ATT-TP-76461

AT&T Fiber Optic Connector & Adapter Inspection and Cleaning Standards

Presented in this document are the AT&T standards for inspecting and cleaning of fiber optic connectors & adapters. This document provides guidelines and procedures for the proper optical fiber connector & adapter inspection and cleaning process. This document is to be used by AT&T personnel and AT&T Authorized Vendors. This document does not address fiber cable splicing procedures. The baseline steps are always to inspect, clean if necessary and inspect again using an approved Video Scope before terminating any fiber connector.

To:	The primary audience for this document are AT&T Employees in the following disciplines: Construction & Engineering, Local Field Organization (LFO-IN), Local Field Organization (LFO-OUT), Special Services, Installation & Repair, Manager - Engineering Implementation (MEI), Maintenance Engineering, Space Planning, Frame Planning, Long Range Technical Planning, Outside Plant, Fundamental Network Planning, New Technology Introduction, all FTTx applications, AT&T Laboratories and most importantly, anyone that may be exposed or required to work on or in close proximity to fiber optic systems.
Effective Date:	February 25th, 2008
Issue Date:	Issue 4, 01/24/08
Expires On:	Expiration upon reissue
Related Documents:	N/A
Canceled Documents:	N/A
Issuing Department:	AT&T Services Inc, Outside Plant Standards, Network Planning & Engineering (NP&E), and AT&T Laboratories Inc and AT&T Optical Safety Organization.

Business Unit: Network Planning and Engineering

Points Of Contact: See Contact List

Author(s):
Mike Yeilding - Area Manager, Common Systems, (925) 823-4747, ATTUID: my1515

Table Of Contents

INTRODUCTION

CAUTION:
The methods and criteria in this document were developed to protect the integrity of the AT&T optical network by stringent use of the proper Inspection and Cleaning methods before mating any optical connector. Irreparable damage can be caused by mating dirty connectors one time.

REMEMBER: **No Job is So Important and No Service is So Urgent-That We Cannot Take Time to Perform Our Work Safely.**

Inspect, Clean if Necessary, Inspect

One important thing to remember in handling fiber optic connectors is that the fiber end face and ferrule must be absolutely clean before connections are made. Dust, lint, oil, 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.

It is difficult to picture the size of a fiber optic connector core without some reference. Single-mode fibers have cores that are only 8-9 µm (µm = micron or micrometer) in diameter. As a point of reference, a typical human hair is 50-75 µm in diameter, approximately 6-9 times larger than the Single-mode core! Dust particles can be 20 µm or larger in diameter and 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 1dB 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 inspected and cleaned if necessary every time they are mated; it is essential that fiber optics users develop the necessary discipline to always Inspect, Clean if necessary, and Re-Inspect all optical connectors before they are mated. Inspection must ALWAYS precede and follow cleaning of connectors.

It is also important to cover a fiber optic connector when it is not in use. Unprotected connector ends are most often damaged by impact, such as hitting the floor. Most connector manufacturers provide some sort of protection boot. The best protectors cover the entire connector end, but they are generally simple closed-end plastic tubes that fit snugly over the ferrule only. These boots will protect the connector's polished ferrule end from impact damage that might crack or chip the polished surface, however the connector must be inspected before use to insure the protective cover did not contaminate the end face.

IMPORTANT:
If you intend to print this document it is important that you view or download the following presentations before printing.

If you are in HTML view, you may view the following files by right clicking on the file of your choice and then selecting "Open In New Window". You will be greeted with a "Password" window to which you will respond by clicking the "Read Only" button.

If you are in HTML view, you may download the following files to your computer by right clicking on the file of your choice and then selecting "Save Target As".

IMPORTANT:

Do NOT Left Click the Following Links. Follow the instructions above.

Slide show illustrating Fiber Inspection (Scenario One)

Fiber Grading_spencer_scenario1ss.pps
You may download this file from the online version of this document.
Note: You must have the proper application in order to open the file.

Slide show illustrating Fiber Inspection (Scenario Two)

Fiber Grading_spencer_scenario2ss.pps
You may download this file from the online version of this document.
Note: You must have the proper application in order to open the file.

Slide show illustrating Fiber Inspection (Scenario Three)

Fiber Grading_spencer_scenario3ss.pps
You may download this file from the online version of this document.
Note: You must have the proper application in order to open the file.

Westover FBP-ATT-1 user Guide. This Slide Show along with the video in section 2.1 or 2.2 should provide adequate training in the use of the Westover Scopes.

ATT Inspection Kits_V3[1].0.ppt
You may download this file from the online version of this document.
Note: You must have the proper application in order to open the file.

CAUTION:
INSPECTION must ALWAYS precede cleaning or mating of optical connectors to prevent permanent damage or contamination of the connectors that could lead to service interruptions.

Printing instructions if you are in the HTML view:

1. Press CTRL+a or CTRL+A to select the entire document.
2. Press CTRL+c or CTRL+C to copy to the clipboard
3. Open a new MSWord document
4. Press CTRL+v or CTRL+V to paste to the MSWord document

Printing instructions if you are in the PDF view:

1. Place the cursor in the middle of the page.
2. Right click the mouse and a dialog box will appear

3. Select Print from the dialog box that appeared in Step 2.

1. Reason For Current Issue

DATE	ISSUE	DESCRIPTION
01/24/2008	4	Major rewrite of entire document to bring into compliance with industry standards.

2. Safety And Training

First and foremost, it is extremely critical that all technicians working on fiber optic technology take proper precautions with regard to laser transmissions that will be concentrated and directed toward the working employee. Do not expose eyes to this optical transmission and insure that all end caps and/or terminators are properly placed on all connector ends. All AT&T personnel associated with fiber optic technology must read and adhere to ATT-770-000-013, Safety Guidelines for Fiber Communications Systems.

IMPORTANT:
All Inspection Scopes contained in this document are Video type scopes or indirect image converters as defined by ATT-770-000-013. This document does not support the use of any Non-video type or direct viewing Inspection Scope.

2.1. Westover Video for Course Credit

This video instructs the video scope user how to find and use the various controls on the Westover Scopes as well as basic fiber inspection techniques. No other instruction should be needed on the use of the scope, however Westover will perform on site training if required. Please use the following information to find and enroll in “ROADM Probe Microscope FBP-ATT-1” the first time you view the video. Enrollment can be accomplished by going to the LMC Learning Management Center or paste this link (http://lmc.sbc.com/gui/sbc/index.jsp) into your browser. The following information will allow you to receive training credit for watching the video.

1. The LMC course name: ROADM Probe Microscope FBP-ATT-1
2. Course Number: 50864320

2.2. View Westover Video for Review (No Credit)

This video instructs the video scope user how to find and use the various controls on the Westover Scopes as well as basic fiber inspection techniques. No other instruction should be needed on the use of the scope, however Westover will perform on site training if required. Use this link Video or copy and paste this link "http://cdn.sbc.com/CDM_Content/CDMFTP/Enterprise/Westover_Scientific_Training_Video-1.wmv " into your web browser to view a training video for the Westover Fiber Inspection Scope. Video length is about 32 minutes and can be viewed using Microsoft Windows Media Player.

3. Definition Of Terms For This Document

- **Adapter** - A device allowing two connectors to mate. Adapters are made up of a sleeve contained within a housing.
- **Adapter Housing** - The bulk of the adapter that allows compatible connectors to latch, screw, or snap in place.
- **Alignment Sleeve** - The sleeve within an adapter that aligns one ferrule to another when two connectors are mated.
- **APC Angled Physical Contact** - An "angled physical contact" connector is polished on an 8 degree angle. When compared with a normal "physical contact" (PC) connector, an APC connector exhibits better reflectance properties (<- 60dB, because the angled polish reduces the amount of light reflected at the connector interface).

  NOTE: APC connectors shall not be mated with UPC, SPC, or PC connectors as this may cause irreparable damage to both connectors.
- **Buffer** - An outer coating that protects the optical fiber.
- **Bulkhead** - Interface of an optical card or a module that you connect an optical connector into (i.e. adapter & connector on a faceplate or the port or an optical module…)
- **Cable** - One or more fibers encompassed by strength members and covered by a protective jacket.
- **Caution** - Items designated in the text as a caution. This could include important information regarding procedure or possible issues of which to be aware.
- **Cladding** - The glass surrounding the fiber core.
- **Connector** - A termination at the end of a fiber or optical cable that enables repeated connections to components or other fibers and cables.

