

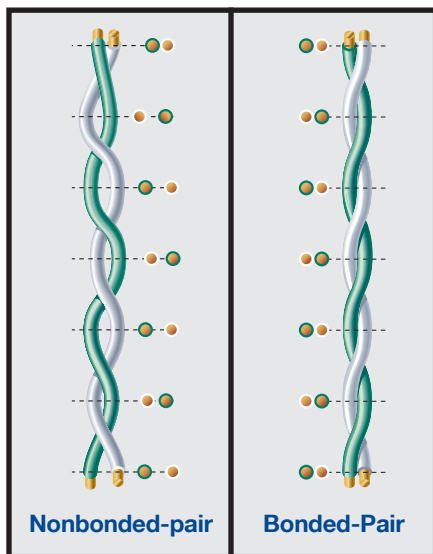
CB 006

**Bonded-Pair Technology**

Bonded-Pair cables provide the reliable performance required for high availability, high resiliency environments.



**Our Bonded-Pair Cables Ensure Reliable Performance and Resiliency when Reused. It is the best open-architecture cable available in the market today.**



Installed and manipulated nonbonded-pairs (left) have a tendency to gap, varying the centricity of the two conductors. Belden Bonded-Pairs (right) do not gap so the physical integrity of the pair is maintained.

At Belden, we know that not every application and installation is exactly the same. Depending on the critical nature of the information transmitted and the overall attributes of the environment, sometimes customers just need a little more – more reliable performance in terms of less resends, and resiliency when reused. That’s why Belden developed the Bonded-Pair technology, along with a family of cables, cable assemblies and modular cords to support all types of demanding environments and installations.

Belden Bonded-Pair Cables feature a patented design that bonds the individual conductors along their longitudinal axis to guarantee extremely uniform spacing within each twisted pair – a key factor in maintaining consistent electrical performance.

Stresses applied to cables, assemblies and cords when manipulated will change the physical structure of a nonbonded-pair cable. When cables, assemblies and cords are squeezed and bent in pathways and cable managers, the majority of the pulling force is distributed to the pairs of cable. The pairs must withstand this force despite being tugged around bends and corners - while, ideally, maintaining a consistent centricity. Furthermore, any kink in the

cable also changes the relationship of the conductors of a pair. For these reasons, the electrical properties of a nonbonded-pair cable can degrade over time, especially in conditions where the cable is re-used during Moves, Adds and Changes (MAC).

In comparison, because of the robust design of Bonded-Pair Cables, concerns about stretching and bend radius are eliminated. Bonded-Pair Cables boast significantly higher maximum pulling tensions and tighter bend radii over the recommended guidelines to overcome real-world installation issues. Thus, the electrical performance of Bonded-Pair Cables, Cable Assemblies and Modular Cords change little over time and with reuse.

The performance of the entire network depends on the integrity and reliability of cables. When the performance of a single cable in the network is compromised, overall system performance is jeopardized. Bonded-Pair Cables, Cable Assemblies and Modular Cords maintain their physical integrity – and therefore their electrical performance – even when subjected to handling stresses during installation and throughout their use and reuse.

Belden Bonded-Pair Cables deliver quality and reliability to mission critical applications.

## Bonded-Pair Technology – When You Need the Very Best

When the rigors of installation cause gaps to occur at multiple points along a twisted pair, the distance between conductors, or the conductor-to-conductor centricity, is altered. This creates increased signal reflection and noise interference that can degrade network performance.

### The Best Electrical Characteristics

Because Belden Bonded-Pair Cables avoid those potential gaps, they provide improved return loss and balance performance. Superior transverse conversion loss (TCL), capacitance unbalance and resistance unbalance results in less modal conversion, which means the cabling infrastructure is less susceptible to electromagnetic and radio frequency interference (EMI/RFI) in noisy environments. Stated another way, the bonded pair construction creates a better data transmission pathway, which results in a lower number of packet resends and decreased latency in noisy conditions than the non-bonded construction. Many of Belden's customers in the Financial Services industry have reported that they have been able to get in and out of trades faster than with the unbonded construction.

