FIBER INSPECTION PROBES VS. FIBER-OPTIC MICROSCOPES

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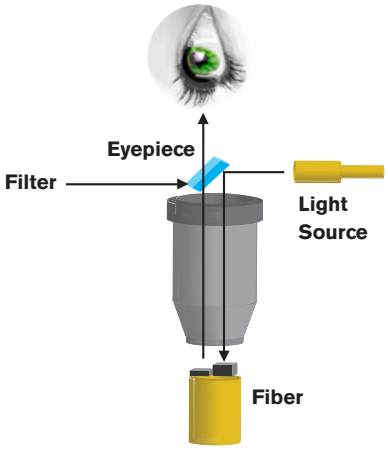
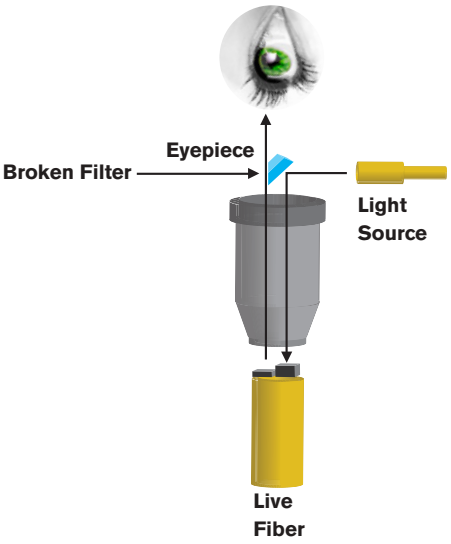
The fiber-optic marketplace has come to widely accept the benefits and necessity of connector cleaning. However, this has lead to some confusion over which connector inspection tool is best: fiber inspection probes (FIP) or fiber-optic microscopes (FOMS). Although both instruments are used to inspect connectors, there are important differences between them.

1. Eye Safety

Fiber-optic microscopes rely on an internal filter to protect the eye from an accidental live fiber inspection.



However, if the fiber-optic microscope filter is missing, damaged or malfunctioning, there is a risk of eye damage in an accidental live fiber inspection situation.

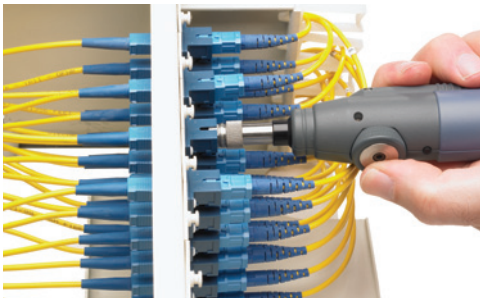


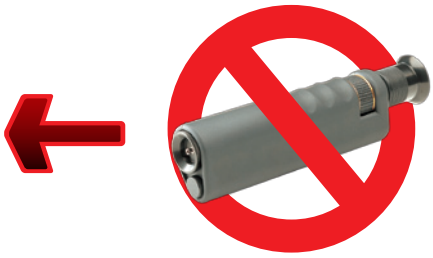
When using an FIP, there is absolutely no risk of eye damage since you view the image on a video display instead of directly.

2. Connector/Patch Panel Bulkhead Inspection

Since the ferrule (male) of the connector to be inspected is inserted at one end of the instrument and the user must look in at the other end, fiber-optic microscopes are not designed for inspecting connector bulkheads (female) located in a patch panel.