- **Contamination or Contaminant** - Loose foreign material, debris, or residual film from solvent or cleaning material present to a great extent on the optical connector end-face.
- **Core** - The innermost part of an optical fiber.
- **Danger** - Items designated in the text as a danger. This could include important information regarding danger that could result in injury or bodily harm.
- **Defects** - Defined as “permanent non-linear features”. This includes embedded contamination, pits, etc.
- **Ferrule** - The part of the connector that aligns the fiber so that optical connections can be made.
- **Fiber** - A strand of glass used for the transmission of optical signals.
- **Grading** - The process used to identify the Zones on the fiber face and determine the size and number of contaminants, defects or scratches that are present.
- **In-situ** - The condition describing a connector attached or an integral part of a chassis or backplane while inspecting or cleaning.
- **IPA** - Isopropyl alcohol also known as propan-2ol.
- **Mating** - Securing of one connector to another.
- **MPO** - “Multi-path Push On” connector.
- **Pit** - Irregular shaped feature on the optical connector end-face (hole, bump or grain) caused by poor cleaning, improper polishing or handling processes. (Also see Defect)
- **PC Physical Contact** - Designed to eliminate connector loss caused by gaps between two fiber ends, physical contact polish (PC) was the first type available. Originally flat, PC ferrules were later slightly curved--a principle then applied to FC, SC, ST and D4 connectors--to optimize connection. The result: typical insertion loss values of 0.2 dB for single mode fibers and maximum return loss values of 35 dB.
- **Polish or Polished** - Fiber optic connectors are often polished after termination to remove surface defects and to improve optical qualities such as insertion loss and back reflection. PC and UPC connectors are polished flat (perpendicular to the length of the straight fiber), whereas APC connectors are polished on an 8 degree angle from the flat. In all of these cases, the ferrule end face adopts a dome-shaped geometry that yields good mating properties in the connector.
- **Scratch** - Permanent linear feature on the optical connector end-face caused by poor cleaning or by connector polishing processes.
- **SPC** - Was applied to FC and ST connectors, which provided return loss values of 40 dB while maintaining 0.2 dB insertion loss.
- **UPC Ultra Physical Contact** - Describes connectors that undergo extended polishing to render the fiber end face more suitable than an ordinary PC connector for optical contact with another fiber. UPC connectors, for example, exhibit better reflectance properties (< -55dB).
- **µm Micron or Micrometer** - A unit of length equal to one millionth of a meter or one thousandth of a millimeter.

One micron equals 0.00004 of an inch.

- **Warning** - Items designated in the text as a warning. This could include important information regarding potential hazards.

4. Inspection and Cleaning Flow

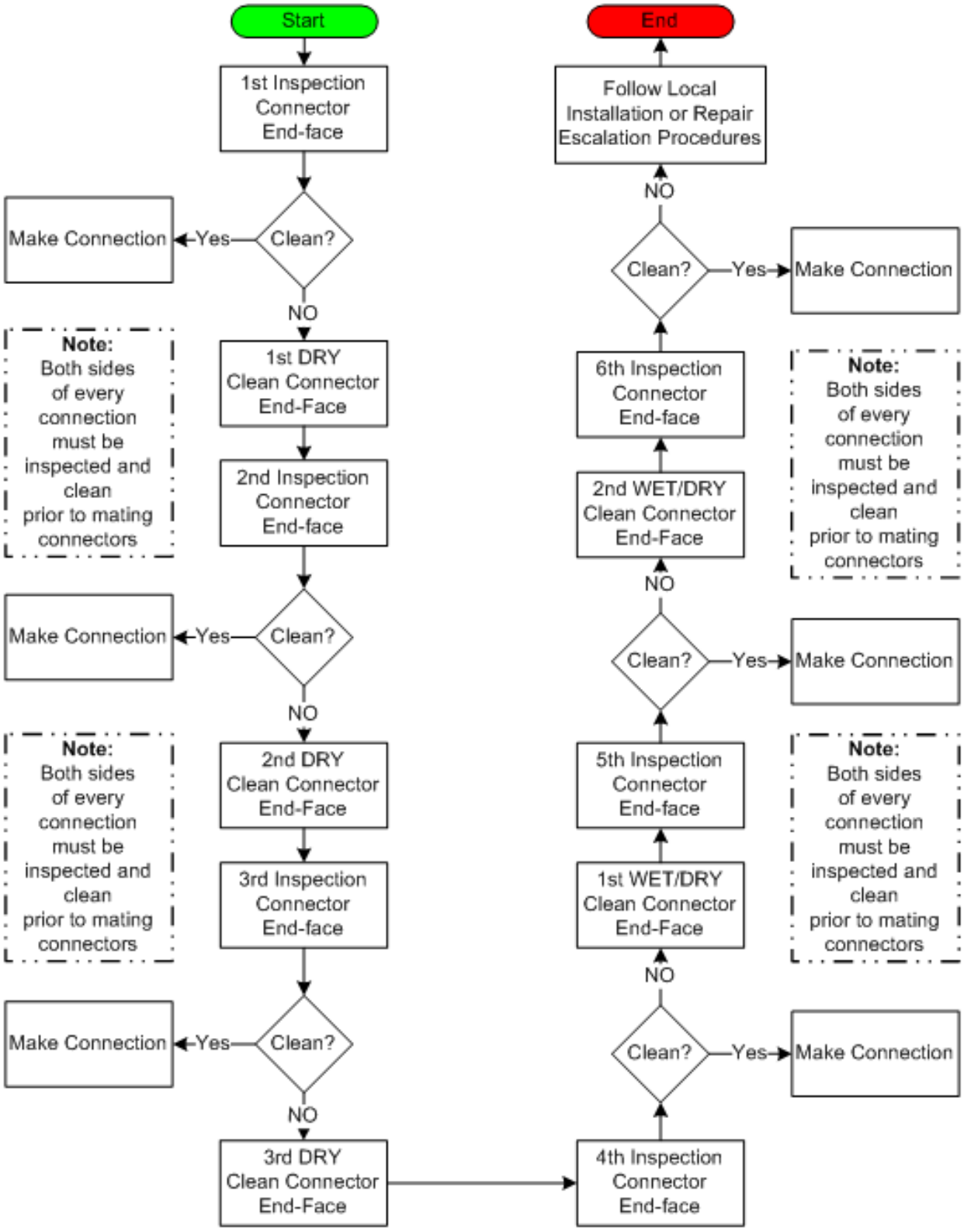
This section contains a Flow Chart that outlines the steps for Inspecting and Cleaning optical fiber connectors such as the LC, SC, MPO, and ST that are commonly used within AT&T for connections between optical equipment where jumpers are required (the preceding connector types listed are intended to be examples only and are not inclusive to all optical connector types found in AT&T's network). The Flow Chart is followed by a sub section that further explains each box in the Flow Chart.

CAUTION:
It is critical that all optical connectors, including test equipment, are cleaned to the standards set forth in this document before mating to maintain the integrity of ATT's optical network.

4.1. Inspection and Cleaning Flowchart

CAUTION:
Inspection must ALWAYS precede cleaning or mating of optical connectors to prevent damage or contamination of the connector.

Figure 1 - Inspection and Cleaning Flowchart



4.2. Expound on The Flow

We have a flow chart above to remind us of the appropriate steps, but what do they mean. Please read and understand the following before beginning Inspection and Cleaning activities.

4.2.1. Start

This is the beginning. The user is preparing to make an optical connection at a Network Element, Patch Panel, Fiber Distribution Frame, Test Set, or other connection point.

IMPORTANT:
All test set connectors, guides, adapters, fiber test cords or jumpers that could cause contamination, should be inspected and cleaned before you proceed. See Section Titled "Items To Be Cleaned"

4.2.2. First Inspection of Connector End Face

CAUTION:
Only Test Sets and Cleaning Supplies that are ATT Approved For Use Should be Used For These Procedures

NOTE:
Movable contaminants are never acceptable anywhere on the end face of a connector.

1. The user prepares the Inspection Scope for use and removes the protective cover from the fiber jumper or adapter and immediately places the cover in an ESD bag for storage.
2. Make the connection between the inspection scope and the optical connector and observe the condition of the fiber end face.

