

Improving Voice & Data Network Reliability and Reducing Service Costs

Benefits from an Enhanced Reliability Modular Connection Block

Industry experts, conservatively estimate 5-10% of voice and data access lines in a given year are serviced to resolve corrosion related issues. The costs to repair and replace these connections easily amounts to millions of dollars that service providers and their customers collectively bear. In addition to the service expense, service provider Quality of Service (QoS) requirements can also be negatively impacted, resulting in additional network operating expense. As homes and businesses demand more reliable wiring for voice and data communications, these costs will continue to rise. The use of enhanced reliability modular connecting blocks, designed to eliminate corrosion related network failures, can eliminate costs and allow for better deployments of service personnel.

Network Requirements

Homes and businesses are demanding increasing data-transfer speeds for broadband communications and highly reliable voice communications, as a result, crisp and clear communication lines are essential. Network quality requirements will only increase as the demand for broadband connectivity (cable modem, DSL, satellite or fixed wireless) jumps from 5.2 million households in 2000 to 35.1 million in 2006.¹ With current network deployment practices, the service provider bears the cost and responsibility to ensure these connections are functional and reliable.

The Impact of Corrosion and Contamination

Noisy lines, slow connection speeds, and service outages are often due to the effects of corrosion. Within a home or business, voice and data networks have several potential failure points in which corrosion related problems could occur. The most common failure point is the modular connecting block (fig. 1) where a voice or data device cord connects with the internal wiring infrastructure. Industry experts conservatively estimate that 5-10% of access lines in a given year are serviced to resolve issues involving corrosion. This percentage is significantly higher in regions more prone to contamination and corrosion. BellSouth alone identified over 240,000 dispatches/year attributed to failed modular connecting blocks.²

Today's standard modular connecting block (fig 1) offers little protection from contamination. Although the plastic housing blocks the majority of everyday contaminants, hidden contaminants such as moisture create a treacherous environment for fostering corrosion. Contamination can occur from all directions, attacking cables, and connector cavities from outside the wall as well as inside.

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Inside the modular connecting block, the base spring-wire is a combination of nickel and brass or bronze, plated with gold to protect the base material, and crimp-connected to a copper lead wire. When dissimilar metals are exposed to moisture, galvanic action and corrosion can occur in as little as one week. Corrosion causes the gold plating to rupture, which accelerates the corrosion process. During corrosion, the connectors develop low insulation resistance and decreased dielectric breakdown voltage. This will impact the dial tone service, network connection speed and signal integrity. Once corrosion begins on the connection, it can wick down the insulation and into the jack. Ordinary station cable can wick moisture at rates of up to 1-foot per day, leading to greater replacement costs.

Corrosive Environments

Modular connecting blocks are exposed to innumerable threats in our environment including moisture from macro and micro-environmental humidity, condensation, flooding, wind-blown salt, chemicals, dust, and other contaminants. Understanding the wide array of environments that foster corrosion is important to appreciate the gravity of proper network component selection.



(fig. 1)

Normal Environments – Conditions within homes and businesses are often the source of corrosion and contamination.

Building Materials – Masonry walls (concrete, cinder block and red brick), concrete slab foundations, and un-insulated exterior walls all promote high humidity from daily exterior temperature changes. Flake board sheathing and other engineered wood products will often release corrosive organic acids. Steel flanges, used to mount modular connecting boxes within the walls, tend to rust rapidly promoting corrosion on the modular connecting block.

Room Function – Kitchens and bathrooms have a higher than average humidity and are exposed to more aggressive cleaning agents than other areas of a home. Basements are often permanently damp and support higher levels of insect infestation and spider webs. The location of a jack near the floor will also facilitate corrosion and contamination from dust, dirt, insects, and carpet fuzz that absorbs moisture. Misapplied paint is also another potential contaminant.

Modular jack corrosion and contamination results in more than \$1.25 Billion in service costs each year in the U.S. alone

High Risk Environments – Environmental conditions that facilitate the corrosion process are everywhere. Telcordia, formerly Bellcore (Bell Communications Research, Inc.), has tested numerous conditions that are known to facilitate corrosion and created a generic requirement for modular connecting blocks under TR-NWT-001334. Blocks that are specified to this specification exhibit significantly higher performance in such areas. Many modular connecting blocks on the market do not meet minimum FCC Part 68 registration requirements nor National Electrical Code Requirements.³ Some corrosive conditions they recognize are:

High Humidity - High average local humidity is the largest contributor to the failure of the modular block according to Telcordia studies.⁴ Even areas that have low relative humidity but experience brief periods of humidity may experience condensation on interior walls.

Coastal Regions – Areas within a 1/4 mile of a lake or seashore are frequently found to have more corrosion damage than areas further inland. Additionally, regions with prevailing winds that carry salt laden air for several miles from a salt-water body

are at a high corrosion risk. Although these winds may only persist for a few weeks and the deposit may not be readily apparent, the damage remains.

