

## Inspection and Cleaning Procedures for PureLink Fiber Optic Connections

### Introduction

For optimum performance of you PureLink Optical Device, it is recommended that every fiber connector be inspected and cleaned prior to connecting the fiber cable to the device. The following procedures in this document describe recommended basic inspection techniques and processes for cleaning fiber optic cables, and optical receptacles used in PureLink designed devices.

Note: This document is intended for use by service personnel, field service technicians, and hardware installers.

### Why Inspection and Cleaning are Critical

Any contamination in the fiber connection can cause failure of the component or failure of the whole system. Even microscopic dust particles can cause a variety of problems for optical connections. A particle that partially or completely blocks the core generates strong back reflections, which can cause instability in the laser system. Dust particles trapped between two fiber faces can scratch the glass surfaces. Even if a particle is only situated on the cladding or the edge of the endface, it can cause an air gap or misalignment between the fiber cores which significantly degrades the optical signal.

- A 1-micrometer dust particle on a single-mode core can block up to 1% of the light (a 0.05dB loss).
- A 9-micrometer speck is still too small to see without a microscope, but it can completely block the fiber core.

These contaminants can be more difficult to remove than dust particles.

By comparison, a typical human hair is 50 to 75 micrometers in diameter, as much as eight times larger. So, even though dust might not be visible, it is still present in the air and can deposit onto the connector. In addition to dust, other types of contamination must also be cleaned off the endface. Such materials include:

- Oils, frequently from human hands
- Film residues, condensed from vapors in the air
- Powdery coatings, left after water or other solvents evaporate away

These contaminants can be more difficult to remove than dust particles and can also cause damage to equipment if not removed.

When you clean fiber components, always complete the steps in the procedures carefully. The goal is to eliminate any dust or contamination and to provide a clean environment for the fiber-optic connection. Remember that inspection, cleaning and re-inspection are critical steps which must be done before you make any fiber-optic connection.

### Best Practice Reminders and Warnings

Please review these reminders and warnings before you inspect and clean your fiber-optic connections.

#### Reminders

- Always turn off any laser sources before you inspect fiber connectors, optical components, or bulkheads.
- Always make sure that the cable is disconnected at both ends
- Always wear the appropriate safety glasses when required in your area.
- Always keep a protective cap on unplugged fiber connectors.
- Always store unused protective caps in a re-sealable container in order to prevent the possibility of the transfer of dust to the fiber.

## Inspection and Cleaning Procedures

### Warnings

- Never look into a fiber while the system lasers are on.
- Never connect a fiber to a fiberscope while the system lasers are on.
- Never touch the end face of the fiber connectors.
- Never twist or pull forcefully on the fiber cable.

### Best Practice Recommended Tools:

- Fiber Inspection Scope
- Connector Cleaning Cartridge
- Connector Receptacle Cleaning Tool