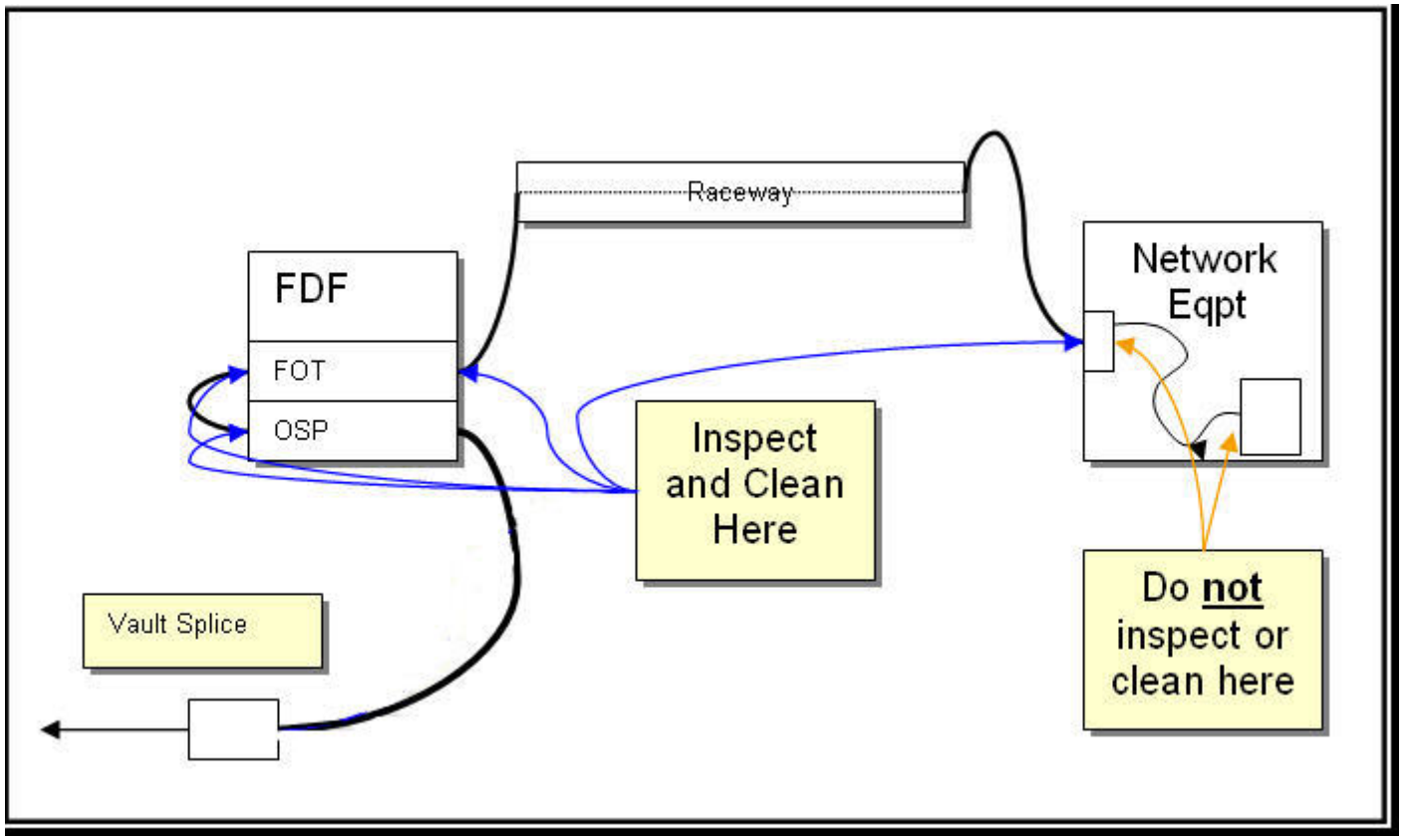
   A. If the end face is clean of visible contamination, defects, or scratches at 200x, this connector is ready for use.

   B. If the end face has any contamination, defects, or scratches make a mental picture of the end face, remove from scope and proceed to section titled "First Dry Clean".

4.2.3. What Should Be Cleaned

The rule of thumb is as follows: Always clean and inspect both the male and female connectors before mating the two together. Thus, it follows that any connection made outside of the manufacturer's sealed network equipment, wherever it is located, must have the mating pair cleaned and inspected. This includes connections within the Fiber Distribution Frame (FDF) or between the FDF and any Network Transport or Switch equipment. This would also include any transport or switch internal bay footprint connections. The example below shows where the connectors must be cleaned:

Figure 4:



Under normal circumstances, AT&T personnel and their authorized contractors do not need to open sealed network equipment to clean the connectors within the product (Refer to figure above “Do not inspect or clean here”). It is anticipated that all external connectors that are affixed to network equipment will require cleaning.

Once the connector has been cleaned, the connector may be left in one of the following states:

1. Terminate the connector on another clean mating connector.
2. Place a dust cap over the connector. The connector must be re-inspected to verify that the dust cap was not dirty.
3. Place a terminator that has also been cleaned on the cleaned connector. The connector must be re-inspected to verify that the terminator was not dirty when placed. Connectors that are not properly terminated through the use of a dust cap, terminator or not mated at the time of cleaning will require re-inspection and possible re-cleaning upon

subsequent termination at a later date and time.

4.2.4. First Dry Clean

1. Choose the appropriate Dry Clean product for the type connector being cleaned.
2. Follow the procedure for the Dry Clean product chosen to clean the connector end face and proceed to section titled “Second Inspection of Fiber End Face”.

4.2.5. Second Inspection of Fiber End Face

1. Make the connection between the inspection scope and the optical connector and observe the condition of the fiber end face.

    A. If the end face is clean of visible contamination, defects, or scratches at 200x, this connector is ready for use.

    B. If contamination, defects, or scratches are on the end face:

        A. If any of the remaining contaminants moved during the first cleaning attempt or you are unsure, go to “Second Dry Clean”.

        B. If all remaining contaminants stayed in place during first cleaning, the end face must be graded (See section titled “Grading The Fiber End Face ”) using criteria in section Optical Connector End Face Criteria

2. If the grading results:

    A. Show the connector is usable, this connector is ready for connection with another clean connector.

    B. Show the connector is unusable, go to section titled “Second Dry Clean”.

4.2.6. Second Dry Clean

1. Choose the appropriate Dry Clean product for the type connector being cleaned.
2. Follow the procedure for the Dry Clean product chosen to clean the connector end face and proceed to the section titled “Third Inspection of Fiber End Face”.

4.2.7. Third Inspection of Fiber End Face

1. Make the connection between the inspection scope and the optical connector and observe the condition of the fiber end face.

    A. If the end face is clean of visible contamination, defects, or scratches at 200x, this connector is ready for use.

    B. If contamination, defects, or scratches are on the end face:

        A. If any of the remaining contaminants moved during the first cleaning attempt or you are unsure, go to the section titled “Third Dry Clean”.

        B. If all remaining particles stayed in place during second cleaning, the end face must be graded (See section titled “Grading The Fiber End Face ”) using criteria in section Optical Connector End Face Criteria .

2. If the grading results:

    A. Show the connector is usable, this connector is ready for connection with another clean connector.

    B. Show the connector is unusable, go to the section titled “Third Dry Clean”.

4.2.8. Third Dry Clean

1. Choose the appropriate Dry Clean product for the type connector being cleaned.

2. Follow the procedure for the Dry Clean product chosen to clean the connector end face and then proceed to the section titled “Fourth Inspection of Fiber End Face”.

4.2.9. Fourth Inspection of Fiber End Face

1. Make the connection between the inspection scope and the optical connector and observe the condition of the fiber end face.

    A. If the end face is clean of visible contamination, defects, or scratches at 200x this connector is ready for use.

    B. If contamination, defects, or scratches are on the end face:

        A. If any of the remaining contamination, defects, or scratches moved during the cleaning attempt or you are unsure, go to the section titled “First Wet Clean”.

        B. If all of the remaining particles stayed in place during the third cleaning, the end face must be graded (See section titled “Grading The Fiber End Face ”) using criteria in section Optical Connector End Face Criteria .

2. If the grading results:

    A. Show the connector is usable, this connector is ready for connection with another clean connector.

    B. Show the connector is unusable, go to the section titled “First Wet Clean”.

4.2.10. First Wet Clean

1. Choose the appropriate Wet Clean and Dry Clean product for the type connector being cleaned.

2. Follow the procedure for the Wet Clean product chosen followed immediately by Dry Clean product to clean connector end face and proceed to section titled “Fifth Inspection of Fiber End Face”.

    NOTE: Wet Cleaning MUST always be immediately followed (before solvent dries on end face) by the appropriate

Dry Clean.

