

The Impact of Installation Stresses On Cable Performance

TB-66

Unlike traditional unbonded-pair cables which degrade in performance when put through the rigors of installation, tests show that Belden's patented Bonded-Pair cables perform to the same high standards whether just off the reel or installed in the wall.

When looking at the guaranteed performance on a cable's data sheet, it is expected that the cable will deliver that same performance after it has been installed in the wall. Ultimately, this is the only performance that matters; Category 5e cable that yields 5e performance on the reel but provides only Category 5 performance after installation is of little value.

Installation can alter cable performance. When cables are installed, they are bent around corners, pulled on, and can kink when coming off the reel. All of these installation factors change the physical properties of the cable, which in turn most often degrade the cables' electrical performance. Belden has found that many unbonded-pair cables that pass their respective

performance standards on the reel will fail those standards after a typical installation.

Test Setup

In order to demonstrate the effects a typical installation can have on an unbonded-pair cable, Belden selected several industry-leading Category 5e and Category 6 cables and subjected them to the Installation Stress Test described below. Additionally, Belden conducted identical tests on its DataTwist® 350, MediaTwist®, and DataTwist 600e Bonded-Pair cables.

Initially, 328-foot samples of each cable were tested directly off the reel, without being subjected to any stress. These tests represented the laboratory, or "on-the-reel," performance of the cable. To simulate pulling the

cable through and around cable trays, conduit, office furniture, ceilings, and walls, each cable was then run through a series of controlled bends and twists. This replicated routing the cable from the closet to the workstation outlet. Then, a 10-foot length of the cable was loosely coiled into a 12-inch service loop at the workstation end. At this point, the end of the cable was placed into a standard single-gang outlet box. The cables were tested again to identify any changes in the performance of the cable. The cables were handled without violating the installation guidelines specified in TIA/EIA 568-B.



Installation Stress Test Set-Up

The Results

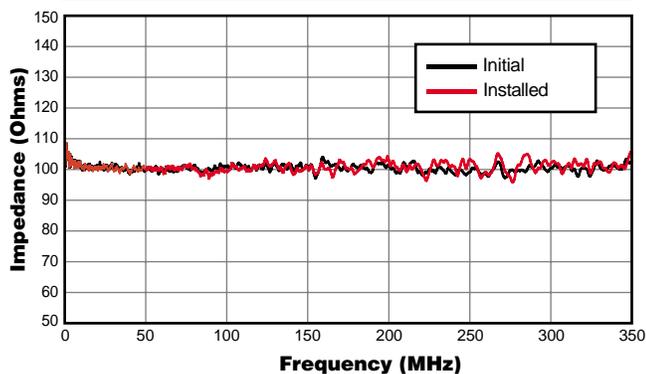
The graphs here show the striking results of Belden's tests. All of the cables tested performed within industry specifications when initially pulled off the reel; however, when the unbonded-pair cables were subjected to the installation stress test, the performance of these cables degraded sharply. In many

cases, the unbonded-pair cables performed below specifications and actually failed the cable requirements.

On the other hand, the Belden Bonded-Pair cables exhibited the same high degree of performance whether just off the reel or

installed in the wall. It is the type of performance one should expect from cables in actual use — and positive proof that Belden cables are durable and created to meet a higher standard of excellence day in and day out.

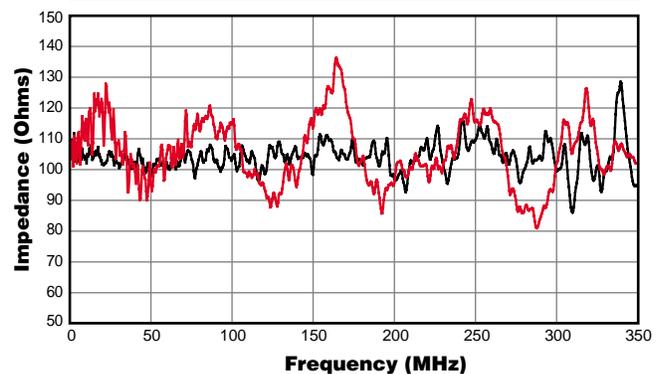
DataTwist® 350 Impedance



Impedance: Much has been made about “tuned” cabling systems where all of the components in the channel are “matched” to 100 ohms. Optimally, the impedance of a cable should be centered at 100 ohms.