#### Fiber Inspection Scope example:



#### Connector Cleaning Cartridge Example:



#### Connector Receptacle One-Click Tool

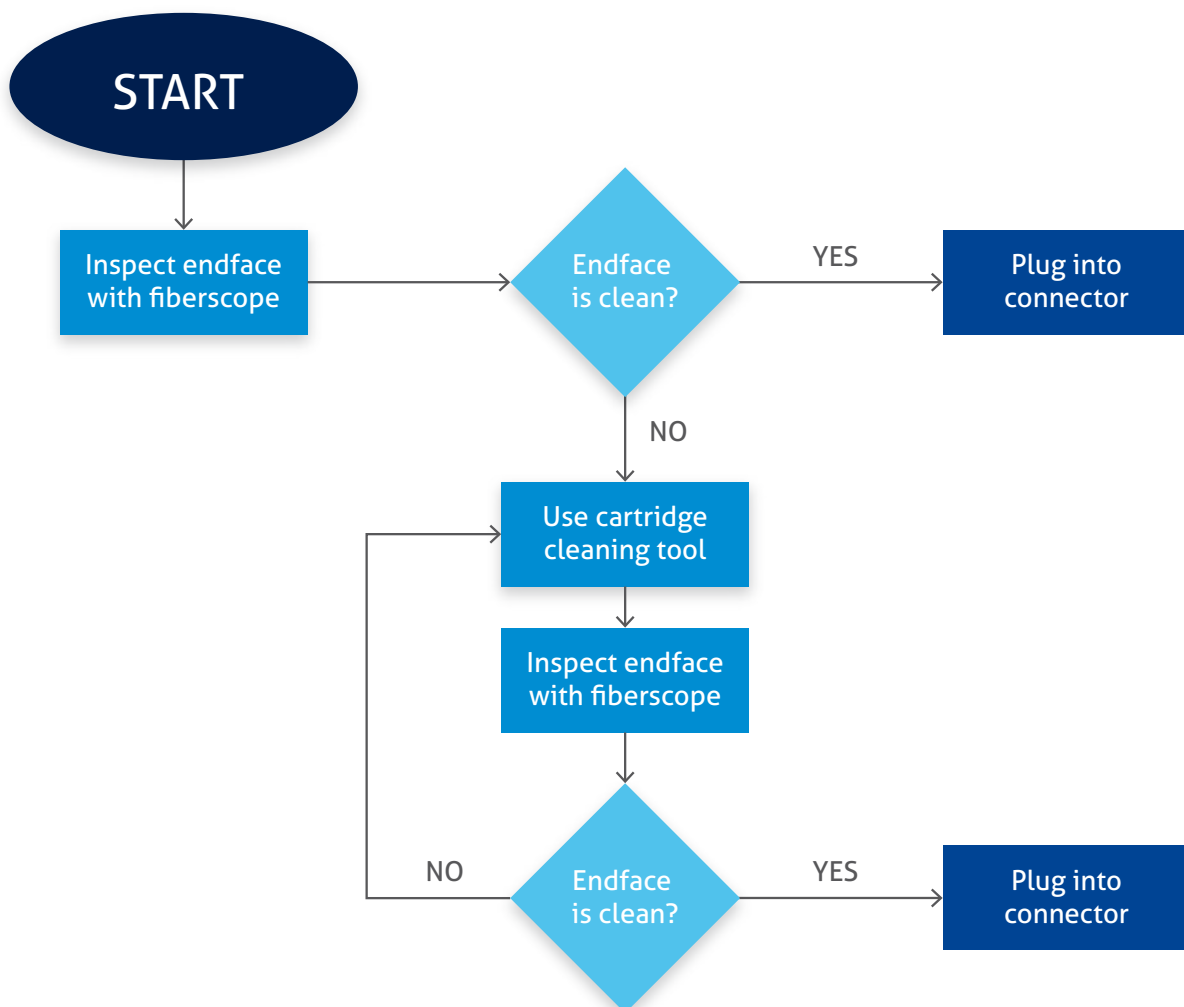


## General Cleaning Process

1. Inspect the fiber cable connector with the fiberscope.
2. If the connector is dirty, clean it with a connector cartridge.(see below for instructions)
3. Inspect the connector with the fiberscope.
4. If the connector is still dirty, repeat the connector cartridge process.
5. Inspect the connector with the fiberscope
6. If the connector is still dirty, continue to repeat steps until connector is visibly clean using the fiberscope. If connector is scratched or chipped, installation of a new cable is recommended.
7. If new cable is installed, use fiberscope to ensure connector is clean prior to installation.

Figure 1 shows the connector cleaning process flow.

Figure 1



## Fiberscope Connector Inspection Technique

A fiberscope is a customized microscope used in order to inspect optical fiber components. The fiberscope should provide at least 200x total magnification. Specific adapters are needed to properly inspect the endface of most connector types, for example: 1.25 mm (LC) or 2.5 mm (SC, ST)

Complete these steps in order to inspect the connector:

1. Make sure that the lasers are turned off before you begin the inspection.
2. Remove the protective cap and store it in a clean re-sealable container.
3. Verify the style of connector you inspect and put the appropriate inspection adapter or probe on your equipment.
4. Insert the fiber connector into the fiberscope adapter, and adjust the focus ring so that you see a clear endface image.

## Cleaning Techniques for Fiber Optic Cables

Tools

• Cartridge Cleaning Tools Examples:

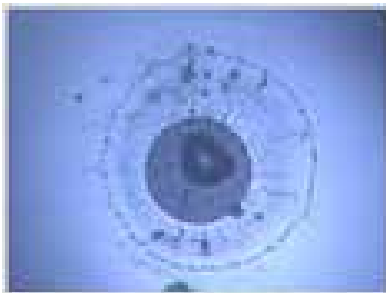


### Cartridge Cleaning Tools Examples:

1. Make sure that the lasers are turned off before you begin the inspection.
2. Remove the protective endcap and store it in a small resealable container.
3. Inspect the connector with a fiberscope.
  - If the connector is dirty, clean with a cartridge
4. For cartridge cleaners a shutter slides back and exposes a new cleaning area
5. Hold the fiber tip lightly against the cleaning area and make 2 figure eight's
6. Inspect with Fiberscope

Example of dirty vs. clean connector when viewed through a fiberscope:

### Cartridge Cleaning Tools Examples: Before



### Cartridge Cleaning Tools Examples: After



## Cleaning Techniques for Optical Device Ports

### Fiber Cleaning Techniques Using the One Click Tool

#### Using Extended Mode



To use extended mode, pull the tip outward while simultaneously pushing down on the lock button. Extended mode is useful for panels with multiple optical ports or other tight spaces.

