GENERAL HANDLING GUIDELINES FOR FIBER OPTIC COMPONENTS

Optical fiber is very strong in some ways, but since it contains a very thin strand of glass, it is also quite delicate. Treat it like fine crystal, follow the handling procedures outlined here, and you will minimize the time and expense associated with broken component fibers.

- Wear finger cots or gloves. Your hands may look clean, but dirt and oils on them can damage the fiber and contaminate connectors.
- Never use the fiber pigtail to pick up or support the weight of the device. Keep both the device and the optical connector together in your hand(s)

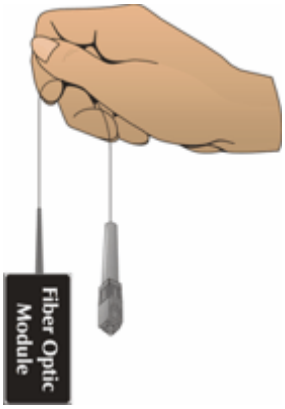


Figure 1: Improper way to handle fragile fiber pigtails

Figure 2: Letting the Fiber Dangle Over Sharp Corners will Damage the Fiber

- The fiber is made of a very pure, expensive glass. Treat it with the same care that would be used when handling expensive crystal glass.
- Do not allow kinks or knots to develop in the fiber.
- Carefully work out any tangles-patience will save time and money
- Do not pull on the fiber when kinks or knots are present. Pulling will only cause knots, kinks, and curls to tighten and exceed the minimum bend radius.
- Always use the correct tools for stripping and cleaving the fiber. It will save time and reduce breakage caused by scratches.
- Follow all ESD precautions and approved fiber cleaning procedures (see below, cleaning section).
- Always read and comply with the handling instructions on the shipping container removing components from their packing containers.

CLEANING

Connectors and bulkhead adapters should be cleaned before interconnection. A microscopic bit of dirt or contamination can **DAMAGE** the connector or **DEGRADE PERFORMANCE**. In high power systems this dirt can act as a lens to focus the high power and actually 'burn' the interconnection.

The fiber end face and ferrule must be absolutely clean before it is inserted into a transmitter or receiver. Dust, lint, oil (from touching the fiber end face), or other foreign particles obscure the end face, compromising the integrity of the optical signal being sent over the fiber. From the optical signal's point-of-view, dirty connections are like dirty windows. Less light gets through a dirty window than a clean one.

It is hard to conceive of the size of a fiber optic connector core. Single-mode fibers have cores that are only 8-9 µm in diameter. As a point of reference, a typical human hair is 50-75 µm in diameter, approximately 6-9 times larger! Dust particles can be 20 µm or larger in diameter. Dust particles smaller than 1 µm can be suspended almost indefinitely in the air. A 1 µm dust particle landing on the core of a single-mode fiber can cause up to 1 dB of loss. Larger dust particles (9 µm or larger) can completely obscure the core of a single-mode fiber.

Fiber optic connectors need to be cleaned every time they are mated and unmated; it is essential that fiber optics users develop the necessary discipline to always clean the connectors before they are mated.

Warning! To prevent serious eye damage, never look directly into a fiber optic cable connector or mating adapter. Never assume laser power is turned off or the fiber is disconnected at the other end.

Warning! Always handle, use and dispose of chemicals and other cleaning materials in accordance with manufacturer's instructions.

Note: Always perform the cleaning procedure described below for cable connectors prior to fiber optic cable installation. Whenever possible, inspect each connector before connecting it to its mating adapter. This can be done using a simple 100x illuminated microscope (fiberscope). Here are what you could see for a clean and a dirty fibre:

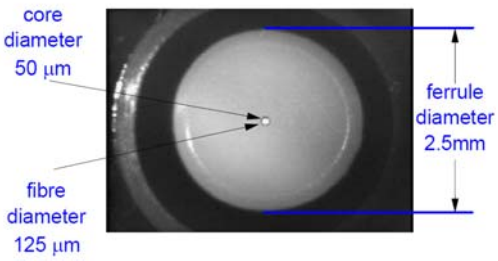


Figure 3: clean 50um Multi mode fibre

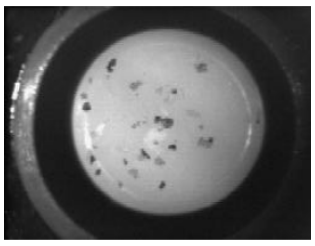


Figure 4: Same fibre with dust. Attenuation >15dB.

