

Cleanliness & Gigabitness

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Documenting your efforts to provide high-quality fiber optic terminations and keeping connectors clean are this issue's topics for our Datacom Q&A tutorial.

Q: What tests does the interferometer provide to document a high-quality termination?

An interferometer (SEE FIGURE 1) uses higher 400X to 600X magnification (SEE FIGURES 2 & 3) to view the ferrule endface in four scenarios.

A microscopic "Live View" of the ceramic

ferrule is the first view (depicted as a "bull's eye"). Contrary to belief, the ferrule endface is not flat, and thus is given the description of PC (positive contact). This *bull's eye effect* is the actual concentricity of the ferrule end's steps created during the ferrule's manufacturing process.

Compare the ferrule's targeted center



FIGURE 1: Interferometer testing.

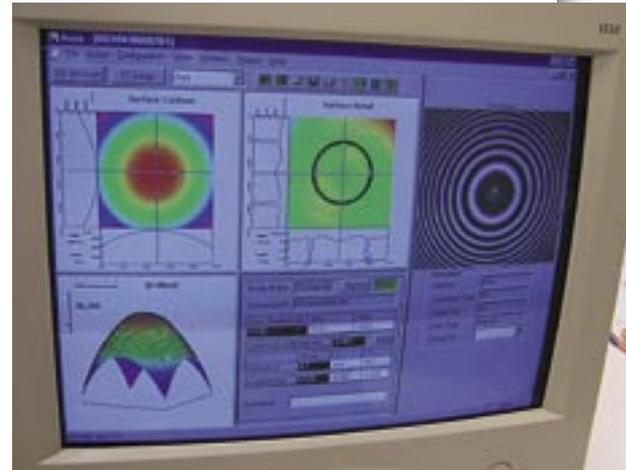


FIGURE 2: Interferometer magnifications.

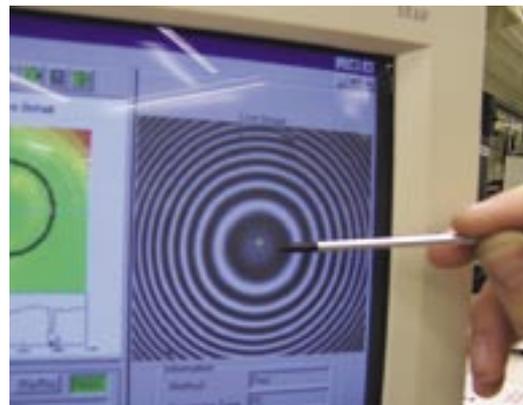


FIGURE 3: "Bulls Eye" magnification of the ferrule tip's steps.

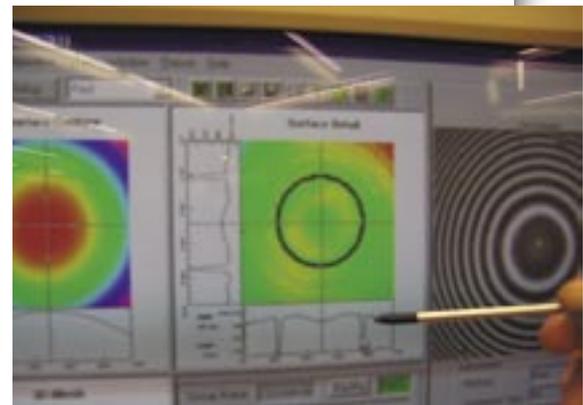


FIGURE 4: Surface detail of epoxy ring and slight undercut of glass tip.

Acronyms in Article

- BER** = bit error rate
- CAD** = computer-aided design
- IL** = insertion loss
- MM** = multimode fiber
- RL** = return loss
- SM** = single-mode fiber

IF YOU'VE GOT QUESTIONS ABOUT DATACOM

Bo Conrad, a BICSI-certified instructor, will answer them. To have your question answered in *Power Outlet* e-mail us at poweroutlet@rexelusa.com and put "Ask Bo" in the subject line.

to the actual center or the “+” of the fiber. Linear and angular differences are measured in degrees and are called the “offset”. Telcordia specs and/or the customer specifications will dictate the maximum offset.

SEE FIGURE 4—the second view.

All these measurements are directly related to the polishing process.

