

Deployable fiberoptic systems for harsh mining environments

In subterranean mining operations, access to communication networks deep underground is critical for transporting data, voice and video, and other supporting applications that are essential for efficient and safe operations.

Whether accessing sophisticated ERP or maintenance management systems, engaging in fleet management, video surveillance, or access control, or protecting miners with wireless locator systems, these networks serve as a literal lifeline between workers deep within mines and surface operations.

For this, mining networks require more than permanently installed network cabling, it also requires unique deployable systems designed for quick installation, extension and even relocation as the active mine site area moves, or equipment is moved in and out.

Ruggedized fiberoptic systems

Given the increasing bandwidth requirements and concerns about electromagnetic interference (EMI), fiberoptic cable is quickly replacing the more traditional copper cables. Designed to survive the rigors of a mining environment, this ruggedized cabling can withstand everything from dust and debris to chemical exposure, temperature extremes, radiation, electrical power transients, interference, fire, moisture, humidity, water, crush, tension, flexing, impact and vibration.

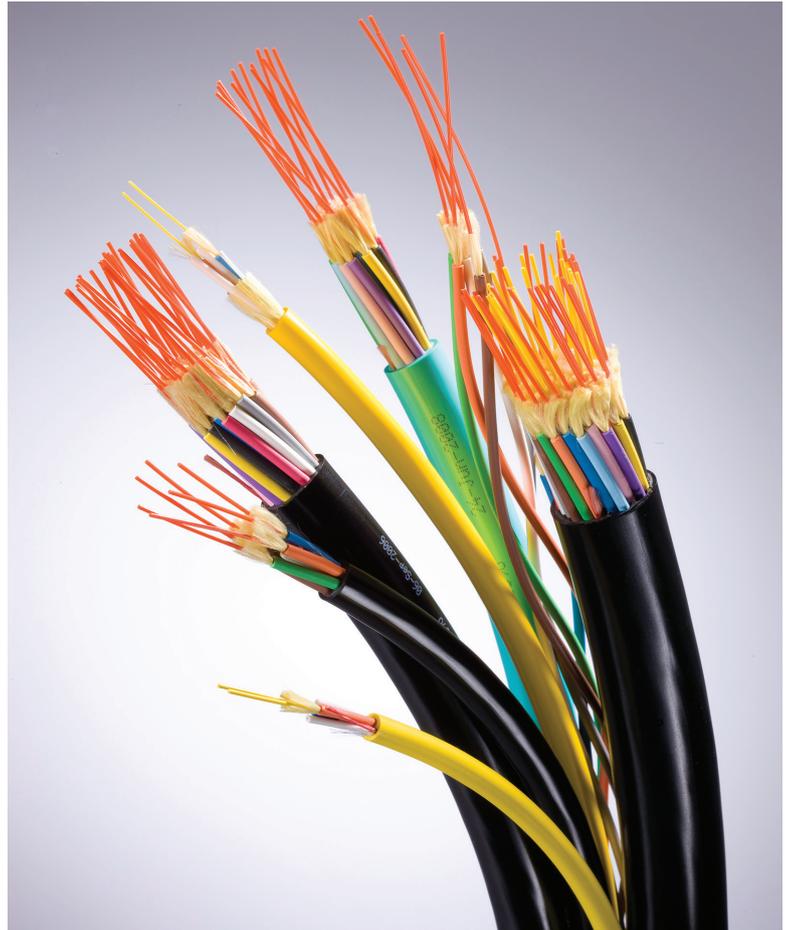
The fiberoptic cable, however, is only a component of a complete, deployable system, explained Rick Hobbs, director of business development at Optical Cable Corp. (OCC). OCC is a company that designs and manufactures fiberoptic cabling, connectors and assemblies for harsh environments such as mining.

According to Hobbs, other key elements include hardened cable jacketing, “genderless” connectors for quick deployment without regard for male or female ends and hybrid options that include copper along with fiber to provide power for underground Wi-Fi networks.

Hardened cabling

For locations that require compliance with the U.S. Mine Safety and Health Administration’s (MSHA) Part 7, Subpart K of Title 30 of the Code of Federal Regulations (CFR) signal cables mining applications, OCC typically recommends its MSHA-rated B-series breakout cable.