High Insect Populations – Insects are frequently found in connecting blocks where they contaminate it with acidic excretions, eggs, and dead remains. Exterminator pesticides will further contaminate the connecting block.

Industrial Pollution – Areas that have high levels of airborne industrial pollution such as major metropolitan areas or areas near industrial plants.

Extreme Temperatures – Extremely warm and dry areas like the Southwestern U.S. experience corrosion inside homes due to swamp coolers used to cool and add moisture to homes.

Extreme Environments – Occasionally extreme environment conditions present themselves that can prove catastrophic to network component integrity.

Flooding – Areas prone to flooding such as coastal areas, floodplains, and low-lying inland areas exhibit the extreme tests to connecting blocks. A flood can bring with it salt, sewage, oil, and many other unknown chemicals and debris it picks up from the surrounding area contaminating everything in its path. A real-life example of the results of such an extreme environment came in the 500-year flood that hit Grand Forks, N.D., in the spring of 1997. Floodwaters sat for 15 days depositing sewage, salt, fertilizer, rotting food, and cattle feed into homes and businesses throughout the city.

Cost of Corrosion and Contamination

With more than 250 million access lines in service throughout the U.S., service providers collectively spend an estimated \$1.25 billion/year for failed modular connecting blocks due to corrosion and contamination. When servicing corrosion related problems, a replacement connecting block is needed in almost every case. Unfortunately, this usually solves the problem for only a short period of time, allowing corrosion to set in again. Telecommunication service providers typically use \$100 as a benchmark cost for a “truck roll” service call.



Based on the considerable number of corrosion related service calls, these costs are serious business. A conservative calculation (Table 1) shows us a typical network could experience costs of \$5 Million/year to maintain corroded and contaminated wiring.

Table 1

Lines in Service	1,000,000
Est. Corrosion calls per year	50,000
Cost per Truck Roll	\$100
Total Cost per Year	\$5,000,000

Searching for a Solution

In 1992, BellSouth became active in finding a solution to battle the significant expenses generated by corrosion related failures to modular connecting blocks. BellSouth partnered with Bellcore, the research and testing group that defines industry specifications, and began to search for a non-toxic substance that would remain in the modular connecting block after the removal of the connecting plug. The search led them to *GelGuard™*,



a cross polymer gel developed by Raychem (now a division of Tyco Electronics).

(fig. 2)

Originally designed for its sealed outside-plant (cabling) products, *GelGuard* was ideal for a corrosion protection application.



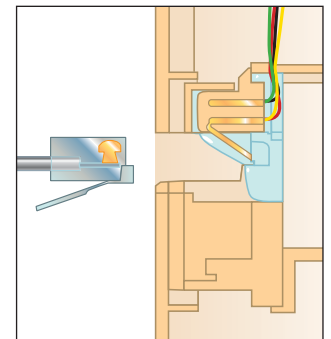
BellSouth directed Tyco to partner with Suttle (a division of Communications Systems, Inc.) an industry leading manufacturer of communication block hardware and the supplier of choice for BellSouth. The Suttle/Raychem collaboration produced the protective modular connecting block solution branded as *CorroShield®*.

CorroShield®

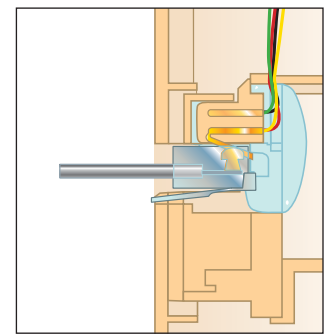
The *CorroShield* products utilize the specially formulated *GelGuard* which is applied during manufacturing to all surfaces at risk of contamination, completely surrounding the gold contact wires. When the voice or data cord is

How *CorroShield®* Protects Your Connections.

Prior to plug insertion, the *CorroShield* gel maintains an airtight seal around all conducting surfaces in the jack.



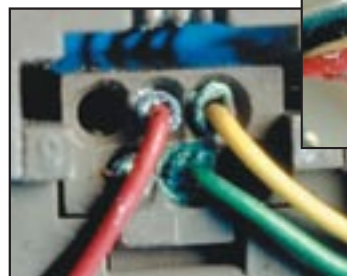
The gel is displaced upon plug insertion, resulting in a protective airtight seal around the plug and jack conducting surfaces.



(fig. 3)

inserted (fig. 3), the gel displaces and forms an airtight seal around the connection, preventing corrosion and other contact problems.

One of the attributes critical to the design and performance of the *CorroShield* solution is the memory characteristics of the gel. For years, attempts to protect connecting blocks from corrosion would prompt service providers to apply grease to the conductors. The shortcoming of this solution would materialize when a customer would unplug a device, re-exposing the conductors to environmental contaminants. The unique memory characteristics of the *CorroShield* gel return it to its original position after a plug is removed, maintaining the airtight seal. Competing products have been introduced into the market, but the inability of the gel to remain pliable and stay in the connecting block limits the effective life of the product. *CorroShield* products have been developed and tested to deliver hundreds of reinsertion events for continued protection in a high service environment.