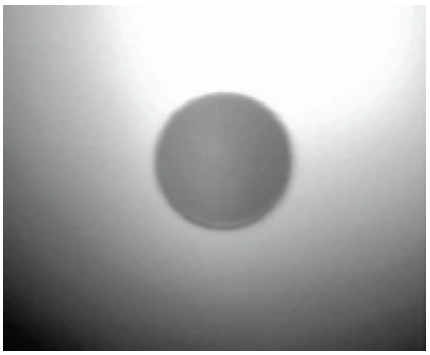
Typical patch panel bulkhead inspection



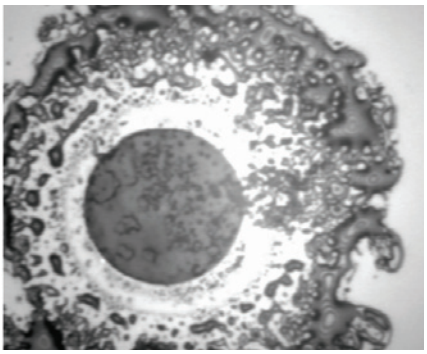


3. Cross Contamination

Cross contamination can occur when a clean connector is inserted in a dirty connector bulkhead. The mating of both connectors tends to move debris and dirt to the center of the connector where it can interfere with the optical transmission and cause extensive damage.

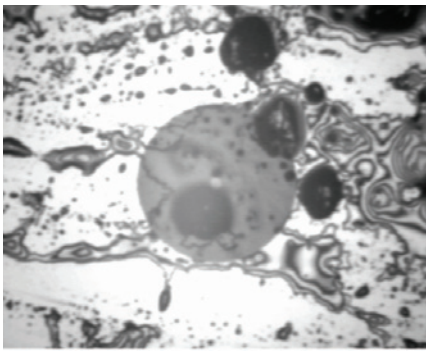


Clean connector

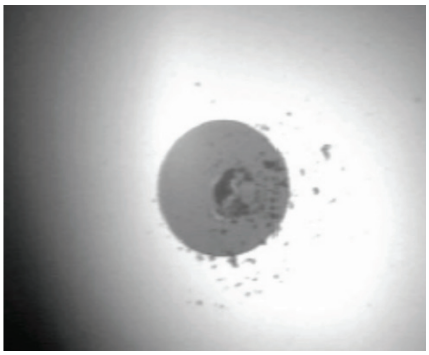


Cross contaminated connector

For instance, let's consider a cross-contaminated connector is plugged into a powered-up erbium-doped fiber amplifier (EDFA). The output power of an EDFA is around +25 dBm. At this power level, any debris or dirt is burned, permanently damaging the connector and, more importantly, the EDFA, which costs around US$10,000.