MSHA cables are designed to withstand the rigors of difficult pulls, high tensile loading and



severe crush occurrences and can repeatedly endure the abuse associated with the extreme demands in surface and subsurface mining.

The B-Series Breakout Cable is one of OCC’s most rugged, high-strength cables. Each individual, color-coded sub-cable has its own tight-buffered coating to protect each fiber.

In addition, these cables have a tight-bound outer jacket, which is pressure extruded directly over the cable’s core. This combination of a helically stranded core and a pressure extruded outer jacket provides an overall cable construction that offers crush and impact protection and increased tensile strength.

“The breakout cable is essentially a double-jacketed construction,” said Hobbs. “Instead of 900 micron buffers and an outer jacket, each of the 900 micron buffers has a 2.5 mm subunit protecting it.”

As an alternative, if cost is an issue and the conditions warrant it, MSHA-rated distribution

The costs of components for fiberoptic cables continues to fall, making it an attractive alternative to traditional cables.

style cabling is an alternative. This cable is also extremely rugged, featuring the helically stranded core and extruded outer jacket, but not the additional 2.5 mm subcable for each fiber.

According to Hobbs, other MSHA-rated cable designs are available, offering escalating degrees of cable protection to meet the specific needs of an application.

These include alternative jacket materials, such as PVC and polyurethane, which are specifically tailored to meet the mechanical and environmental needs of the application. Additional options within each cable type include jacket materials for applications requiring lower coefficient of friction, chemical resistance and temperature flexibility for low and high extremes. Water tolerant options are also available that take advantage of the qualities of tight buffered cable and super absorbent polymer aramid yarn.

Hybrid cables, connectors

For applications that can benefit from fiberoptics and copper, hybrid cables offer both within the same cabling sheath.

A distinct advantage of a hybrid cable-connector solution is that the customer can bundle both the high performance of fiber with the copper power or control signal in one cable. This reduces the number of cables that must be designed, purchased and deployed into a system.

Hybrid cabling also facilitates installation of wireless access points underground.

Unlike traditional wireless networking devices that require 110-V ac power for each device, with a hybrid system 12Vdc or 48Vdc power can be supplied in the same cable to power wireless routers, as well as other electronic devices.

As a result, certified devices are able to communicate throughout the network, including VOIP devices and IP cameras.

This provides personnel, even deep within mines, the means to communicate with each other and even make calls outside the mine.

Wireless systems also play a key role in providing post-accident miner locator tracking and two-way communications, a requirement of the Mine Improvement and New Emergency Response (MINER) Act of 2006.

Some of the available tracking systems

involve small, wearable radio frequency identification (RFID) locator tags that can be attached to miners or a piece of equipment. These tags communicate with wireless access points or nodes placed in strategic locations throughout the mine to pinpoint their location.

Genderless connectors

Genderless connectors, designed for quick deployment, are able to connect with one another allowing the user to connect fiberoptic cables without regard for male or female ends.

Companies such as OCC have further simplified the genderless design with user friendly mating interfaces (the company's EZ-Mate family) capable of "blind mate" and/or applications that require thousands of mating cycles.

The connector system is designed to resist extreme harsh mechanical and environmental conditions including high vibration, mechanical and thermal shock, and fluid immersion.

With genderless connectors, multiple identical cable assemblies can be daisy-chained together over a distance of up to several kilometers while maintaining polarity. Polarity can be an issue when connecting an odd number of traditional male to female gender connectors. In such cases, additional connectors, which add signal loss, are required to correct polarity.

In high traffic areas where the risk of damage to installed cabling is elevated, spare assemblies, fitted with genderless connectors, can be stored to allow for fast and easy replacement with minimal interruption to operations.

Increasing conversion to fiberoptics

According to Hobbs, there are many mining companies that are converting to fiberoptics as the costs for components continue to drop, making fiber a better solution than copper in most applications. Even die-hard copper devotees are moving to fiber and when they do, they rarely look back.

"When system engineers realize the increased bandwidth opportunities afforded by installing a fiber network, they usually expand their requirements, and identify creative new ways to utilize the technology to provide innovative solutions for their applications," said Hobbs. ■