CorroShield protects all conducting surfaces (fig. 4)

Contamination can occur from all directions and in some applications the space behind the connector cavity can be the most vulnerable. In addition to protecting the connector cavity, many *CorroShield* products feature an extra level of protection immediately behind the cavity by sealing the entire cavity in a protective plastic shell. To prevent screw terminal corrosion, *CorroShield* is also available with filled Scotchlok™ connectors from 3M. For technicians, this means no more time consumed backing off screw terminals, stripping and landing the wires, and re-tightening the screws. With the Scotchlok™ connectors, the wire is simply inserted complete with insulation and squeezed for a gas-tight termination and maximum protection. The *CorroShield* product line has also been extended to connection cords, which have the *GelGuard* injected into the plug ends, right where the line cord and the plug wires are spliced together.

The Savings

Saving time and money exhausted in service calls is why *CorroShield* was created. Service Providers have found that its use will result in a 5-10% reduction in corrosion service calls each year, leading to significant savings. BellSouth has encountered a reduction in modular block failures of approximately 330,000 over the first two years of use, equating to roughly \$33 million in savings.⁵ PacBell also noted an average cost savings of \$80,000 per month after beginning to use *CorroShield*.⁶ Figure 5

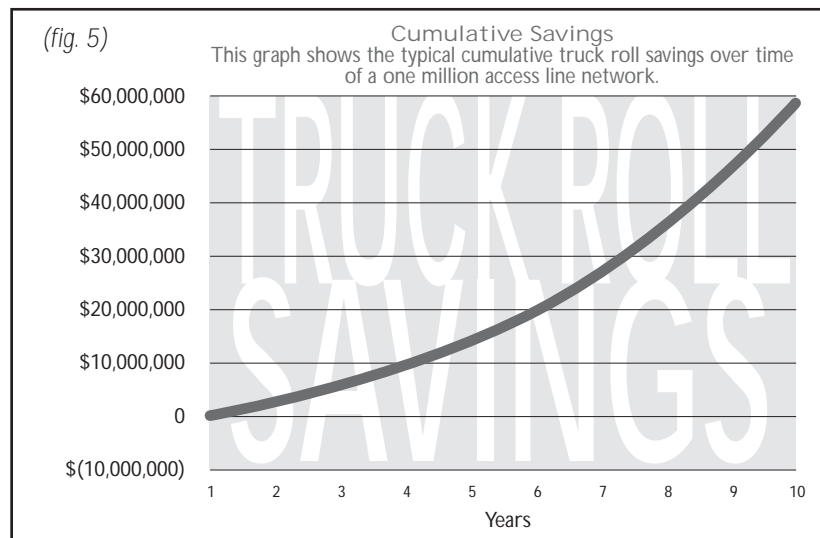
shows that over time this can add up to tens of millions of dollars in savings.

The Ultimate Test

The capabilities of the *CorroShield* solution were evidenced in a real-life test during the 500-year flood that hit Grand Forks, ND in 1997. Jacks and demarcation blocks filled with these contaminants, producing conditions that never could have been duplicated in a laboratory. Conditions like this make it difficult for anything to function. As the water receded after two weeks of exposure to several corrosive elements, only one connecting block consistently produced dial tone according to US West (Qwest) officials, the gel-filled connecting block from Suttle. Lauren Fritz, The US West Director of Service Assurance, had the responsibility to verify and restore service to victims of the flood. "What we discovered was simply amazing", says Fritz, "in every case where the installer had used a gel-filled jack, we had crisp, clean dial tone".⁷ The *CorroShield* connecting blocks from Suttle, performed like they were designed to – sealing the modular block connections from the harsh corrosive environment.

Conclusion

Corrosion and contamination easily cause more than a billion dollars of damage in service costs alone each year to modular jacks throughout the U.S. The inevitable harsh environmental conditions in and around homes and businesses will continue to assault voice and data communication networks leading to recurring replacement costs and negatively impacted QoS. These costs will only increase as the demand for reliable connectivity grows with the increasing prevalence of broadband communications. Stopping the vicious replacement cycle of dry jacks with the use of the proven *CorroShield* enhanced reliability solution will start telecom service providers on the road to significant savings that directly affect the bottom line.



Sources:

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- 2 Balmes, Jr., Mark: Director of Transport Product Evaluation, BellSouth Telecommunications, Inc.- USA. Improving Performance at Customers Premises. 1996. p.4.
- 3 Telcordia (Bellcore) Special Report: Recommendations for Use of Enhanced Reliability Modular Blocks: SR-NWT-3513. Issue 1, March 1995. p.4
- 4 Ibid.
- 5 Balmes, Jr., Mark: Director of Transport Product Evaluation, BellSouth Telecommunications, Inc.- USA. Improving Performance at Customers Premises. 1996. p.5
- 6 H.J. Sinigiani, PacificBell. The 79 Cent Problem., Raychem., p. 3.
- 7 Muscoplat, Rick: "The River Ran Through It", America's Network. September 15, 1997.

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