4.2.11. Fifth Inspection of Fiber End Face

1. Make the connection between the inspection scope and the optical connector and observe the condition of the fiber end face.

   A. If the end face is clean of visible contamination, defects, or scratches at 200x, this connector is ready for use.

   B. If contamination, defects, or scratches are on the end face:

      A. If any of the remaining contaminants moved during the cleaning attempt or you are unsure, go to the section titled “Second Wet Clean”.

      B. If all remaining particles stayed in place during the First Wet Clean, the end face must be graded (See section titled “Grading The Fiber End Face ”) using criteria in the section titled Optical Connector End Face Criteria .

2. If the grading results:

   A. Show the connector is usable, this connector is ready for connection with another clean connector.

   B. Show the connector is unusable, go to the section titled “Second Wet Clean”.

4.2.12. Second Wet Clean

1. Choose the appropriate Wet Clean and Dry Clean product for the type connector being cleaned.
2. Follow procedure for the Wet Clean product chosen followed immediately by Dry Clean product to clean the connector end face and proceed to “Sixth Inspection of Fiber End Face”.

   NOTE: Wet Cleaning MUST always be immediately followed (before solvent dries on end face) by the appropriate Dry Clean.

4.2.13. Sixth Inspection of Fiber End Face

1. Make the connection between the inspection scope and the optical connector and observe the condition of the fiber end face.

   A. If the end face is clean of visible contamination, defects, or scratches at 200x, this connector is ready for use.

   B. If contamination, defects, or scratches are on the end face:

      A. If any of the remaining contaminants moved during the first cleaning attempt or you are unsure, follow the same local escalation procedures as with any other installation or maintenance problem.

         NOTE: No connections should be made with movable contamination present anywhere on the end face.

      B. If all remaining particles stayed in place during cleaning, the end face must be graded (See section titled “Grading The Fiber End Face”) using criteria in the section titled Optical Connector End Face Criteria .

2. If the grading results:

   A. Show the connector is usable, this connector is ready for connection with another clean connector.

   B. Show the connector is unusable, go to section titled follow the same local escalation procedures as with any other installation or maintenance problem.

5. Inspection Tools

CAUTION:
Inspection should ALWAYS precede cleaning or mating of optical connectors to prevent damage or contamination of the connectors.

IMPORTANT:
All Inspection Scopes contained in this document are Video type scopes or indirect image converters as defined by ATT-770-000-013 . This document does not support the use of any Non-video type or direct viewing Inspection Scope.

5.1. Quick Guide for Fiber Inspection Video Scopes

Table 2: Quick Guide for Fiber Inspection Video Scopes

Scope	Types of Connectors	Magnification	Male	Female
Westover Fiber Inspection Probe Kit MPO (FBP-ATT-1) ***	SC, LC, ST, MPO/ MPT (APC)	200x or 400x	X	X
Westover Fiber Inspection Kit (Non MPO) FBP-ATT-2 ***	SC, LC	200x or 400x	X	X
EXFO FOT-932X ***	SC	200x or 400x	X	X
EXFO FIP-S1 ***	SC	200x	X	X
Noyes VFS2 Video Fiber Scope *	SC, LC, ST, D4	250x	X	X
Noyes VS300 View Safe Inspection Scope **	ST, SC, FC, MPO (APC)	400x	X	N/A

***Other adapters available for this platform.**

****The Noyes VS300 View Safe Inspection Scope is limited to inspecting male connectors only. (**ATT currently requires both the male and female connectors to be inspected before mating**.)**

*** Connector types can be expanded by ordering from the list in section titled "Westover Fiber Inspection MPO Adapter Kit " or "Westover Fiber Inspection Individual Items "

WARNING:
Interconnecting APC with other connector types will result in poor test results and/or service interruption and can cause permanent damage to the connectors. Do not attempt to connect an APC connector to PC, UPC, or SPC connectors.

5.2. Westover Fiber Inspection Probe Kit MPO (FBP-ATT-1)

CAUTION:
Only ATT Approved For Use Test Sets and Cleaning Supplies Should be Used For These Procedures

ATT is deploying MPO (also known as MPT which is a registered trademark of USConec., Ltd.) fiber optic connector based equipment (Fujitsu FW7500, FW4500, Cisco ONS15454 MSTP, and OPTera Connect DX). MPO stands for Multi-fiber Push On connector designed for the MT ferrule. MPO connectors are used with single-mode and multi-mode fiber-optic cables. The MPO is a connector manufactured specifically for a multifiber ribbon cable. The MPO single-mode connectors have an angled ferrule allowing for minimal back reflection, where the multi-mode connector ferrule is commonly flat. The ribbon cable is flat and appropriately named due to its flat ribbon-like structure, which houses fibers side by side in a jacket. The MPO connector offers up to 12 times the density of standard connectors, providing significant space savings. A need exists to inspect this type of connector both in and out of the bulkhead. Based upon the recommendation of ATT Labs and the OSP Product Evaluation Staff, the Fiber Inspection Probe Kit MPO manufactured by Westover Scientific and supplied by EXFO America, Inc. is approved for use in ATT-TELCO-PAN-OUTSIDEPLANT-2006-0009 .

This scope will inspect male and female connectors:

- FPB-HD2-P2-V 3.5” Display with integrated Patch Cord Module and Visual Fault Locator
- Westover Fiber Inspection Probe 200/400 (FBP-FP5)
- Extra Battery Tray, Charger and Batteries
- 2.5 MM UNIVERSAL (SC, ST and other patch cords with 2.5 MM ferrule)
- 1.25 MM UNIVERSAL (LC and other patch cords with 1.25 MM ferrule)
- MPO/MPT Angled (for patch cord and in bulkhead or adapter)
- SC (In bulkhead or adapter)
- ST (In bulkhead or adapter)
- LC (In bulkhead or adapter)
- User Guide

ATT Inspection Kits_V3[1].0.ppt
You may download this file from the online version of this document.
Note: You must have the proper application in order to open the file.

Figure 6: FBP-ATT-1

Ordering Information Item is Non-Stock. Delivery interval: 30 Days

PID 310108329

Catalog Description: SET TEST FIBER INSPECTION PROBE KIT MPO

Narrative: Video Inspection Probe Kit is a portable, video microscope used to inspect MPO fiber optic terminations. See SBCPAN- OUTSIDEPLANT-2006-0009 for kit contents and general information.

5.3. Westover Fiber Inspection Kit (Non MPO) FBP-ATT-2

This kit does not include the adapters to inspect MPO which makes it a less expensive alternative to the Fiber Inspection Probe Kit MPO above, however it offers the flexibility to grow into the MPO world if necessary by ordering the Westover Fiber Inspection MPO Adapter Kit below. There are other adapters also available for this platform in the section below that is titled “Westover Fiber Inspection Individual Items.” The following figure shows the kit in the hard case and out of the case.

Figure 7: Westover Fiber Inspection Kit (Non MPO) FBP-ATT-2

- FPB-HD2-P2-V 3.5” Display with integrated Patch Cord Module and Visual Fault Locator
- Westover Fiber Inspection Probe 200/400 (FBP-FP5)
- FBPP-BAP1 Barrel Assembly
- FBPT-SC Bulkhead Tip for SC connectors
- FBPT-LC-L Bulkhead Tip for LC connector Long Reach
- FMAE-U12 Patch Cord Adapter Universal 1.25mm
- FMAE-U25 Patch Cord Adapter Universal 2.5mm
- FBPP-MK1 Mating Adapters (not shown in picture above)
- AC Power Adapter, Extra Battery Tray, Charger and Batteries, FBPP-HSC9 Hard Case

- Users Guide

  ATT Inspection Kits_V3[1].0.ppt
  You may download this file from the online version of this document.
  Note: You must have the proper application in order to open the file.

