Clean Up Your Act

Fiber networks are more reliable when the installation is kept clean.

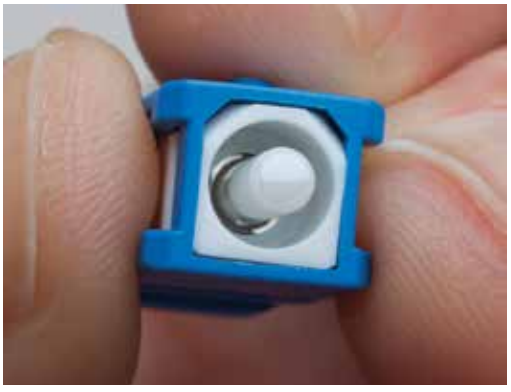
By Mike Jones / *MicroCare Corp.*

Modern societies have an apparently limitless desire for greater connectivity. From Facebook to video on demand to mobile cloud computing, the demand for digital data appears to be infinite and insatiable. Broadband access has become a crucial link in every aspect of people's lives, affecting jobs, medical care, security and even the congestion on the highways.

Because of the utility, ubiquity and affordability of broadband data, end users are demanding. They expect uninterrupted data services. Reliable, trouble-free fiber optic networks are the key to the interconnected future. Maintaining all that fiber can be problematic, but cleaning fiber is the single most important task a tech in the field can accomplish to ensure that a fiber network achieves its design goals.

According to numerous industry sources, properly cleaning fiber connectors can eliminate 80 percent or more of all network problems. Cleaning is critical to the long-term reliability of any network and at the heart of the profitability of a successful fiber deployment.

Field technicians must be taught the proper procedures to clean fiber. They must be provided the right tools. Managers must include the cost of cleaning in their budgets and quotes. And end users should demand proof of cleaning from installers, including, both sides of every end face, every time a fiber is installed, tested or reconfigured.



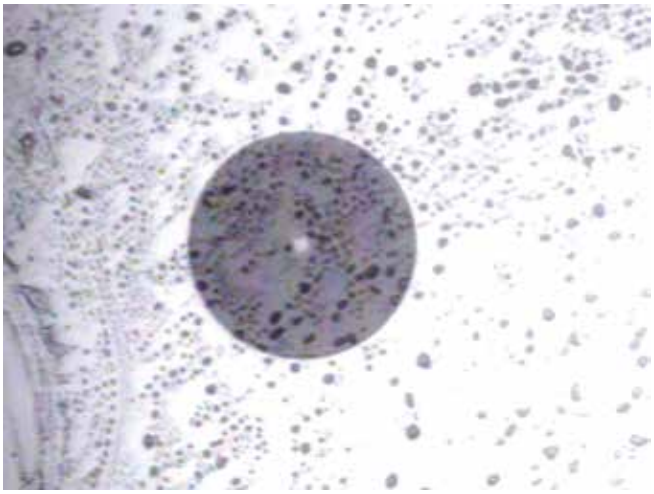
The fiber end face is where the rubber meets the road. Only perfectly clean end faces can enable fiber networks to achieve their maximum potential.

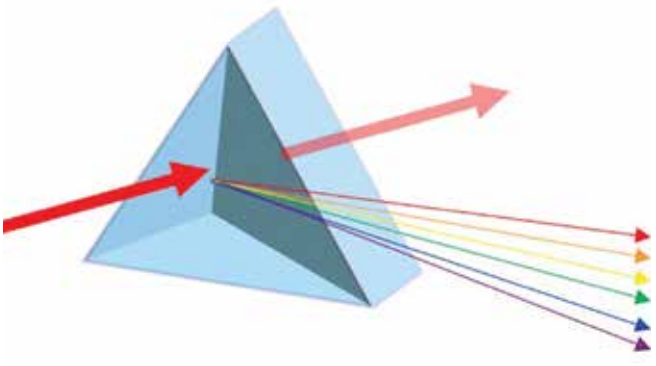
Properly cleaning fiber connectors can eliminate 80 percent or more of all network problems.

CONTAMINATION AFFECTS SIGNALS

Contamination is defined as anything on an end face that should not be there and is removable. It includes fingerprint oils, lint from clothing, moisture, exhaust fumes, outgassed plasticizers from protective dust caps, plastic particles from connector wear and simple dust. Each type of contamination causes different problems, but all types must be removed.

Consider fingerprint oils. This thin liquid contains numerous compounds, salts and fluids that can create air gaps between end faces. The





Translucent liquid contamination is particularly troubling for fiber networks because the fluid changes the refractive index of the fiber, which can spray different optical frequencies unpredictably.

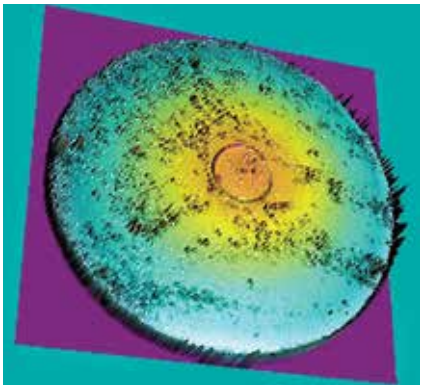
air gaps cause insertion loss (the signal weakens) and back-reflection (the signal is diverted back to its source).