As the charts indicate, after installation the impedance of the unbonded-pair cables quickly deviates from 100 ohms. In some

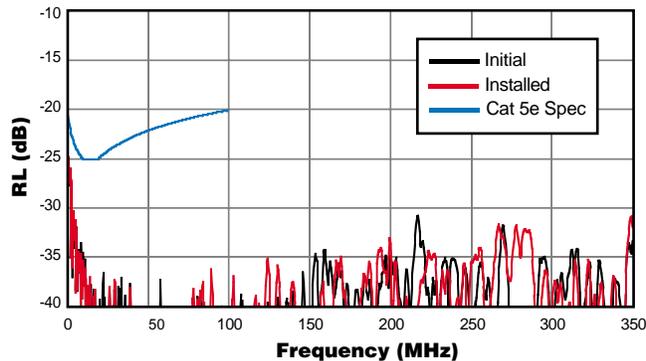
Industry Cat 5e Cable Impedance



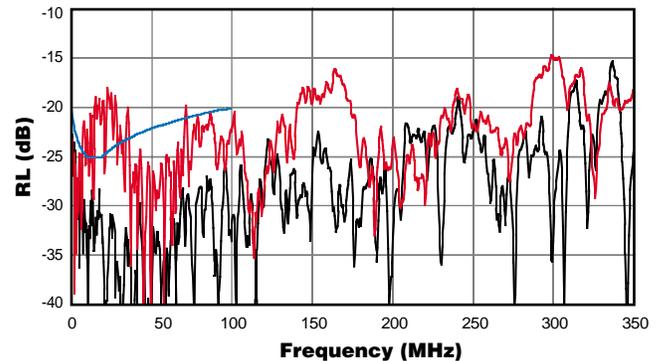
instances, impedance in the unbonded-pair cables deviated as much as 35 ohms after installation. Fluctuations in a cable's impedance are directly related to decreased Return Loss performance.

In contrast to the unbonded-pair cables, the impedance of Belden's Bonded-Pair cables remained stable around 100 ohms before and after installation.

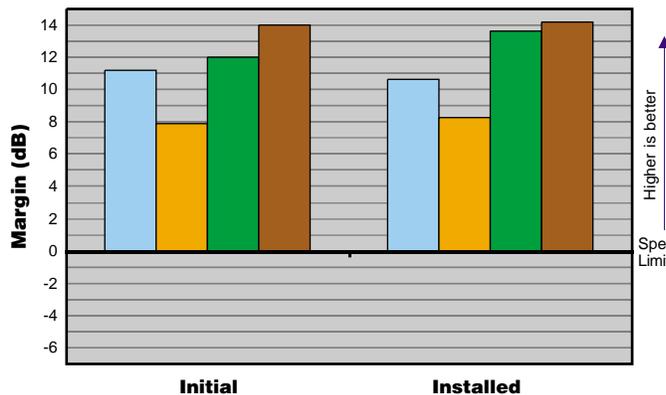
Belden DataTwist® 350 Return Loss



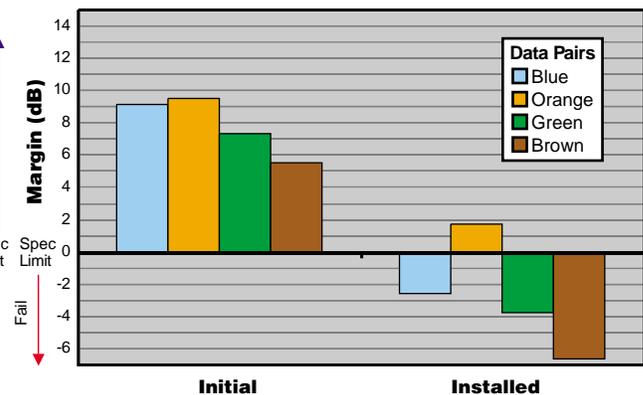
Industry Cat 5e Cable Return Loss



Belden DataTwist 350 Cat 5e Return Loss Margin (20-100MHz)



Industry Cat 5e Cable Return Loss Margin (20-100MHz)



Return Loss: With full-duplex protocols such as Gigabit Ethernet, Return Loss is a critical electrical characteristic because both ends of a pair transmit and receive signals simultaneously. A cable with poor Return Loss values can significantly impact the performance of an active network, reduce network efficiency, and lead to excessive bit error rates.

