Tech Article

Ultra High Fiber Count Cable – Managing Cleaning Challenges

Author: Jay Tourigny, MicroCare Senior Vice President
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Data centers can be huge in both footprint and data volume.

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For absolute reliability in any ultra high fiber count cable network one thing is clear. It is imperative that all connectors are clean before installation.

Our world is increasingly interconnected. High-speed wireless networks make it possible to instantly access and use data-intensive apps on billions of smartphones and tablets globally. The IoT (Internet of Things) allows millions of devices to connect and interact with one another over the internet. The amount of data crossing networks to support this need for high connectivity is staggering and steadily increasing.

Hyperscale Data Centers

One way that giant data-focused companies like Amazon and Google manage their massive data traffic and reliably deliver their services to their billions of customers is through the use of hyperscale data centers. These centers are enormous. They include buildings that span hundreds of thousands of square feet. They house millions of servers operating together via a high-speed network. Supporting the servers are thousands of feet of fiber optic cables and hundreds of thousands of optical connections.

However, the demand for increased bandwidth and computing speed is not limited to just these hyperscale behemoths. Many other companies with smaller enterprise data centers are also feeling the pressure to meet the data expectations of their customers. Most are requiring faster wireless speeds to manage high-level or high-volume tasks like video streaming, image rendering or managing their high-traffic web sites.

Many data centers, whether hyperscale or smaller enterprise, are upgrading to 25 gigabit speeds to keep pace. They are also moving toward all-fiber infrastructures because fiber optic cables will typically carry more data, and carry the data faster, than copper cables, especially over long distances.

Rapidly changing fiber optic cable construction is also helping to improve bandwidth capacity and provide faster transmission speeds. Recent developments are enabling fiber optic cable manufacturers to pack thousands more singlemode optical fibers into a single cable. The result is ultra-high-fiber count (UHFC) cables that can carry double or triple the data at faster speeds.

Only a few years ago, an 864-fiber cable was considered a huge trunk. Today, typical fiber counts are 1,728, 3,456, and 5,184. A next generation UHFC with 6,912 fibers was just recently introduced into the industry. A 7,776-fiber version is on the horizon.

Updated Fiber Optic Cable Connectors

Typically, the higher the fiber count of the cable, the more vulnerable the connectors and end faces are to damage and contamination. Therefore, to get absolute reliability and uninterrupted service from any UHFC network it is imperative that all connectors are cleaned and inspected to meet IEC 61300-3-35 standards prior to installation. This helps avoid potential fiber network problems. These include insertion loss (weakened signal), back-reflection (signal diverted back to its source) or a complete system shut down.

Fiber optic cables are growing in size to meet increased data demands.

The fiber optics industry groups are mobilizing to help recruit and train new talent.

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Three newer types of connector options for ultra-high-fiber-count cables are gaining traction across the industry. The CS duplex connector system for the next-generation QSFP-DD transceivers, the 16 fiber-array MT-based connector, and lens-array ferrules for parallel optic and silicon photonics applications. All have their advantages and all bring their own cleaning challenges.

CS Single-Fiber and Duplex Connectors

These connectors utilize the standard 1.25-mm LC form factor ferrule, but with tighter spacing between the ferrules. The CS design, reduces the pitch to 3.8 mm from the LC standard of 6.25 mm. The result is a theoretical capacity increase of 80%. The clearances on CS adapters are very tight which makes it difficult for cleaning tools to get inside the ferrule. High quality, non-linting fiber cleaning sticks with a high-purity fiber cleaning fluid or a mini push-to-clean tool typically work best for cleaning.

Multi-fiber Connectors

Some cable manufacturers are migrating from the traditional 12-fiber arrays to a 16-fiber array using the same 2.5-mm x 6.4-mm standard MT ferrule footprint. These connectors are on optical backplanes, where the data jumps from the fiber transport into the switch for routing. Not only are these connectors denser, they are 80% glass to improve thermal expansion control. These connectors may retain more static than other connectors, so the use of an optical-grade, static-dissipating cleaning fluid is important to remove it.

