

How fiber cleanliness is crucial to 5G connectivity

Modern fiber cleaning and inspection processes can ensure providers are prepared for our 5G interconnected future.

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It has been almost 10 years since the introduction of the 4G broadband network. And now many users are eagerly awaiting the all-out launch of the next generation of 5G connectivity.

Currently only available with a limited range, it is estimated that 5G connectivity will be available on a widespread global scale over the next 5 years.

Combined with all-new 5G-enabled devices and thousands of new and updated apps, 5G is planned to satisfy the public's insatiable need for more automation and greater connectivity in their lives.

5G will enable development of new applications including smart factories, driverless vehicles and fully automated home systems. Plus, existing functions

like online selling, social media, tele-medical monitoring and tele-education will likely be bolstered using 5G's ability to quickly manage the massive amounts of data for our more-connected world.

As 5G connectivity expands, traditional coaxial or copper-core cables are being replaced with faster and more-reliable all-fiber networks. Fiber-only transmission will be essential to manage the billions of devices and the enormous volume of data while still providing the connectivity speed and reliability that users demand. This means that network providers must be prepared to install new all-fiber networks and to upgrade and maintain any existing fiber infrastructure already in place.

Fiber cleanliness is crucial to 5G

Whether installing a new fiber network or maintaining an existing one, it is essential for service providers to implement proper fiber-cleaning procedures to ensure the fiber network performance and reliability.

This includes ensuring that all connections and splices are kept perfectly clean to avoid potential problems such as insertion loss (weakened signal), back reflection (signal is diverted back to its source), or a total system shutdown.

5G is planned to satisfy the public's insatiable need for greater connectivity.



This is especially important with a 5G network because every milliwatt of power is necessary for optimum connectivity and peak performance.

A contaminated splice or cable endface can block the light through the fiber, changing the index of refraction or the path of the signal through the fiber. If the contamination is severe, the refraction angle can change enough that the signal can be completely lost. Modern, faster 5G networks, with their higher frequencies, are more sensitive to changes of the refractive angle, making them more vulnerable to contamination.

Connectors and splices can be contaminated from a variety of sources including fingerprint oils, lint, exhaust fumes, moisture or simply dust. The main cause of dust-based contamination is connector wear debris. Wear debris dust is caused by contact friction when connectors are mated. Dust particles can be ground into the ferrule surface, resulting in pitted, scratched or scarred

endfaces. Therefore, it is essential that all fiber endfaces are thoroughly cleaned during installation or maintenance operations to prevent 5G network interference or failures.

Even new fiber needs cleaning

Even brand-new fiber cables need to be cleaned and tested to ensure any contamination is removed. Jumpers and patch cords, even those direct from the factory, do not guarantee cleanliness. End caps are not cleaned at the factory before packaging, so dust and other leftover manufacturing debris could be trapped inside the sleeve and migrate to the endface.

Some cable manufacturers use mold release agents to pop the endface cap or housing from their molds during manufacturing. Leftover release agent inside the end caps can transfer to the connectors. Outgassed plasticizers from the protective plugs on the end caps can leave a haze of small droplets of oil on the endfaces. Even putting the protective plugs on at the factory and removing it by the network installer causes wear debris.

New 5G networks will require huge amounts of new fiber cables, but they are not pristine clean and ready to use straight from the box. Installers should always thoroughly clean both ends of the connector pair before they are mated to ensure clean fiber connections and reliable performance.

The standard for inspection and cleaning of fiber-optic connectors is the international IEC standard 61300-3-35.

IEC 61300-3-35 focuses on fiber-optic interconnection devices and passive

components. It is a set of requirements for fiber-optic connector endface quality, and includes precise cleanliness grading criteria to measure pass or fail certification for the inspection of a fiber endface before connection.

IEC 61300-3-35 uses certification criteria based on a series of concentric circles with the center being the

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core of the fiber. The standard uses four domains, ranging from A at the core zone through to D, the contact/ferrule zone on the outer edge. Each area denotes the acceptance of contaminant, whether they are permanent defects like scratches and pits or removable contamination such as dust or fingerprint contamination.

There is a set of requirements for connector endface quality in each zone, which focuses on a specific size and number of defects. For example, the core of the fiber, where the signal travels through, has the most-stringent quality requirements because any contamination in this zone can cause backreflection, insertion loss, and equipment damage.

Measurement and inspection using the IEC 61300-3-35 standard is critical to a fiber's performance. Just a one-micron length of contaminant can be the difference between having an endface that meets or fails the recommended specification.



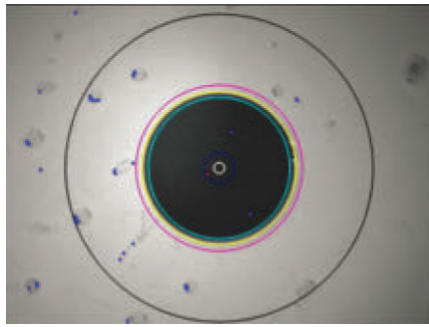
Hermetically sealed cans keep cleaning fluids pure and clean.