Light is made up of different wavelengths. If a fiber end face is coated with oil, the contamination changes the index of refraction engineered into the fiber. This will change the path of the signal through the fiber. The changed path is known as chromatic aberration. If the contamination is very severe, the refraction angle can change enough for the signal to be completely lost. This is particularly acute in wavelength-division-multiplexed fiber systems, which use different colors of light to load more channels into the fiber. The higher the frequency of the light, the greater its sensitivity to changes of the refractive angle. This means that fast modern networks are more vulnerable to contamination.

DON'T LET THE DUST SETTLE

Dust can have a huge impact on network reliability. The environment is loaded with airborne dust that can play havoc with fiber end faces: plant pollen, exhaust particulate and skin particles are just a few sources. Like oil, these microscopic particles create air gaps between end faces. This can result in back-reflection, signal attenuation, instability in the laser system or even a complete system shutdown.

Dust also can scratch the surface of the fiber if particles are trapped between two terminus end faces. At a microscopic level, the two end faces are jammed together with a great deal of pressure. A rigid chunk of dust between the two end faces can pit or scar the end faces beyond repair.



Most field techs carry optical inspection scopes to examine end faces, but interferometers offer a richer, more detailed look at the contamination in all three dimensions.
Photo courtesy Promet Optics

Once dust has found its way onto a fiber end face, it can become locked in place by static. Static can be generated on an end face in several different ways, but the most common is simply wiping an end face with a dry wipe while cleaning. This creates friction, and the friction creates static. Other activities that can produce a static charge include

- Using foam swabs to clean an end face
- Cleaning with only compressed air
- Inserting a connector into or removing it from an adapter during mating
- Removing the protective end cap from a connector
- Connecting the fiber to test equipment multiple times.

To eliminate static during cleaning, iNEMI, IPC and other organizations strongly recommend "wet-dry" cleaning with the use of a static-dissipative fluid.

The components of a fiber connector are made from nonconductive materials such as plastic, ceramics, glass and epoxies. This means there is no path for the electrostatic charge to dissipate, so a charge remains on a connector end face indefinitely, sometimes even for months. Even if the central contact zone initially was clean, an electrostatic charge can cause dust to migrate from the outer regions of the ferrule toward the ferrule apex in the contact zone. The dust particles will be locked tightly to the ferrule surface as if the end face were a magnet.

Introducing a static-dissipating cleaning fluid creates a conductive path that makes it easy to physically wipe away dust and other debris. The most effective cleaning process to solve the static problem is using a nonflammable, high-purity, optical-grade cleaning fluid. Isopropyl alcohol (IPA) purchased from the local pharmacy is not a suitable fluid.

Technicians should be trained to clean fiber effectively and provided with the equipment that works best for the job at hand. They should clean every end face, every time.

CHOOSE THE RIGHT FLUID

Although IPA may be your cleaner of choice, it is not the way to go. Traditionally used to clean fiber, IPA contains hygroscopic molecules that absorb moisture from the air. This is especially apparent with the old-style pump bottles that often are used in the field. These bottles rarely are cleaned, adding another source of cross-contamination.

Many field techs are provided cheap paper wipes to clean their end faces, but these can cause static and leave particulate on the end faces. A cheap paper wipe (top) is easily ripped, and many fibers are released, but a stronger, cleaner fabric wipe is much stronger, resists shredding and is less likely to leave fibers on the end faces.

Water trapped in the alcohol slows the drying process. This means more time is needed to evaporate the liquid from the end face. Some techs and engineers may use canned air to speed the cleaning and drying of the fiber, but all this does is increase the static charge and push the debris around the area being cleaned.

When choosing a cleaning fluid, ensure that it is fast-drying and nonflammable, has a low surface tension and dissipates static. Fast drying time is especially important for cleaning fiber, as it keeps moisture from being attracted to the fluid and therefore stops contamination. Using a specially designed fiber cleaning fluid and a lint-free wipe will achieve optimum results.

Alcohol is no longer suitable for cleaning modern fiber optic networks. A much better choice that will lower network maintenance costs is a nonflammable, water-free, fast-drying fluid packaged in a sealed, nonrefillable container. Here, a lint-free fabric wipe is dampened from a convenient pump bottle dispenser.

Another key point to look out for is the packaging of the cleaning fluid. Make sure it is hermetically sealed to prevent cross-contamination. Refillable pump bottles are simply not up to the task and will contaminate the fiber even more.

Also make sure always to clean both ends of a connector pair just before mating. Don't forget to clean new jumpers and patch cords; even protective end caps do not guarantee cleanliness.

If a stick is used to apply cleaning fluid, use one stick per end face to avoid cross-contamination and rotate sticks in only one direction. "Clicker" cleaning tools are extremely convenient and quick. They are a good option for light contamination; however, out in the field, where high contamination is likely, the best option is cleaning fluid and wipes.

EDUCATION IS KEY

Education is key to prevent network failure caused by contamination. Technicians need to be trained to clean fiber effectively and provided with the equipment that works best for the job at hand. Make no assumptions about the cleanliness of end faces even if the fiber and its connectors are new. Expecting a patch cord from the factory to be pristine is unrealistic. Clean and inspect every end face, every time.

Find a cleaning method that is quick and effective, and it will future-proof your fiber installations. Seek the help of an experienced vendor that specializes in fiber cleaning and can advise you which method will work best for you.

Modern, proper cleaning procedures save time and money because they make a network more reliable. Expensive warranty claims and repair visits will be significantly reduced. Don't cut corners. Do the job right the first time, and clean! ❖

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