This is the “Surface Detail,” showing the concentricity of the glass protrusion in relation to the width and depth of the epoxy rings as well as the degree of overcut or undercut of the glass. Too much of either will affect either or both the IL and RL.

Excessive adhesive will show a thicker “mud ring” effect with poorer quality ferrules having larger core drills (greater than 127 μm). It may even shift the glass off center creating a larger degree offset.

“Surface Counter” is the third view (SEE FIGURE 5). It’s the measurement of the optical glass core/cladding curvature radius. It should

be centered and symmetrical within the minimum and maximum tolerances. The center core should be the only area in red. Pits, scratches, or over cuts will be shown as red “hot spots” or “streaks”.

A: “3D Mesh,” CAD-like drawing is the fourth view; SEE FIGURE 6. The contour should be elliptically symmetrical without any spikes or contusions and the rainbow colors should be evenly distributed from red at the tip, green on the sides, to blue/violet at the base.

WHERE WE’VE BEEN HEADING

All these measurements are directly related to the polishing process. The factors to consider include:

- ◆ angle of the connector when placed in the puck or polishing jig;
- ◆ amount and consistency of pressure being applied to the connectors in the jig or puck;
- ◆ types and “grit” of the polishing papers;
- ◆ speed of the jig platform;
- ◆ amount of water being applied;
- ◆ and more.

The slightest variations in any of these practices have an astounding measurable effect on the ferrule endface affecting both IL and RL. For a view of a failed connector, SEE FIGURE 7.

These considerations are the major reason that field terminations do not have the consistency and quality performance compared to those assemblies manufactured from a professional cable assembly

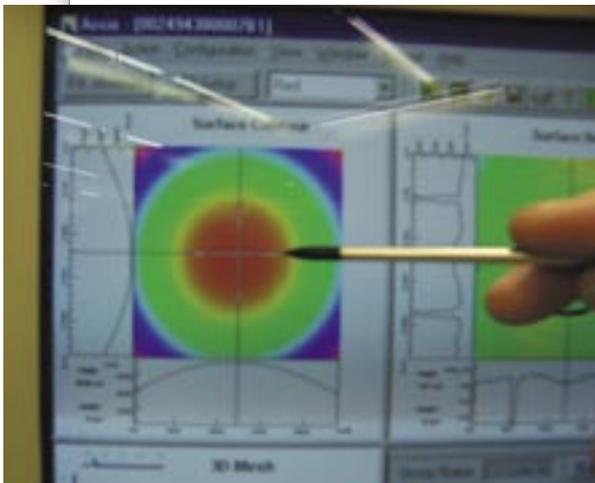


FIGURE 5: Surface Contour view of a symmetrical tip.

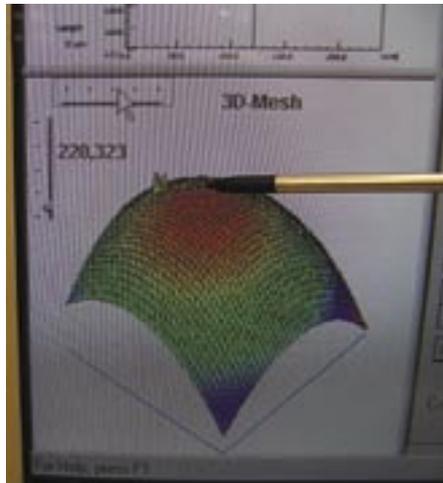


FIGURE 6: 3D Mesh view of the tip with a slight imperfection.

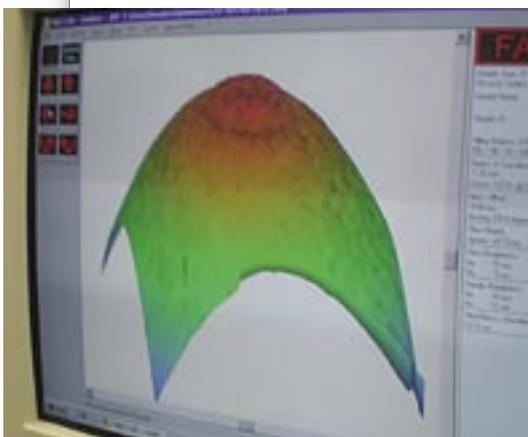


FIGURE 7: 3D Mesh view of a Failed connector.