  Ordering Information Item is Non-Stock. Delivery interval: 14 Days

  PID 310124102

  Catalog Description: SET TEST FIBER INSPECTION KIT STANDARD

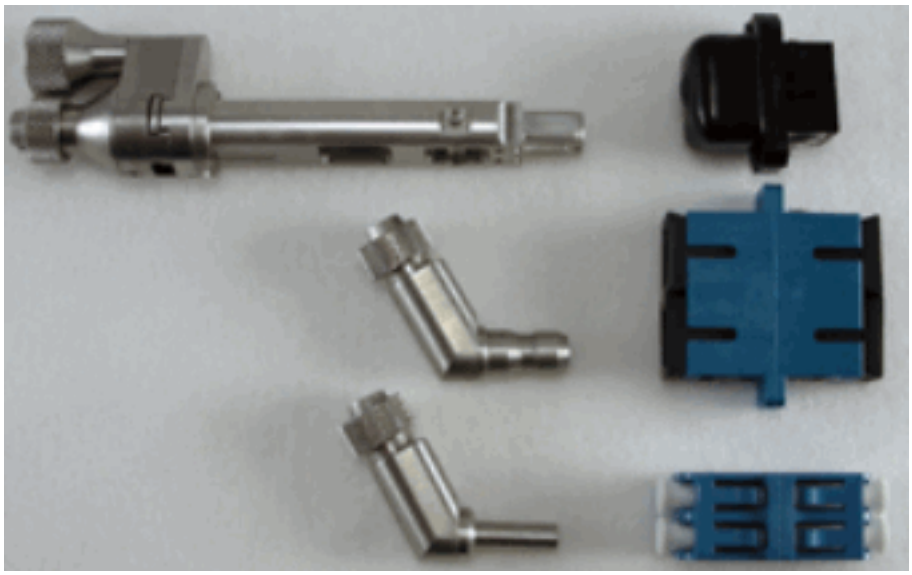
  Narrative: Video Inspection Probe Kit is a portable, video microscope used to inspect fiber optic terminations.

5.4. Westover Fiber Inspection MPO Adapter Kit

The kit listed in this section can be added to the Westover Fiber Inspection Kit (Non MPO), EXFO FOT-932X, or the FIP-S1 Fiber Inspection Probe 200X with Handheld Display to add the capability to inspect MPO connectors.

NOTE: If ordering this kit to supplement the Westover Fiber Inspection Kit (Non MPO) FBP-ATT-2, it is recommended to also order the FMAE-MTPA patch cord adapter from the “Westover Fiber Inspection Individual Items” section below. This adapter can not be used with the EXFO FOT-932X, or the FIP-S1 Fiber Inspection Probe 200X with Handheld Display.

Figure 8: Westover Fiber Inspection MPO Adapter Kit



Vendor Part #			Pid
FBPT-ATT-TK1	ROADM Tip Kit:		
	FBPT-MTPA-XL - Tip, MTP/MPO APC Bulkhead, Extra Long Reach		310124110
	FBPT-SC-A6 - Tip, SC Bulkhead, Angled 60 Degrees		
	FBPT-U12-A6 - Tip, Universal 1.25mm Bulkhead, Angled 60 Degrees		
	Mating Adapters - MTP, SC, LC (1 ea.)		
Delivery Interval is two weeks.			

5.5. Westover Fiber Inspection Individual Items

The individual items listed in the following table can be added to the Westover Fiber Inspection Probe Kit MPO (FBP-ATT-1), Westover Fiber Inspection Kit (Non MPO) (FBP_ATT-2), EXFO FOT-932X, or the FIP-S1 Fiber Inspection Probe 200X with Handheld Display to expand their inspection capabilities. See figures and more explanations on the following pages.

Vendor Part #	PID	Description	
FBP-P5	310124136	Set Test Dual Mag Probe Microscope (200x & 400x)	
FBP-HD2-P2-V	310124144	Set Test Display-HD2 w/P-cord Scope & VF Locator	
FBPT-MTPA-XL	310124151	Set Test Tip-MTP/MPO APC Blkhd Extra Long Reach	
FBPT-SC-A6	310124169	Set Test Tip-SC Bulkhead Angled 60 Degrees	
FBPT-U12-A6	310124177	Set Test Tip-1.25mm-Uni Blkhd Angled 60 Degree	
FBPT-SC-APC*	310124185	Set Test Tip SC-APC Bulkhead	
FBPT-LC-APC	310124193	Set Test Tip LC-APC Bulkhead	
FBPT-U25M*	310124201	Set Test Tip Universal 2.5mm Patch-cord	
FBPT-U25MA*	310124219	SET TEST Tip Universal 2.5mm APC Patch cord	
FBPT-U12M*	310124227	Set Test Tip Universal 1.25mm Patch cord	
FBPT-U12MA-SF*	310124235	Set Test Tip Universal 1.25mm APC Patch cord	
FMAE-U25	310124243	Set Test Adapter Universal 2.5mm Patch cord	
FMAE-U12	310124250	Set Test Adapter Universal 1.25mm Patch cord	
FMAE-MTPA	310124268	Set Test Adapter MTP/MPO APC Patch cord	
FBPP-BK1	310124276	Set Test Kit-Extra Batt Tray Charger w/12 Batts	
FBPT-ST*	310124284	Set Test Tip ST Bulkhead	
FBPT-ST-A6	310124292	Set Test Tip ST Bulkhead Angled 60 Degrees	
FBPT-LC*	310124300	Set Test Tip LC Bulkhead	
FBPT-LC-L	310124318	Set Test Tip LC Bulkhead Long Reach	
FBPT-SC*	310124326	Set Test Tip SC Bulkhead	
FBPP-BAP1	310129093	Barrel Assembly for Probe (Required for use with FBPT-ST, -LC, -SC, -SC-APC, -U25M, -U25MA, -U12M, -U12MA-SF)	
FBPP-HSC11	310124334	Set Test Large Hard Case	
FBPP-MK1	310124342	Set Test Mating Adapters - MTP SC LC (1 ea.)	
FBPP-BAP1 is required to between the FBP-P1 or FBP-P5 Probe Microscope and this Tip. Delivery Interval is two weeks.			

5.5.1. Westover FBP-P5 Dual Magnification Probe Microscope (200x & 400x)

This is the FBP-P5 Dual Magnification Probe Microscope (200x & 400x) that is included with the Westover Fiber Inspection Kit (MPO) FBP-ATT-1, Westover Fiber Inspection Kit (Non MPO) FBP-ATT-2, AND THE EXFO FOT-932X.

Figure 9: FBP-P5 Dual Magnification Probe Microscope (200x & 400x)

5.5.2. FBP-HD2-P2-V

This item is a 3.5" HD2 Display with Integrated Patch Cord Scope and Visual Fault Locator that also includes FMAE-U25 universal patch cord adapter. This is the same unit included in the FBP-ATT-1 and FBP-ATT-1 kits.

Figure 10: FBP-HD2-P2-V

5.5.3. Westover LC Tips and Adapters

The **FBPT-LC** is used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5) or Fiber Inspection Probe 200 (FBP-FP1) to inspect LC fiber end faces terminated in bulkheads.

The **FBPT-LC-L** is longer than FBPT-LC for reaching into tight spots and is used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5) or Fiber Inspection Probe 200 (FBP-FP1) to inspect LC fiber end faces terminated in bulkheads.

The **FBPT-U12-A6** is angled for reaching into tight spots and is also used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5)or Fiber Inspection Probe 200 (FBP-FP1) to inspect 1.25mm fiber end faces terminated in bulkheads.

Note: These tips can be used with LC Mating adapter seen in section titled “Westover Mating Adapters - MTP, SC, LC” to inspect patch cords at 200x or 400x. Both ends of a patch cord can be inspected and left in place for protection in the Mating Adapter when clean while inspecting and cleaning bulk head adapters.

Figure 11: Westover LC Tips and Adapters

5.5.4. Westover SC Tips and Adapters

The **FBPT-SC** is used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5) or Fiber Inspection Probe 200 (FBP-FP1) to inspect SC fiber end faces terminated in bulkheads.

The **FBPT-SC-A6** is angled for reaching into tight spots and is also used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5)or Fiber Inspection Probe 200 (FBP-FP1) to inspect SC fiber end faces terminated in bulkheads.

Note: These tips can be used with SC Mating adapter seen in section titled “Westover Mating Adapters - MTP, SC, LC” to inspect patch cords at 200x or 400x. Both ends of a patch cord can be inspected and left in place for protection in the Mating Adapter when clean while inspecting and cleaning bulk head adapters.

Figure 12: Westover SC Tips and Adapters

5.5.5. Westover ST Tips and Adapters

The **FBPT-ST** is used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5) or Fiber Inspection Probe 200 (FBP-FP1) to inspect ST fiber end faces terminated in bulkheads.

The **FBPT-ST-A6** is angled for reaching into tight spots and is also used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5)or Fiber Inspection Probe 200 (FBP-FP1) to inspect ST fiber end faces terminated in bulkheads.

Figure 13: Westover ST Tips and Adapters

5.5.6. Westover Universal Patch Cord Tips

The **FBPT-U25M** is used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5) or Fiber Inspection Probe 200 (FBP-FP1) to inspect 2.5 patch cord connectors such as ST or SC.