When you know that your cables and patch cords will undergo several moves, adds and changes; when you know your environment can cause EMI/RFI; when you know your application demands better performance – and when you know you absolutely cannot afford to fail, Belden Bonded-Pair technology is the choice for total peace of mind. So much so, that when network problems occur, our customers

report that they have checked for issues with network equipment, not the cable solution!

The Bonded-pair construction is specially prescribed in environments that demand high reliability, and low latency. This construction provides performance that is close to that of a Shielded cable, without the issue of ground loops or the associated price premium, for noise mitigation.

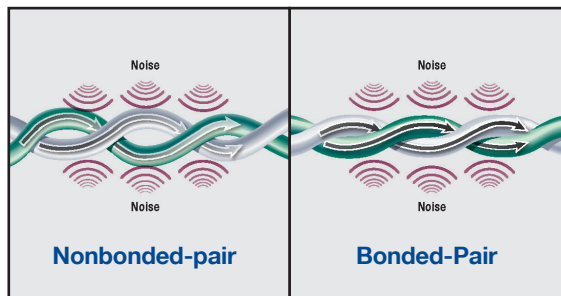
### Service Loops

In environments where service loops are deployed to accommodate routine moves, adds and changes, Belden Bonded-Pair Cables have the ability to handle being continuously coiled and uncoiled. Whether it's a temporary infrastructure or an open office environment that is constantly changing, Belden Bonded-Pair Cables continue to provide optimum electrical performance no matter how often they're reconfigured.

### Patch Cords

The stability of the cabling system and entire network depends on the consistency of modular patch cords. At cross-connects in the data center, patch cords are first squeezed and bent in cable managers during installation and then routinely manipulated by IT personnel.

Made with solid conductors for improved attenuation, Belden Bonded-Pair Patch Cords maintain their physical integrity – and therefore their electrical performance – even when subjected to handling stresses in high-density data center installations.



Noise can invade a nonbonded-pair (left) at the gap point. Because Bonded-Pairs (right) do not have a gap, they have a greater immunity to noise.

## The Perfect Cable for Demanding and Mission-Critical Applications



### Data Centers

A Data Center is typically the heart of business' operations, where downtime is not acceptable and the ability to make quick changes is paramount. It is a dynamic environment where IT personnel continuously roll and reconfigure substantial quantities of cable. The resulting effects on performance from moving cables are particularly pronounced from the perspectives of latency and reliable performance during reuse in the Data Center. Belden Bonded-Pair Cables help the cabling infrastructure handle the stringent performance requirements in a high-availability Data Center. The system will provide consistent performance today and tomorrow, giving you peace of mind for decades to come.

### EMI-RFI Environments

Whether it's machinery on the factory floor or medical imaging equipment at a healthcare facility, elevated ambient EMI/RFI environments can induce and or introduce interference in the form of noise onto signals being transmitted over twisted-pair cable. This can degrade overall performance by making it more difficult for the active equipment to distinguish between the noise and the true signal. Because Bonded-Pair Cables maintain their centricity and symmetry along the length of the cable, noise from outside sources is significantly reduced. That's why leading industrial, medical and research customers routinely choose Belden Bonded-Pair Cables.

### High-Frequency Applications

When gaps form between conductors in a pair, it can create an impedance mismatch that causes portions of a signal to be reflected back towards a receiver, which is measured as return loss. At low frequencies, return loss is a minor effect, but at higher frequencies, it has a much more significant impact. With applications like 10 Gigabit Ethernet operating at 500 MHz and broadband video operating up to 860 MHz and higher, return loss is a key consideration. Belden Bonded-Pair Cables exhibit far better return loss performance characteristics following installation, making it the ideal choice for high-frequency applications.



### Mission Critical

In vital financial, transportation and government facilities, dropped signals are simply not an option. When a system absolutely cannot afford a failure, and total peace of mind is of the utmost importance, Belden Bonded-Pair Cables help defend mission-critical applications against downtime by making your network infrastructure impervious to movement and less susceptible to noise.

As an example, in a successful effort to definitively show how Belden Bonded-Pair Cables can withstand real life, heavy duty situations, a Belden Bonded-Pair Cable was flexed by a fourteen foot long C-track for over a year and a half. After 10 million flexes, the Belden Bonded-Pair Cable still exhibited performance that exceeded the TIA standard. Despite the physical rigor and potential damage that the cable can endure either in testing or in real life, Belden Bonded-Pair Cables will continue to maintain their electrical characteristics all the way into the connector.