Lens Array Connectors

The lens array connectors basically are expanded beam lenses on a microscopic scale. These designs collimate the optical signal and eliminate the need for physical contact. They use a very small, tightly focused "spot size" beam to pass the signal into the receiving lens. This minimizes problems associated with scratching and contamination between the lenses. However, these molded plastic connectors attract dust into the central signal "spot-zone" and can be difficult to clean with anything other than a can of optical-grade duster.

Planning for High-Fiber Count Installation Success

The new ultra-high-fiber count cables and connectors make data access for end users fast and reliable. But, there are some unique challenges when it comes to installation. However, with some thoughtful planning and thorough preparation, companies can prepare to meet and overcome them.

Staffing Challenges – Hire and Train More Fiber Optic Techs

To provide a faultless multi-gigabyte service that the UHFC cables promise, the fiber used in the networks must be properly installed and perfectly cleaned to support successful connectivity. However, finding qualified fiber optic splicing, cleaning and installation technicians can be difficult. Many technicians in the field today have more experience with copper cable, but lack the knowledge for fiber optics. This is especially true in more rural areas where fiber optics networks are not as prevalent. Currently some contractors are flying fiber installation teams in from metro areas to complete the fiber work on their data centers. There is real concern within the industry that the combination

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Fiber cleaning kits at the installation site help speed installations and avoid downtime.

of extensive travel along with the intensity and amount of work required may actually cause burnout on some of the installation teams.

The fiber optics industry groups are mobilizing to help recruit and train new talent. Fiber optics companies need various and sophisticated ways to train their existing employees. Some use online fiber installation training seminars. Others use AR (Augmented Reality) to create visual guides to walk installers through the processes step-by-step, via AR goggles.

Resources Challenge – Invest in Time, Tools and People

Even with the use of mass fusion splicers to fuse bundles of 12 ribbonized fibers simultaneously, it can take a fiber installation technician 3-4 days to inspect, clean and install a 6,912-fiber cable. Therefore, it is important for companies to carefully plan in advance the correct amount of time, equipment and personnel needed to complete an installation project. In addition to budgeting extra time, an installer also may require additional tools and helpers to work more efficiently. It may be necessary to invest in extra splicing trays, more testing or inspection equipment and another technician to help complete the installation in a timely manner.

Companies should also plan ahead to ensure they have the correct type and sufficient quantity of splice and end face cleaning products needed to complete the install. Cleaning kits are an excellent option. They ensure technicians have all the necessary high-purity cleaning fluids, optical-grade wipes, lint-free cleaning sticks and push-to-click tools to complete the required end face cleaning. They should keep the kits well-stocked and handy at the installation site to speed the process and avoid downtime.

New and improved splicing and cleaning tools to boost efficiency are in development now. Whether the tools are brand new or are retrofits for existing equipment, one thing is for certain. They must be rugged and simple to use. The tools need to be tough enough to stand up to the sheer volume of usage and easy enough to deliver consistent, repeatable and reliable results every time.

Conclusion

The ever-increasing demand for more bandwidth and faster connectivity has spurred the rise of large-scale and hyperscale data centers. New ultra-high-fiber-count cables help support the delivery, the speed and reliability that data end-users require.

However, these ultra-high-fiber-count cables are complex and time-consuming to splice, clean and install, posing a resource challenge to fiber optic technicians and the companies they work for. But with the proper planning and preparation, companies can streamline their installation operations. Fortunately, better tools and innovative methods are on the way. These tools will enable fiber optic technicians to work even more quickly, yet carefully to optimize their time and cost-effectiveness.

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About the author:
Jay Tourigny is Senior Vice President at MicroCare which offers precision cleaning, lubricating and debinding solutions. He has been in the industry more than 30 years and holds a BS from The Massachusetts College of Liberal Arts. Tourigny holds numerous U.S. patents for cleaning-related products that are used on a daily basis in medical, fiber optic and precision cleaning applications. For more information, visit microcare.com

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