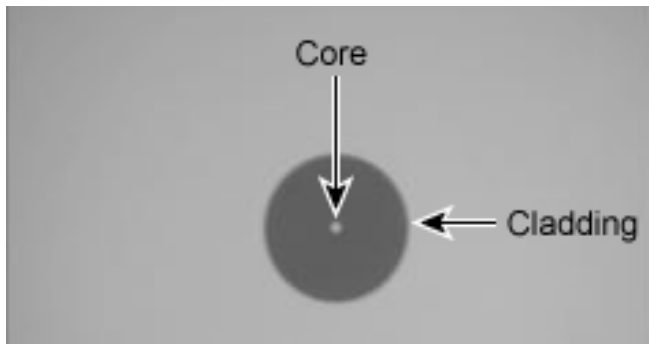
#### Cleaning the Optical Port



1. Remove the guide cap completely from the device, and insert the tip of the tool into the optical port connector. Push the case to start the cleaning process; a click indicates that the cleaning is complete. 2. Insert optical cable

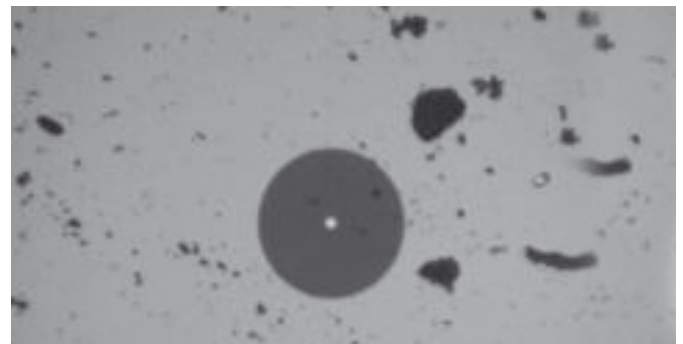
## Reference Material; Cable Connector End Face Examples

#### A Clean Connector



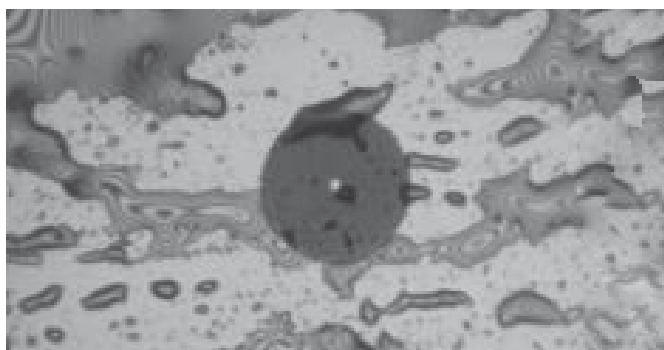
A clean connector should not have any major debris or scratches across the core.

#### Connector with Dust



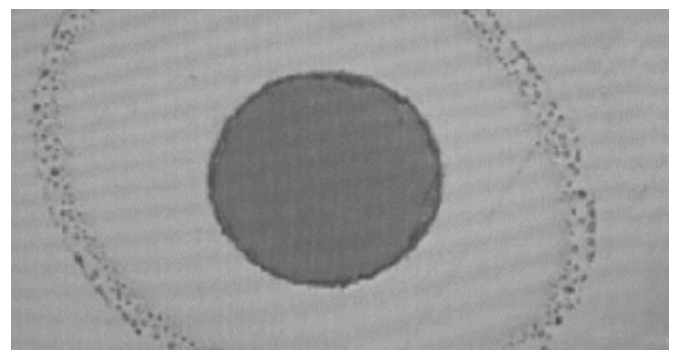
A connector with dust particles spread across the surface of the endface that needs cleaning.

#### Connector with Liquid or Oil Contamination



A connector with liquid or oil contamination that needs cleaning.

#### Connector with Dry Residue



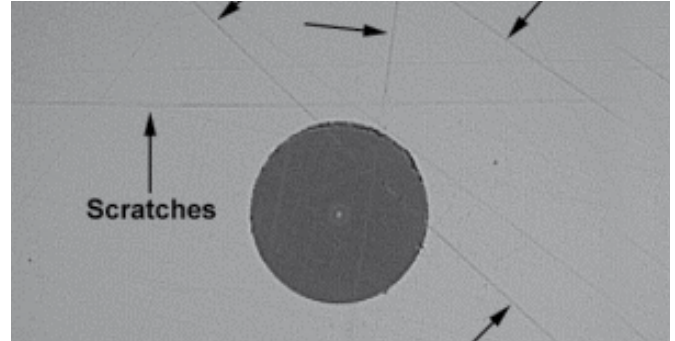
A connector with a dry residue that needs cleaning.

## Connector with Oil Residue



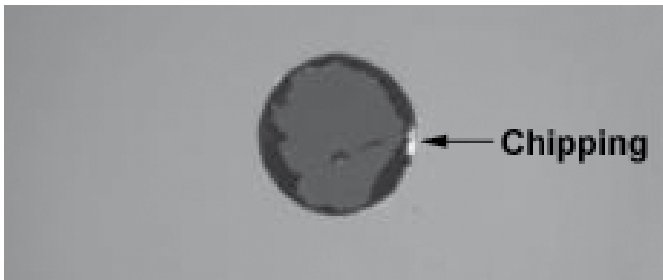
A connector with an oil residue that needs cleaning.

## Connector with Scratches



A connector with scratches. These scratches are not detrimental to the endface and does not clean off. But, deep scratches that appear to cross the fiber-optic core can cause signal loss.

## Connector with Chipped Cladding and Excessive Epoxy



A connector with damage to the cladding. Cleaning cannot remove damaged cladding. A small amount of epoxy around the cladding is allowable, but this shows excessive epoxy around the cladding that does not clean off. This connector must be replaced.