### Real-life Users Explain the Value of Belden Bonded-Pair Cables

“At Northwestern University, we have exclusively used Belden Bonded-Pairs for more than ten years. Bonded-Pairs lock in the exact manufactured construction of a given cable for its total useful life. We have used bonded Category 5e 1700A and Category 6A 10GX32 cabling with no deterioration in cable performance.”

– **Jay Needleman, RCDD/OSP**

Field Operations Manager  
Northwestern University

“In our hospitals, installs can be challenging but we have used Belden Bonded-Pair Cable for years now and have continued to see consistent electrical performance from connector to connector.”

– **J. Christine Cerny**

Manager – Enterprise Networking  
Community Health Network

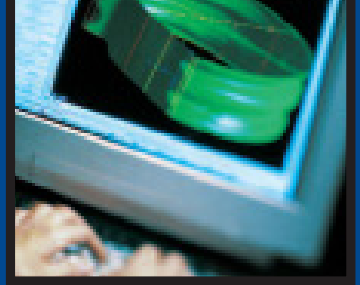
“I have personally used Belden Bonded-Pair Cable since it was introduced to the market. I believe that this technology offers the best guarantee for performance compared to other leading brands. We have customer sites that have had this cable installed for over 15 years and it still is performing as originally intended.

“We will continue to use this product for future projects as well.”

– **Donald C. Walker, RCDD**

Project Manager/Design Engineer  
Walker Communications





## Bonded-Pair Cables Won't throw You for a Loop

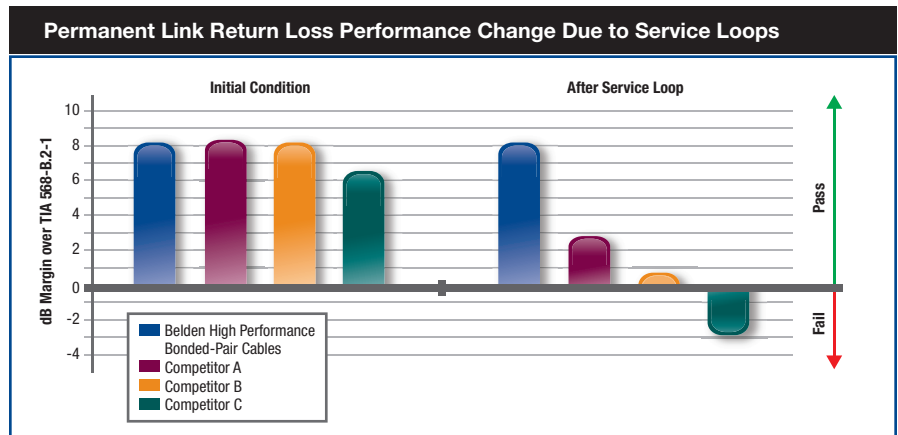
Avoid the pitfalls of frequent moves, adds and changes by using Belden's dependable Bonded-Pair Cables.

In today's open office environment, frequent moves, adds and changes are commonplace. To accommodate furniture moves within cubicles, an extra length of cable for each workstation is often deployed. These service loops are typically coiled and left up in the ceiling for easy accessibility during reconfigurations.

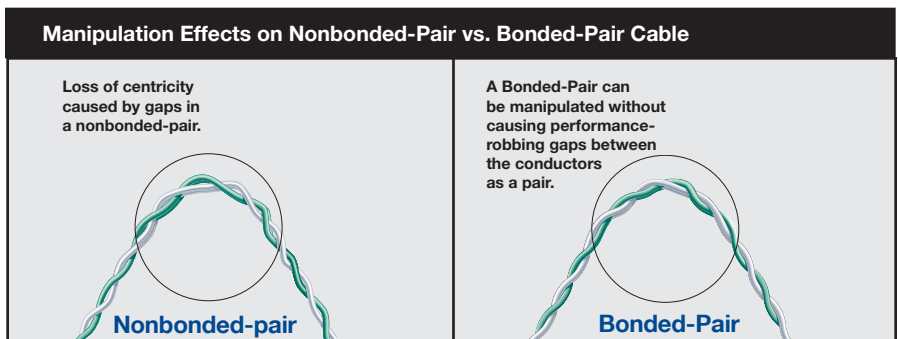
Over the life of the cabling infrastructure, service loops can be uncoiled and recoiled several times, which can ultimately create gaps between twisted pairs and degrade network performance. Because Belden Bonded-Pair Cables avoid the gaps that alter cable geometry, they exhibit little change in return loss performance following service loop deployment.