One of the best ways to meet this cleanliness standard is to use the right fiber-optic cleaning tools and fluids engineered for fiber-optic applications. Better cleaning tools and procedures allow technicians to clean quickly and thoroughly, saving time and money on both new 5G fiber network installations and any subsequent maintenance or repairs.

Choose the right cleaning fluid

Fiber industry organizations recommend “wet/dry” cleaning as the most effective method for cleaning fiber end-faces. Water and isopropyl alcohol (IPA) are common choices, but are hard to buy in high purity packaging and difficult to keep clean and uncontaminated during day-to-day use.

A better option to use for 5G networks is a specially engineered



An inspection scope reveals contamination of the endface.

optical-grade cleaning fluid for fiber-optic connectors. The optical-grade fluids are fast-drying, static-dissipative and are sold in hermetically sealed packaging to maintain high purity of the fluid contents.

The fast drying time is especially important for cleaning 5G fiber because it speeds cleaning time and keeps moisture from being attracted to the fluid,

minimizing contamination. Some installers may use aerosol duster products to speed the cleaning and drying of the fiber, however this increases the static charge on the endface (attracting more dust) and pushes the debris around the area being cleaned. A static-dissipative cleaning fluid also helps deflect impurities, especially dust from the surface being cleaned.

Cleaning fluids in hermetically sealed packages are preferred because the packaging keeps the fluid pure and clean. It prevents the fluid from absorbing any airborne contaminants such as moisture, microscopic dust particles, exhaust particles from traffic and pollen from plants. All of these contaminants will degrade the cleaning process.

In addition, optical-grade cleaning fluids are nonflammable and



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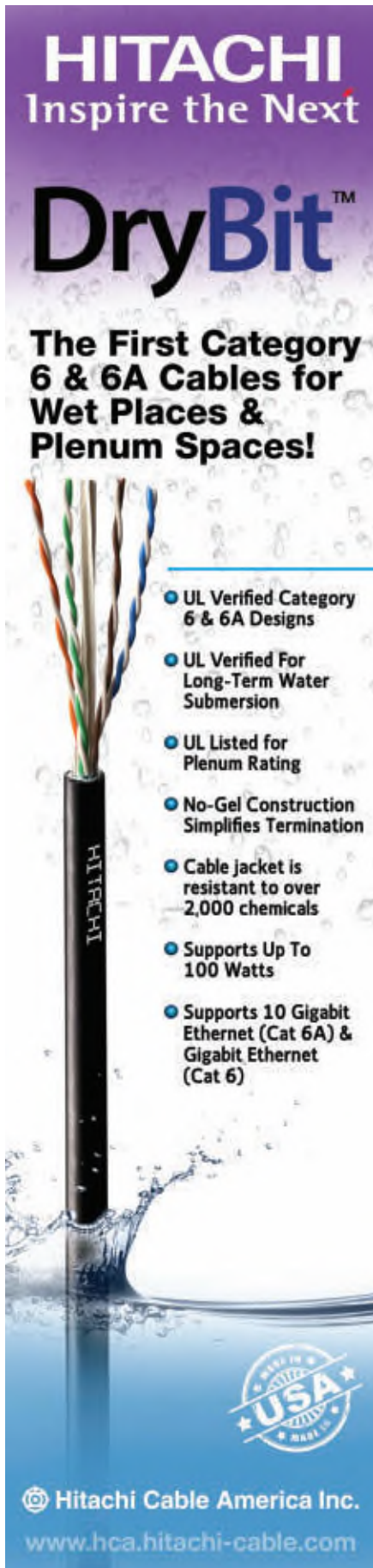


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It is essential that all connections are perfectly clean to ensure reliability.

non-hazardous, making them safer to store, and easier to transport either by air or inside service vehicles—an important consideration if an installer needs to fly or drive to remote areas and needs to bring their cleaning tools and fluids to the 5G installation site.

Inspect, clean, inspect

Fiber-optic contamination is minuscule—just microns in size—and can only be seen with an inspection microscope. It cannot be seen with the naked eye, so it is important to use an inspection scope during installation or maintenance to ensure both ends of the connector pair are clean and trouble-free. By using the three-step “inspect-clean-inspect” process, operators can visually distinguish any contamination that might interfere with or damage the surface of the fiber endfaces, clean the contaminant away and then reinspect the endfaces to confirm the contaminant is gone.

Inspecting can also identify permanent defects like scratches and pitting, all of which may affect the signal, prior to installation. This prevents

5G network performance problems and eliminates repair calls to troubleshoot, identify, repair and clean the faulty connectors.

Widespread 5G deployment is approaching quickly. It is important for providers to be prepared by providing the reliable, trouble-free fiber-optic networks that are the key to our 5G interconnected future. By implementing modern cleaning and inspecting processes, fiber installers can help ensure excellent optical network performance while meeting the expanding speed and data demands of users worldwide.

When choosing fiber-optic cleaning fluids, tools and methods, installers should seek the help of an experienced supplier that specializes in fiber cleaning to advise them on which will work best for their 5G fiber network. ♦

Jay Tourigny is senior vice president at MicroCare Corp., which offers the Sticklers brand fiber cleaning solutions. Tourigny has been in the industry for more than 30 years and holds a bachelor of science degree from the Massachusetts College of Liberal Arts. He holds numerous U.S. patents for cleaning-related products.