CLEANING THE BULKHEAD MATING ADAPTERS

When cleaning a cable connector/ bulkhead mating adapter pair, clean the mating adapter first. The mating adapter should not require cleaning if it has been used with clean, defect free fiber connectors and capped when not in use. However, if the adapter is suspected of being dirty, use only clean, dry, oil-free compressed air and follow these steps:

Compressed air technique:

Step 1: Aiming away from the adapter, release a short blast of compressed air to remove any dust inside the nozzle of the compressed air can.

Step 2: Use three to four short blasts of air directed at the adapter to remove dust.

Figure 5: Compressed dry air

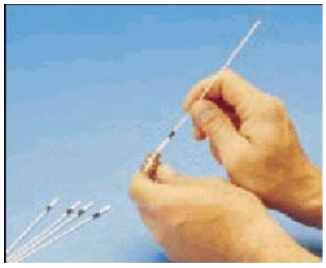
Follow the manufacturer's instructions for use of compressed air. Improper use of compressed air can result in contamination of the adapter.

Lint-free swab technique:

Step 1: Lightly press and turn the swab to clean the ferrule face.

Step 2: Properly dispose of the swab. NEVER REUSE A SWAB.

Figure 6: Swabs



A more thorough cleaning requires disassembly of the part and should only be done by a specially trained technician.

Warning: Use a clean dust cap on adapter ports and fiber connectors when not in use.

CLEANING THE CABLE CONNECTORS

Various cleaning tools are available at CERN:

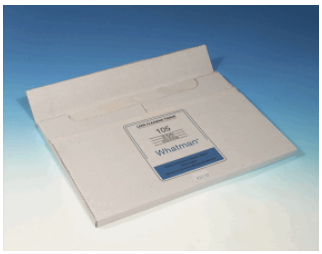


Figure 7: SCEM 19.44.15.130.3- LENS CLEANING TISSUE 20 x 30 cm

Figure 8: SCEM 19.44.15.160.7- LENS CLEANING WET TISSUE

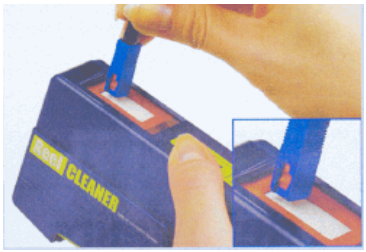


Figure 9: SCEM 34.10.01.A- OPTICAL CONNECTOR REEL CLEANER

Instructions to use lens cleaning tissue

Step 1: Fold a clean wipe several times, to get a pad of 6 to 8 layers of material.

Step 2: Remove the protective cap on the optical fiber cable connector.

Step 3: Dampen (but do not soak) a corner of the pad with alcohol using the alcohol dispenser.

Step 4: Firmly press the tip of the ferrule into the alcohol-moistened area of the wipe. Pinch the wipe firmly with your fingers against the ferrule and twist the ferule. Repeat three times, using a clean area of the wipe. Clean the tip and as much of the outside of the ferrule as possible.

Step 5: Press the ferrule tip into a clean, dry spot of the wipe, pinch, and twist once.

Step 6: Discard the used wipe.

Step 7: (Optional) Use clean, dry, oil-free compressed air to remove tissue fragments that may have been deposited on the tip of connector.

Step 8: Whenever possible, inspect the ferrule end-face. If it is still dirty, repeat steps 1 through 8. If the ferrule is damaged it may need to be replaced. Defects on the fiber cable connector can damage the mating connector and repair can be costly.

Step 9: If the ferrule end-face is clean and damage-free, place the connector into the matching, clean, mating adapter.

Note: Denatured alcohol can also be used in addition to the lint-free tissue. Use only industrial grade 99% pure isopropyl alcohol. Commercially available isopropyl alcohol is for medicinal use and is diluted with water and a light mineral oil. Industrial grade isopropyl alcohol should be used exclusively.

References & more information:

- Inspection and Cleaning Procedures for Fiber-Optic Connections, Cisco: http://www.cisco.com/en/US/tech/tk482/tk876/technologies_white_paper09186a0080254eba.shtml#H1-Topic6
- Fiber-optics info: http://www.fiber-optics.info/articles/connector-care.htm