and RF, thicker copper increases the bandwidth of the cable at a specific distance. This is due to the greater surface area of the thicker cable. For example 18 AWG Serial Digital coax at 100 feet attenuates a 4,500 MHz signal by 14.78 dB. 20 AWG attenuates 4,500 MHz by 19.29 db, and 23 AWG attenuates 4,500 MHz by 23.67 db. (3 db is means that the voltage is ½ the reference voltage). Smaller cables typically are only rated to 1,000 MHz. A 26 AWG coax will typical attenuate a 1,000 MHz cable 21.40 db lower frequencies are attenuated less.

Many professionals prefer 26 AWG coax cables for computer graphics, since they are field repairable with common BNC and RCA tooling. Smaller AWG cables such as inexpensive 28 and 30 AWG cables are not.

Connector Impedance

An easy way to reduce the cost of a BNC cable or RCA cable is to use a low cost Ethernet or antenna style BNC connector that is rated at 50 ohms. These can be identified by the dielectric surrounding the female BNC center pin. Of the common connectors only BNC connectors are truly 75 ohms. VGA connectors are about 100 ohms and RCA connectors are in the 25 to 60 ohm range. Higher quality cables use connectors as close to the nominal 75 ohm rating as possible.



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Mechanical Strength, Quality and Testing

Strain reliefs, cable shielding, ferrite beads, gold plating, solder/crimp technology and other construction components contribute significantly to the cost of cables. However they also contribute to the durability, reliability of the electrical connection and the likelihood that the signal being transmitted will not interfere with other devices.

Quality vendors use recognized test procedures and test equipment. There are a variety of tests that can be run. Clearly open wires, or shorted wires are never acceptable. However sweep testing is required to completely diagnose the quality of the assembly. Because of the time and cost involved, sweep testing is usually only performed on a small percentage of the assemblies. Open /short testing should be performed and documented on all cables.

Look and Feel

The look and feel of the cables is the final determinant of the cost. It is subjective, but in general the slicker the cable, the more it costs. Look for sharp edges on connectors, soft jackets, fabric overly on the jackets, and gold plating on the exterior of the connectors. Are the VGA hold-down screws easy to operate? Is the cable easy to coil or does it kink? Is the color appropriate for your application? Can a neater installation be done with a cable that combines multiple functions in a single assembly such a HDMI + component video, VGA + audio + network or USB?

Conclusions

In every case lower cost cables and cable assemblies are possible by reducing the performance of the cable. The major factors that drive the costs include:

1. Fire Ratings and insulation
2. Wire Gage (AWG) and construction
3. Connector Impedance
4. Mechanical Strength, quality and testing
5. Look and Feel

A recent comparison of 4 leading suppliers of VGA-BNC and S-Video-BNC cables showed how these play out in the market place. Needless to say not all the cables are the same price. Imagine how much more can be saved with truly a low end product!

Here's the comparison:

Manufacturer	UL/CSA	AWG	Type	Shield	BNC
VGA HD15F-5BNCF					
Liberty	CL2/FT4	26 AWG	Coaxial	95% TC Spiral 100% Foil	75 Ohm
Brand A	AWM 1354	28 AWG	Insulated Conductor	90% TC Spiral	50 Ohm
Brand B	AWM 1354	28 AWG	Coaxial	TC Braid 100% Foil 60%	75 Ohm
Brand C	No ratings listed	26 AWG	Coaxial	95% TC Spiral 100% Foil	75 Ohm
S-Video SVM-2BNCF					
S-Video	CL2/FT4	26 AWG	Coaxial	95% TC Spiral 100% Foil	75 Ohm
Brand A	AWM 2725	30 AWG	Insulated conductor	90% TC Spiral	50 Ohm
Brand B	AWM 2863	26 AWG	Insulated conductor	85% BC Spiral	75 Ohm
Brand C	AWM 20276	28 AWG	Coaxial	95% BC Spiral 100% Foil	75 Ohm

- AWM ratings are not allowed for in-wall installations, CL2 and FT4 are US and Canadian ratings allowing in-wall installations
- Insulated Conductor: A relatively cheap method of making a spiral shielded coaxial construct by utilizing a dielectric insulation on the center conductor and a spiral braid shield that is jacketed or wrapped in Teflon tape. Impedance is usually in the 65-72 Ohm range on this construction. The Brand A product has dye added to the dielectric which will further degrade the impedance values. This construction is for very low frequencies below 10 MHz.
- Dual Shielding is better construction: Foil for frequencies above 50 MHz and Braid for frequencies under 50 MHz
- LWC is Liberty Wire and Cable, employer of the author of this article

It is entirely possible that in many situations the lower cost product will operate satisfactorily. It is also likely that unexpected problems will occur with those products in different environments. Certainly only one product is acceptable for in-wall or in-ceiling installations.

One of my friends recently described an installation where the lowest cost product was used for every product. While every product tested satisfactorily by itself, as a system it failed. Replacing any single product with a higher quality product resulted in a working system. Trying to save a few dollars on materials, end up costing hundreds of dollars in trouble shooting time. That's why you pay more for better products!