Belden's tests found that, in many cases, the unbonded-pair cables that initially passed industry requirements for Return Loss "off-the-reel" failed after installation. For example, in the chart above, the unbonded-pair cable's Return Loss values degraded by more than 12 dB — Return Loss performance more than 15 times worse than prior to installation.

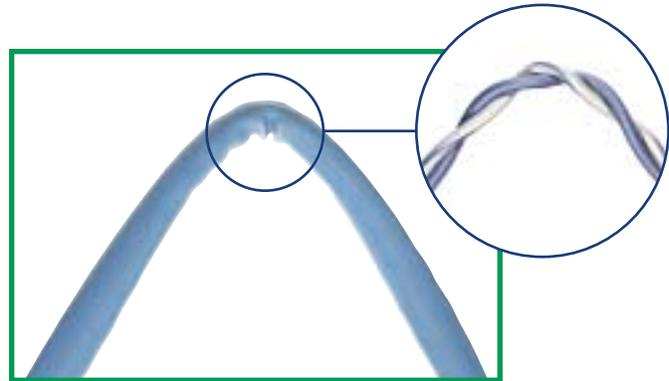
Unlike the unbonded-pair cables, Belden's Bonded-Pair cables exhibited little change in Return Loss performance.

NEXT & PSNEXT: As the conductors of a pair are separated due to installation stresses such as bending, pulling, and coiling, the pair takes on the characteristics of an antenna, both radiating and receiving signals. When one pair in a cable receives the emitted signal from another pair, it is referred to as crosstalk. The NEXT & PSNEXT performance of a cable are important due to their negative impact upon multiple pair protocols.

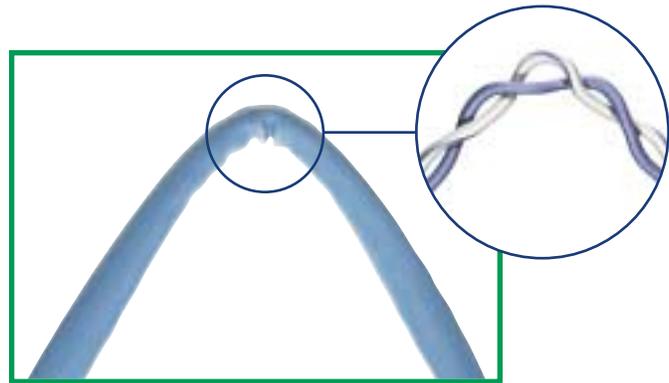
In Belden's testing, crosstalk values were found to change as much as 6 dB, almost four times, in unbonded-pair cables. In contrast, Belden's Bonded-Pair cables demonstrated marginal change in crosstalk performance from "off-the-reel" to after installation.

Why Bonded-Pairs Are Better

The ideal UTP cable should be structurally stable — especially during installation. Topping the list of construction features that provide desired cable consistency and stability are uniform conductor-to-conductor spacing and twisting of the pairs. When the conductors of a twisted pair become separated, impedance mismatches, Return Loss, and crosstalk problems arise. In order to prevent this separation from occurring and to provide structural stability, Belden developed its patented Bonded-Pair technology. As the picture illustrates, even when a Bonded-Pair cable is bent, its conductor-to-conductor spacing remains stable. The benefits of bonded pairs and their immunity to everyday installation stresses such as bending, coiling, and pulling are demonstrated in the illustrations.



Cable with Bonded-Pairs



Cable without Bonded-Pairs

Buyer Beware

A user specifies a certain performance level for the components of a network based upon that network's needs and demands. If the networking infrastructure dictates the need for a physical layer that performs at Category 6 levels, the user must be able to ensure that after the installation, all of the components are performing at that level. When the performance of a component in the network is compromised, overall system performance can be jeopardized.

Based on Belden's studies, if a user specifies an unbonded-pair Category 6 cable, in many cases

the cable will not yield Category 6 performance after installation. In other words, the user would be specifying a component for the networking infrastructure that may not meet the network's requirements. Only Belden's Bonded-Pair cables provide this level of assurance.

These studies reinforce the need for a cable to be able to maintain its performance level in order to compensate for unseen factors that can inhibit the performance of a cabling system (i.e. substandard patch cords and NICs, non-compliant installation practices, and environmental noise factors

like EMI and RFI). Choosing a cable that provides the performance needed after installation, not just "off-the-reef", also protects the end user's technology investment for the future. It helps ensure that the cable does not quickly become obsolete — a very real possibility given the rapidly evolving nature of information systems.

For More Information:

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