The **FBPT-U12M** is used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5) or Fiber Inspection Probe 200 (FBP-FP1) to inspect 1.25 patch cord connectors such as LC.

NOTE: No mating adapter is required to inspect patch cord connectors when using these tips at 200x or 400x, however these tips can not be used to inspect in bulkheads.

Figure 14: Westover Universal Patch Cord Tips

5.5.7. FBPP-BAP1 Barrel Assembly for Probe

FBPP-BAP1 Barrel Assembly for Probe Microscope FBP-P1 or FBP-P5 is required for use with Probe Tips FBPT-ST, -LC, -SC, -SC-APC, -U25M, -U25MA, -U12M, and -U12MA-SF. The Barrel Assembly is placed between the Probe Microscope and the Probe Tip as shown in Figure “FBPP-BAP1 Barrel Assembly Installation” below. Only one Barrel Assembly is required for each Probe Microscope.

Figure 15: FBPP-BAP1 Barrel Assembly

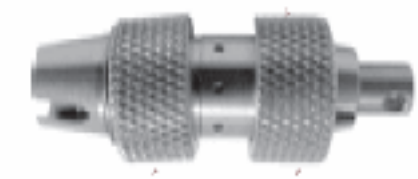
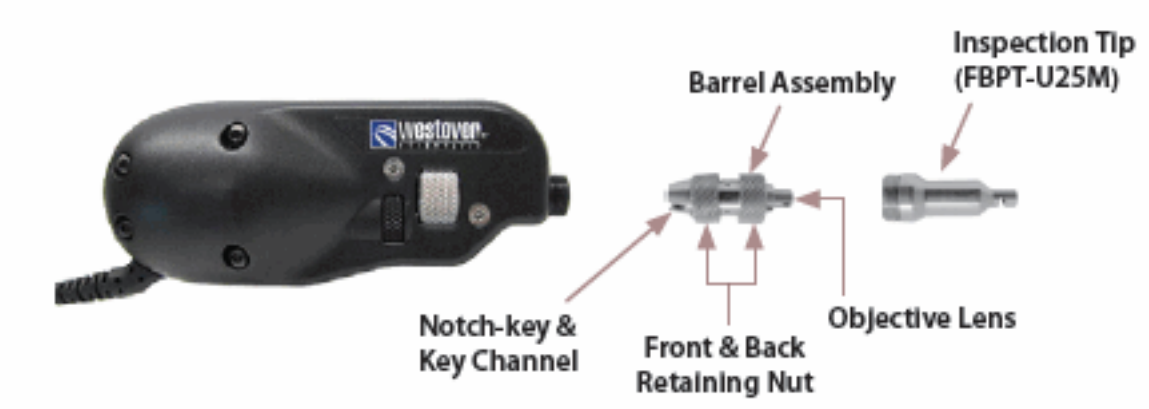


Figure 16: FBPP-BAP1 Barrel Assembly Installation



5.5.8. Westover Universal Patch Cord Adapters for Patch Cord Module

The **FMAE-U25** is used with the Patch Cord Module in either the FBP-ATT-1 or FBP-ATT-2 kits to inspect 2.5mm patch cord connectors such as SC or ST.

The **FMAE-U12** is used with the Patch Cord Module in either the FBP-ATT-1 or FBP-ATT-2 kits to inspect 1.25mm patch cord connectors such as LC.

NOTE: First, Inspect patch cord, clean if needed, and reinspect. When patch cord is clean, leave it in place for protection and proceed to inspect the bulkhead connector. When the bulkhead connector is clean it is time to make the connection.

Figure 17: Westover Universal Patch Cord Adapters for Patch Cord Module

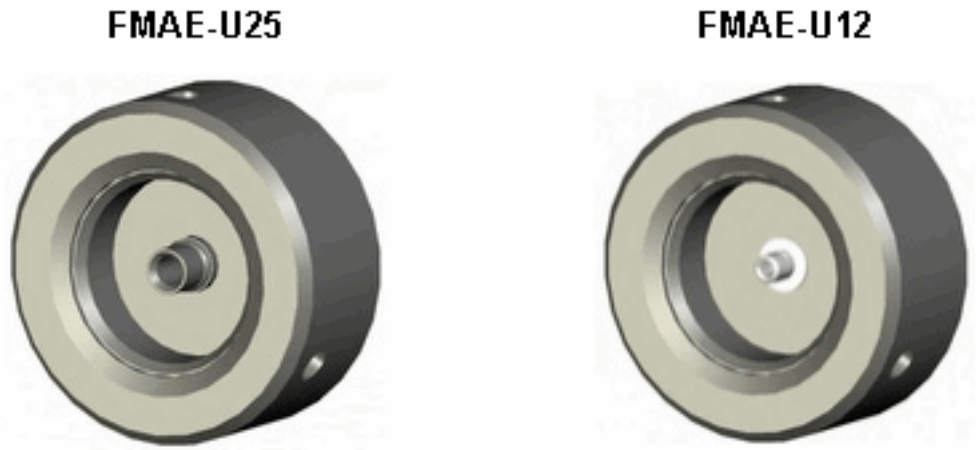


Figure 18: FMAE-U12 on Patch Cord Module

5.5.9. Westover MPO APC Tips and Adapters

The **FMAE-MTPA** is used with the Patch Cord Module in either the FBP-ATT-1 or FBP-ATT-2 kits to inspect MPO patch cord connectors.

The **FBPT-MTPA-XL** is used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5) or Fiber Inspection Probe 200 (FBP-FP1) to inspect MPO patch cord connectors.

Note: The FBPT-MTPA-XL Can be used with MPO Mating adapter seen in section titled “Westover Mating Adapters - MTP, SC, LC” to inspect patch cords at 200x or 400x. One end of a patch cord can be inspected and left in place for protection in the Mating Adapter when clean while inspecting and cleaning bulk head adapter.

Figure 19: Westover MPO Tips and Adapters

The following example shows an MPO connector with a green shell, others may have a green boot, others may not have any green, however you can see the angled end surface.

Figure 20: MPO Connector Example

5.5.10. Westover Replacement Batteries, Charger, and Battery Tray

This item consists of 12 Rechargeable AA Batteries, a 4 Battery Charger, and a Battery Tray for the Westover FBP-HD2-P2-V found in the FBP-ATT-1 and FBP-ATT-2 kits.

Figure 21: Batteries, Charger, and Battery Tray

5.5.11. Westover Mating Adapters - MTP, SC, LC

The FBPP-MK1 Mating Adapters set consists of the three adapters shown below that are used to place the appropriate patch cord/s in one side and the corresponding Bulkhead tip on the other side for inspection of patch cord connectors.

NOTE: These adapters can be used with the tips listed in sections titled “Westover LC Tips and Adapters”, “Westover SC Tips and Adapters”, and “Westover MPO APC Tips and Adapters” to inspect patch cords.

Figure 22: Westover Mating Adapters

Figure 23: Testing SC Patchcord @ 400x

5.5.12. Westover APC Tips and Adapters

CAUTION:
The following four parts MUST NOT be used with non-APC type connectors. Most APC connectors will have green shell or boot as an indicator.

The **FBPT-LC-APC** is used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5) or Fiber Inspection Probe 200 (FBP-FP1) to inspect the LC-APC patch cord connectors.

The **FBPT-SC-APC** is used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5) or Fiber Inspection Probe 200 (FBP-FP1) to inspect the SC-APC patch cord connectors.

The **FBPT-U12-MA-SF** is used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5) or Fiber Inspection Probe 200 (FBP-FP1) to inspect the 1.25mm APC patch cord connectors in a bulkhead.

The **FBPT-U25-MA-SF** is used with the Westover Fiber Inspection Probe 200/400 (FBP-FP5) or Fiber Inspection Probe 200 (FBP-FP1) to inspect the 2.5mm APC patch cord connectors in a bulkhead.

Figure 24: Westover APC Tips and Adapters

The following graphic is used to illustrate the green shell and boot. Some will have both as shown below others may have only the shell or boot in green.

Figure 25: APC Connector

5.5.13. Large Hard Case

The FBPP-HSC11 Large Hard Case is used to store and protect the various Westover components.