Contaminated connector



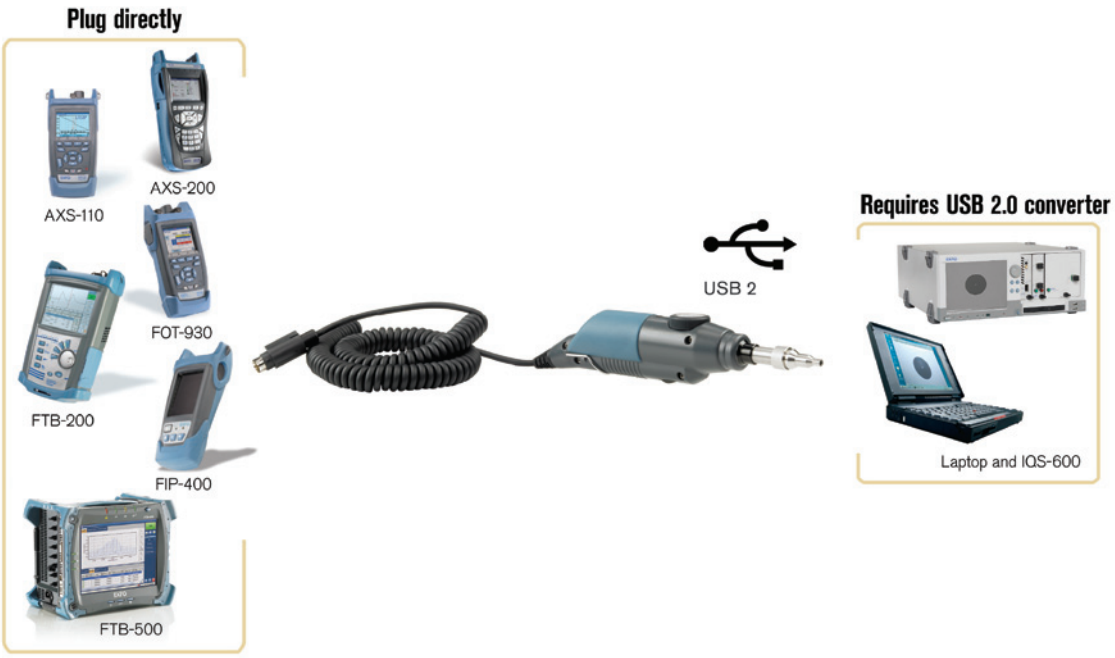
Permanently damaged EDFA connector

4. Inspection Applications

Many connector inspection applications require interfacing with the FIP. Here are some examples:

1. Manufacturing or lab environments where the FIP is connected to a test station or test platform.
2. Manufacturing, lab or field applications where the FIP is connected to a computer.
3. Field applications where the FIP is connected to a test instrument.
4. Generation of a fiber "birth certificate" where the fiber-link connector images are stored for report generation and future reference.

All of these applications make the FIP very versatile. None of these applications can be addressed using a fiber-optic microscope.



5. Cost

Initially, FIPs are more expensive than fiber-optic microscopes. However, looking at the risks and potential costs of using a microscope, investing in an FIP is well justified. Here are a few situations that can result in costly expenses if not equipped with the right tool:

- Network outages can be extremely costly to business in terms of lost revenue and productivity. The table below shows, for different companies, the annual revenue, the revenue lost due to network downtime and the estimated per-hour cost of this downtime. As these numbers date back to 2003, costs have most likely gone up since.

Annual Downtime Cost: Productivity vs. Revenue			
Case Study	**Annual Revenue**	**Lost Revenue**	**Cost/Hour**
Energy	$6.75 billion	$4.3 million	$1,624
High Tech	$1.3 billion	$10.2 million	$4,167
Health Care	$44 billion	$74.6 million	$96,632
Travel	$850 million	$2.4 million	$38,710
Finance (US)	$4 billion	$10.6 million	$28,342
Finance (EU)	$1.2 billion	$379,000	$1,573

Source: "The Cost of Enterprise Downtime 2003" study by Infonetics Research

- A possible lawsuit by microscope users due to accidental eye damage
- Damaging expensive optical equipment such as EDFAs
- Network downtime due to cross-contaminated connectors
- Lost of productivity associated with using an FOMS since it is an incomplete inspection solution (not designed for connector bulkhead inspection)

6. Summary Table

	Fiber Inspection Probe (FIP)	Microscope (FOMS)
Eye safety	Indirect viewing of image; no risk of eye damage.	Direct viewing of image; relies on an internal filter for eye protection. High risk of eye damage, if the internal filter is missing or malfunctioning.
Connector and patch panel bulkhead inspection	Wide variety of adapters to inspect connector ferrules (male) and patch panel bulkhead connectors (female).	Cannot be used to inspect connectors and patch panel bulkheads (female) because of its design (insertion of connector ferrule (male).
Cross contamination	Since both connector ferrules and bulkheads can be inspected, cross contamination is eliminated.	Cross contamination is a serious problem; inserting a clean connector into a dirty bulkhead will contaminate the clean connector.
PC, platform and test instrument connectivity	Most probes can be connected to computers, test platforms or test instruments; images can be stored to generate reports and be used for future reference.	Cannot be connected to a computer, test platform or test instrument; images cannot be stored.
Cost	Higher initial cost, but lower long-term cost.	Lower cost, but higher risks and limited versatility.

7. Conclusion

Dirty/damaged connectors are the no. 1 cause of link deployment problems. Their inspection should therefore be given the full attention it requires. In this context, when we add up the above-mentioned benefits, it is clear to see that although they require a higher initial investment, FIPs constitute a safer, more flexible and more complete connector inspection choice for ensuring smooth link deployment and, ultimately, optimal network performance.

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