To simulate the effects of service loops on cabling performance, cable samples from various manufacturers were tested in permanent links without being subjected to any stress. Service loops were then added to those links without violating any TIA/EIA installation guidelines. When the links were tested again to identify any changes in performance, the links with Belden Bonded-Pair Cables exhibited little change in return loss performance while the nonbonded-pair cables' return loss values degraded significantly.

**Service loops may come and go. But with Belden Bonded-Pair Cables, performance doesn't have to.**



**Belden Bonded-Pair Cables retain their return loss performance – even after a service loop is performed**



**The slightest manipulation of a nonbonded-pair cable can cause gaps between the conductors of the pair and impair electrical performance. Gaps cannot form between the conductors in a Bonded-Pair Cable, resulting in consistent electrical performance.**

Testing Proves the Unparalleled Reliability of Belden Bonded-Pair Products.

## Unmatched Patch Cord Performance

### Robust Patch Cords

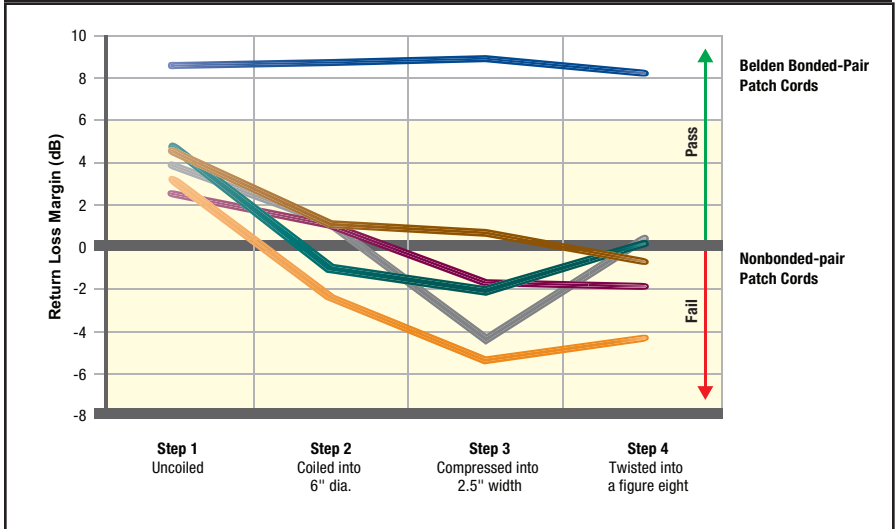
Patch cords are on the network infrastructure's front line and because of that they must be exceptionally robust. Belden Bonded-Pair Modular Patch Cords are the only patch cords on the market to pass TIA/EIA 568-B.2's stringent mechanical stress test. Patch cords often make or break a cabling solution's performance, since a cable channel is only as good as its weakest link. The entire network's performance should not hinge on an unstable component's performance like that of a low quality patch cord. By specifying Belden Bonded-Pair Patch Cords, the installed and certified performance is the same performance patch after patch, year after year.

Belden Patch Cords are made with solid conductors for improved attenuation in long patch cords and pigtails. Their Bonded-Pair cable technology ensures that patch cords meet the stringent TIA mechanical stress reliability specifications.

For more information on Belden Bonded-Pair, or any of our other innovative offerings including our best in-class warranty program go to [www.belden.com](http://www.belden.com) or call Belden today at 1.800.BELDEN.1 to see what we can do for you.

#### Patch Cord Mechanical Stress Reliability

Belden Bonded-Pair Patch Cords vs. Conventional Nonbonded-pair Patch Cords  
(Tested as per TIA/EIA-568-B.2, Normative Annex F.4.3.1)  
Return Loss Margin Variation



**Only Belden Bonded-Pair Patch Cords maintain their return loss performance throughout each step of the mechanical stress test; providing an exclusive performance advantage.**