Figure 26: Westover Large Hard Case

5.6. EXFO FOT-932X

This unit comes as a part of CENTRAL OFFICE TESTSET KIT B. See PAN ATT-TELCO-PAN-2004-3481 section titled “Ordering Information”. This kit is not currently capable of inspecting MPO connectors, however this ability can be added by ordering the Westover Fiber Inspection MPO Adapter Kit or individual pieces in the section titled “Westover Fiber Inspection Individual Items” above.

This EXFO FOT-932X kit contains the following pieces:

- ONE FOT-932X-VFL-FP5-EI-EUI-91-SBC AUTOMATED OLTS/ORL TEST UNIT, 1310/1550 NM, 650 NM VFL, 42 CALIBRATED WAVELENGTHS, VGA COLOR NEXT-GENERATION TRANSFLECTIVE TFT SCREEN in SOFT CASE
- (FIP (SAP# 1041989) Includes : The AT&T kit FP5-SBC :
    - FBP-P5: Video Inspection Probe 400x/200x (FIP-P5)
    - FBPT-SC: SC Tip for bulkhead adapters (FIPT-SC)
    - FBPT-U25M: Universal Tip for 2,5 mm ferrules (FIPT-U25M)
    - FBPP-BAP1: Barrel Assembly
    - ZP-FBP-0842: WESTOVER user guide manual
- ONE LFD-201 LIVE FIBER INDENTIFIER

Figure 27: EXFO 932X with Inspection Probe

Item 3 in Figure titled “Tips and Barrel Assembly for C.O. Kit B” is the barrel assembly that must be attached to the Probe and then the Tips are attached to the Barrel Assembly as seen below.

Figure 28: Installing Barrel Assembly and Tips

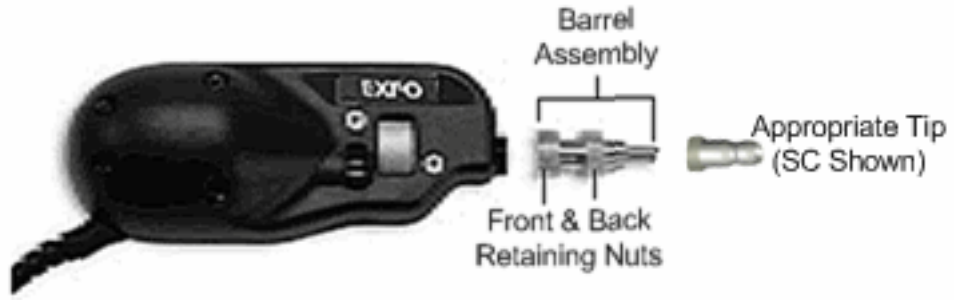
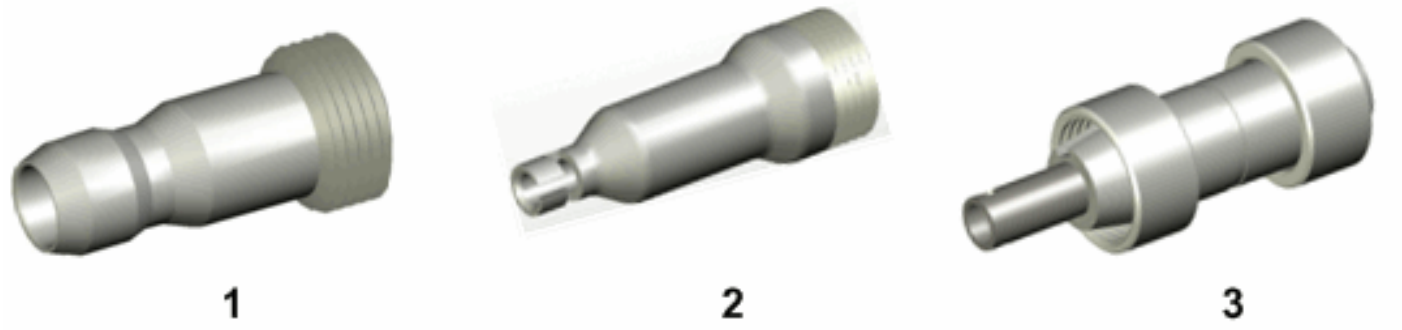


Figure 29: Tips and Barrel Assembly for C.O. Kit B



1. SC Bulkhead Tip
2. 2.5 mm Universal Patch Cord Tip
3. Barrel Assembly (Required for either Tip)

Ordering Information Item is Non-Stock. Delivery interval:

PID : 301148193

Catalog Description: TEST SET INCLUDES; OLTS/ORL/SCOPE, LFD

Narrative: ONE ALL-IN-ONE FOT-932X-VFL-FP5-EA-EUI-91-SBC AUTOMATED OLTS/ORL TEST UNIT, 1310/1550 NM, 650 NM VFL, 200X/400X VIDEO FIBER INSPECTING FIBER ENDS, 42 CALIBRATED WAVELENGTHS, 1/4 V, FOA-98LC ADAPTER.

5.7. FIP-S1 Fiber Inspection Probe 200X with Handheld Display

This unit comes as a part of Central Office Testset Kit A. See PAN ATT-TELCO-PAN-2004-3481 section titled "Ordering Information". This kit is not currently capable of inspecting MPO connectors, however this ability can be added by ordering the Westover Fiber Inspection MPO Adapter Kit or individual pieces in the section titled "Westover Fiber Inspection Individual Items" above.

The complete FIP-S1 Fiber Inspection Probe 200X with Handheld Display kit consists of:

- One LFD-201 Live Fiber Identifier
- One FLS-241-UNIV Visual Fault Locator
- One FIP-S1 Fiber Inspection Probe 200X (Handheld Display Fiber Inspection Probe 200 (FBP-FP1))
    - FBP-P1 (SAP # 1041988) Video inspection probe 200X (FIP-P1)
    - FBP-HD1 Hand Held video display (FIP-HD1)
    - FBPT-SC SC Tip for bulkhead adapters (FIPT-SC)
    - FBPT-U25M Universal Tip for 2.5 mm ferrules (FIPT-U25M)
    - FBPP-BAP1 Barrel Assembly
    - ZP-FBP-0842: WESTOVER user guide manual
    - Power supply for Hand Held video display
- Special rigid case (with cut/off foams for FLS-241 & LFD-201-SBC)

Figure 30: Probe and Handheld Video Display

Item 3 in Figure titled “Tips and Barrel Assembly for C.O. Kit A” is the barrel assembly that must be attached to the Probe and then the Tips are attached to the Barrel Assembly as seen below.

Figure 31: Installing Barrel Assembly and Tips

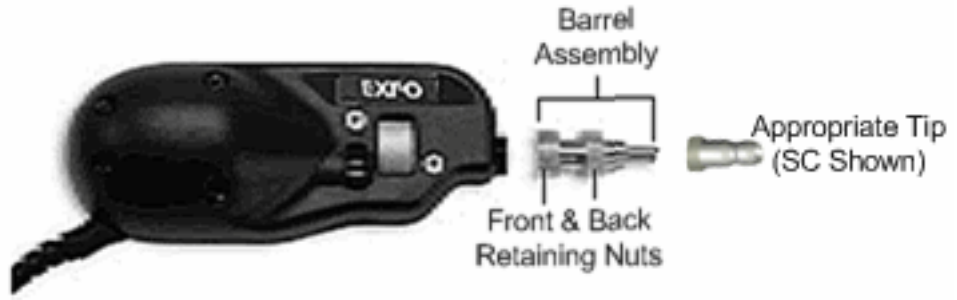
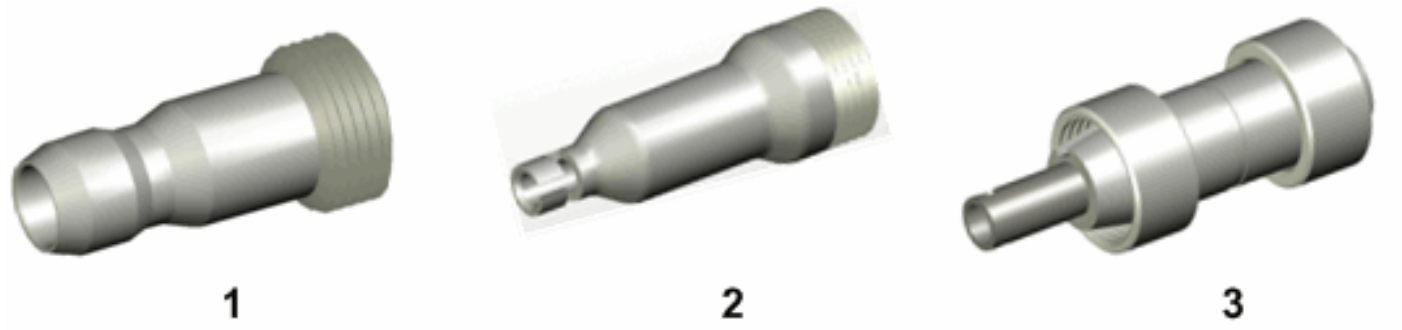


Figure 32: Tips and Barrel Assembly for C.O. Kit A



1. SC Bulkhead Tip
2. 2.5 mm Universal Patch Cord Tip
3. Barrel Assembly (Required for either Tip)

Ordering Information Item is Non-Stock.

