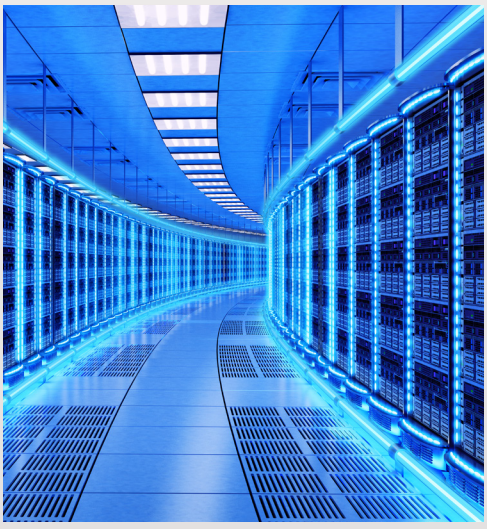
Tech Article

Cleaning High Density Fiber Connections in Giant Data Centers

Author:
Jay Tourigny, MicroCare Senior Vice President

Industry:
Fiber Optics

Published:
Fibre Systems



Large scale data centers typically house millions of severs connected by hundreds of thousands of feet of fiber optic cable.

Cleaning high density fiber connections in giant data centers is a challenge. Today, the demand for fast, flawless connectivity is expanding around the globe. High-speed networks allow instant access to data-intensive apps on billions of devices worldwide while the IoT (Internet of Things) allows them to seamlessly interact with one another. Autonomous vehicles, augmented reality and fully automated home systems including virtual assistants and smart appliances will soon be the norm. In addition, online selling, social media and distanced learning continue to make our lives more convenient and connected.

Data Centers Deliver Connectivity

The one thing that makes this connectivity possible is an effective and reliable network to manage the large volume, or big data, required to operate it all. Data-driven companies are constantly developing ways to manage their users' data demand and the high traffic associated with it. One current solution is to use very large, or hyperscale, data centers.

Hyperscale data centers are enormous. On average, the footprint of a hyperscale data center is 200,000 square feet or larger. Millions of servers inside the centers operate together via fiber optic networks to control the massive amount of data traffic that users require. The networks typically comprise hundreds of thousands of miles of fiber optic cable and hundreds of thousands of optical connections. The data centers allow fast and efficient data handling. However, they do have some drawbacks.

Data Center Concerns

Since the data centers are so large, they are often built in remote areas where there are more wide-open spaces and land is less expensive. However, locating a data center far away can cause performance problems including latency delays. These time degraded responses are unacceptable for many critical applications such as GPS responses for military systems, remote medical monitoring and diagnostic results or vital financial transactions.

Also, because of the mass volume of servers, hyperscale data centers run very hot and require extensive cooling. In an attempt to keep hyperscale data centers cool, companies often employ power-hungry climate control systems that use enormous quantities of electricity and emit large quantities of greenhouse gases.

More Fiber, Smaller Footprint

One solution to these concerns is to make data centers smaller, closer, and more energy efficient. Achieving these goals requires squeezing more fiber into a smaller footprint. Fortunately, fiber optic cable makers have changed cable construction in a way that enables them to pack thousands more optical fibers into a single cable. Just 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. Recently, a UHCF (ultra-high-count fiber cable) with 6,912 fibers was introduced into the industry and a 7,776-fiber version is on the horizon. The result is UHCF cables that carry double or triple the data in the same or even less space. This reduces the size of the data center, allowing for more accessible data center locations and better energy efficiency.

Non-linting fiber cleaning sticks with a high-purity fiber cleaning fluid combine for optimal CS connector cleaning.

Fiber Connectors

However, the higher the fiber count of the cable, the more vulnerable the connectors and end-faces are to contamination. All connectors are inherently dirty because of the moving parts like springs, connectors, and latches, all of which generate wear debris. Therefore, to get absolute reliability and uninterrupted service from any UHCF network it is important that all connectors are cleaned and inspected to meet IEC 61300-3-35 standards prior to installation. This helps avoid potential fiber network problems such as insertion loss (weakened signal), back-reflection (signal is diverted back to its source) or a complete system shut down.

There are three newer types of connector options used with UHCF cables that aggregate more fiber into a smaller footprint: The CS duplex connector system for the next-generation QSFP-DD transceivers, the 16 fiber-array MT-based connector, and the lens-array ferrule 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. With the CS design, pitch is reduced to 3.8 mm from the LC standard of 6.25 mm. The result is a theoretical capacity increase of 80%. The small size of these connectors along with very tight clearances on CS adapters makes it difficult for many cleaning tools to get inside the ferrule. Use high absorbency, non-linting fiber cleaning sticks with a high-purity fiber cleaning fluid to clean these connectors. Or, for cleaning large numbers of connectors a mini click-to-clean tool typically works best.

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 most often used 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 often retain more static electricity than other connectors making dust particles cling to the connector. The use of an optical-grade, static-dissipating cleaning fluid is important to dissipate the static-cling and significantly improve cleaning performance of task-built clickers.

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 design minimizes problems associated with scratching and contamination between the lenses. However, these connectors are typically made from very soft, easily-scratched molded plastics that over time tend to attract dust in the form of a hazy film into the central signal “spot-zone” and can be difficult to clean. To prevent scratching the plastic, the most effective cleaning method uses a “touchless” process of applying a small dose of high purity cleaning fluid that is fast-evaporating, plastic-safe and static-dissipating to gently rinse away surface contamination, and then follow-up by blow-drying the connector using a can of optical-grade duster.

STICKLERS
When you need perfectly clean splices & connectors™

576 fiber cables, like the one here, was once considered large. Many now top out at almost 7,000 strands.

Conclusion

The increasing demand for more connectivity spurred the rise of remote hyperscale data centers. However, with the introduction of UHCF cables, smaller local data centers may now be able to deliver the data speeds and reliability that end-users require. But to obtain the best fiber optic performance, cleaning the high density fiber connections prior to installation will always remain a priority.

Companies looking for help in choosing the best fiber optic cleaning tools and methods should partner with a company with high density fiber connections cleaning expertise. They can help determine the cleaning tools, fluids and processes that will work best.

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.

STICKLERS
When you need perfectly clean splices & connectors™

Follow Us!