FIGURE 8: Traditional cleaning materials are Kim Wipes and 99% pure isopropyl alcohol.



FIGURE 9: Replaceable cartridge type—ideal for all ferrule type connectors.



FIGURE 10: Kleenex-type cube box with rubber pad.



FIGURE 11: Disposable credit card size container with throwaway sheets.

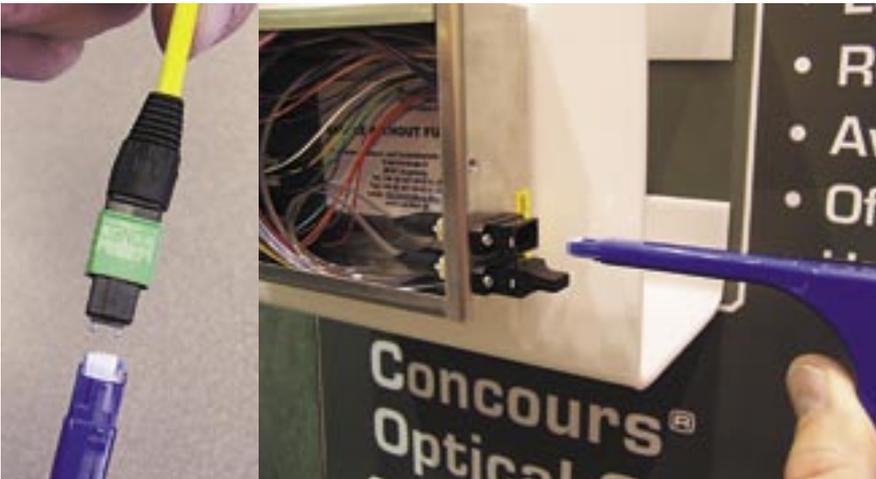


FIGURE 12 & 13: Dry-tape tool for cleaning MTP/MPO/MT-RJ connectors and adapters with pins.

The most popular and traditional method of cleaning a connector is using 99% pure isopropyl alcohol with Kim Wipes.

shop. Gigabit applications demand an extremely low IL budget and high RL. This combination directly affects the BER which should not exceed 1×10^{-10} .

Q: What is the proper method of cleaning a fiber optic connector?

The most popular and traditional method of cleaning a connector is using 99% pure isopropyl alcohol with Kim Wipes (SEE FIGURE 8). This method only cleans the ferrule endface. Excessive use of the alcohol will usually leave a residue cre-

ating crystal-like refractions from the droplets.

Alternative cleaning methods utilize a deposable “dry wipe” method requiring no alcohol. NTT developed and has licensed Optipop™ (USConec™) a dry-clean material enclosed in both a replaceable and throw-away tape-like dispenser (SEE FIGURE 9).

Other options include Chemtronics™ Kleenex-type cube box with rubber pad (SEE FIGURE 10) and Neptec’s™ credit card size container (SEE FIGURE 11) with throwaway ferrule guide sheet. (The later making a nice mar-

keting promotional item).

Another useful tool for cleaning the MTP, MPO, and MT-RJ connectors having guide pins comes from USConec™ (and Fujicura™). It is really the only practical solution to properly cleaning 2, 6, 8, or even 12 fibers of the ribbon-type ferrule situated between the guide pins (SEE FIGURES 12 & 13).

Simple use of compressed air is the most common “legacy method” to clean adapters and barrels. Now, cotton swab-like kits have small dry tape—static free material that can clean the sides of the ferrule or func-

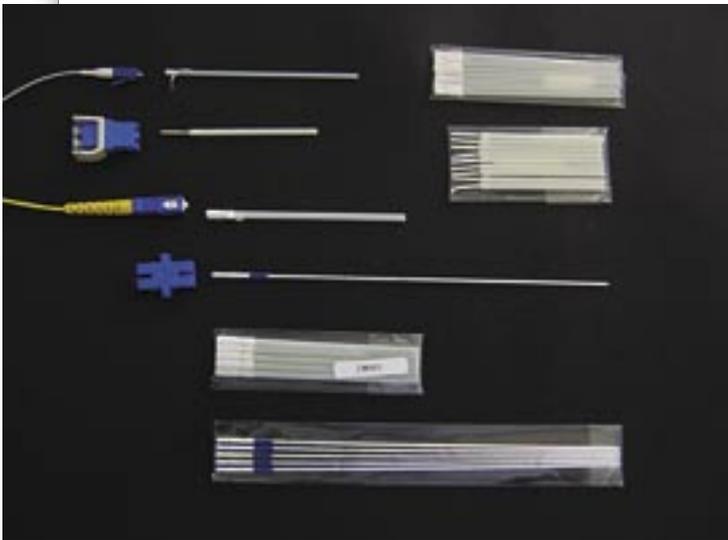


FIGURE 14: Ferrule tip and adapter cleaning kits.

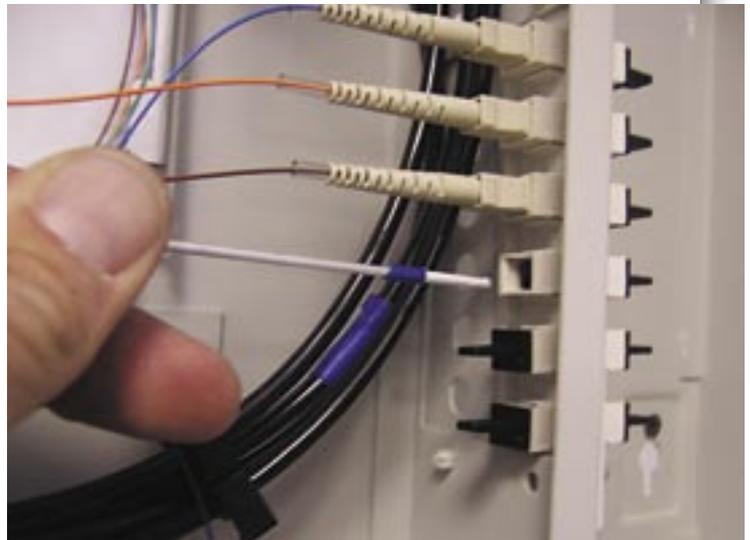
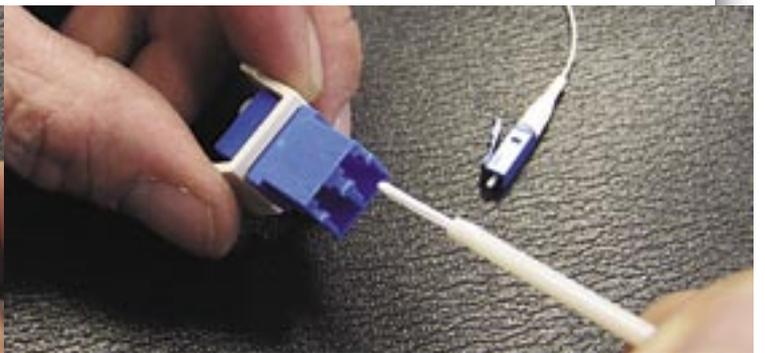


FIGURE 17: Cleaning probe for adapters in enclosures.



FIGURE 15 & 16: Cleaning probe for ferrules and adapters.



tion like a probe for cleaning adapters in their enclosures.

LESSONS TO BE LEARNED

Use of proper termination techniques is only the first step in obtaining a quality termination able to support Gigabit speeds and reduce BER Bit Error Rate. To reduce IL while maintaining higher RL value requires both suppliers to have a QA process and the field technician's practice of keeping the connector cleaned during and after the termination process.

SEE FIGURES 14, 15, 16, & 17.

Testing either a packaged short fiber assembly or a longer installed fiber link requires standardized testing procedures and recordings of the (bi-directional) attenuation tests—plus added RL values for SM cable assemblies.

Quality assurance's final stage is using a higher-resolution visual inspection process: A minimum 200X for MM fiber and even higher computerized magnification for SM

interferometer readings. A differential marketing strategy should include photos of the ferrule's "clean" endface and, if applicable, supporting documentation of all the interferometer tests results.

Remember, cleanliness is next to Gigabitness! Prove it to your customers. A picture of your quality efforts is, literally, worth 1,000 words. ⚡

Conrad, a BICSI-certified trainer, has a bachelor's degree in engineering and an MBA. His company, Crossbow Communications (www.crossbowcom.com) is licensed by BICSI to conduct the Professional Cable installer program. See other "Datacom Q&A" questions (and answers) online at www.rexelusa.com.

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