PID : 301148185

Catalog Description: TEST SET INCLUDES; LFD, VFL, VIDEO SCOPE

Narrative: ONE LFD-201 LIVE FIBER IDENTIFIER; ONE FLS-241-UNIV VISUAL FAULT LOCATOR; ONE FIP-S1 FIBER INSPECTION PROBE 200X WITH HANDHELD DISPLAY; ONE RIGID CARRYING CASE.

5.8. Noyes VFS2 Video Fiber Scope

The Westover Fiber Inspection Kit (Non MPO) FBP-ATT-2 can be purchased for very little more than this unit and can be grown as needed to include connectors that the VFS2 can not handle.

The VFS2 is a small versatile video fiber scope that is approved for use via ATT-TELCO-PAN-2003-3248 The unique "optical-knuckle" allows the user orient the probe head in virtually any direction which allows the user to view connectors that may be located in tight or difficult locations. The VFS2 resolves or identifies .75 micron scratches and the precision adapter tips available for the VFS2 put the fiber in the viewing area right away. These tips ensure the optics will view into the alignment sleeve, thereby simplifying centering the fiber.

This VIDEO FIBER SCOPE allows the user to view male and female connector end faces. The Kit includes a carrying case, VFS2 Probe, 3.5 INCH VFS2 Display, AC adapter/charger, and the following Adapter Tips:

- 2.5 MM UNIVERSAL
- FC
- SC
- ST
- D4
- LC

Figure 33: Noyes VFS2

Ordering Information Item is Non-Stock. Delivery interval: 28 Days

DESCRIPTION - SET TEST, SCOPE, VIDEO FIBER OPTIC VFS2

NARRATIVE VIDEO FIBER SCOPE THAT ALLOWS THE USER TO VIEW CONNECTOR ENDFACES. KIT INCLUDES CARRYING CASE, VFS2 PROBE, 3.5 INCH VFS2 DISPLAY, AC adapter/CHARGER, AND THE FOLLOWING ADAPTER TIPS: 2.5 MM UNIVERSAL, FC, SC, ST, D4, AND LC. 2 YR WARRANTY

PID - 301108528

5.9. Noyes VS300 View Safe Inspection Scope

The VS300 is limited to inspecting jumpers which does not fill the AT&T requirement to inspect both sides of the connection. The **Westover Scientific** Fiber Inspection Probe Kits are available for inspecting jumpers and adapter housings.

The VS300 is approved for use by Product Announcement

The VS300 has the following functionality:

- No optical path to the user's eye.
- NTSC video output.
- A molded easy grip case with easy access battery compartment.

Figure 34: Noyes VS300

The magnification of the unit is equivalent to 400x. The unit has an energy saving automatic shutoff.

Ordering Information Item is Non-Stock. Delivery interval: 28 Days

DESCRIPTION - SET TEST SCOPE FIBER OPTIC INSPECTION VS300

NARRATIVE - Microscope, fiber optic inspection. 400X power, inspects fiber optic end faces. Includes ST, SC, FC. Soft case. Accepts same adapters as SET TEST OPTICAL POWER METER (PID 301001269).

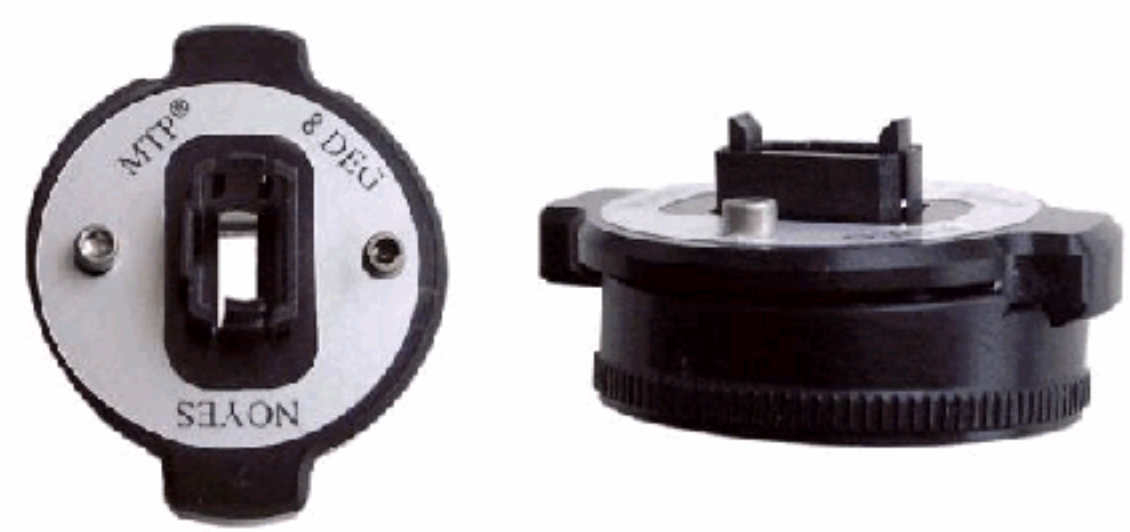
PID - 301056362

5.9.1. Noyes MPO Patchcord Adapter

The Noyes MPO Patchcord Adapter shown in Figure 35 “Noyes MPO Patchcord Adapter” for use with the Noyes VS300 shown in Figure “VS300”. This adapter allows users to inspect MPO patch cord connectors with an existing Noyes VS300 inspection scope.

NOTE: The VS300 can not be used to inspect MPO Bulkhead Adapters.

Figure 35: Noyes MPO Patchcord Adapter



PID 310113840

Catalog Description: ADAPTER CAP MPO/MPT 8 DEGREE

Narrative: This is a an adapter cap for use with Noyes Fiber Systems VS300 View Safe Inspection Scope. This adapter cap allow the user to inspect all of the fiber end faces on an MPO/MPT Multi-Fiber 8 DEG. Connector.

6. Cleaning Products

CAUTION:
Inspection should ALWAYS precede cleaning or mating of optical connectors to prevent damage or contamination of the connector.

This section contains a table named “Quick Guide For Cleaning Tools” that shows some high level information to help select the correct cleaning tool for your application. This section also includes complete descriptions of each cleaning tool approved for use in AT&T and the instructions for using that tool.

Things to remember when choosing tools for cleaning:

- You must clean both male and female, some tools do both.
- Cleaner Fiber Wipe Premoistened should be kept available.
- In-Situ Cleaners are handy for cleaning in and around adapters.

6.1. Quick Guide For Cleaning Tools

Table 5: Quick Guide For Cleaning Tools

Name	Connector Type/s	Male	Female	Dry	Wet	
Cleaner Fiber Optic MPO Male and Female	MPO/MPT	X	X	X	X	
Ferrule Mate 2.5mm (SC, SCAPC, FC, ST) Male and Female	2.5mm (SC, SCAPC, FC, ST)	X	X	X	X	
Ferrule Mate 1.25mm (LC, MU) Male and Female	1.25mm (LC, MU)	X	X	X	X	
Alcoa FCC-02R Fiber Optic Connector Cleaner (Cletop Type)	SC, D4, FC, LC, and ST	X		X		
Cleaner, Fiber Optic Connect-or Universal	ST, SC, FC, LC, or D4. MT-RJ, MPO, or MTP	X		X		
FiberSwiper	SC, D4, FC, LC, and ST, SCAPC	X		X		
IN-situ Connector Cleaner SC (Swab)	2.5mm (SC, SCAPC, FC, ST)		X	X	X	
In-Situ Connector Cleaner LC (Swab)	1.25mm (LC, MU)		X	X	X	
Cleaner Fiber Wipe Premoistened	ST, SC, FC, LC, or D4. MT-RJ, MPO, or MTP	X			X	
Bottled Alcohol	Not Recommended for the procedures in this document. Procedures are provided to use Cleaner Fiber Wipe Premoistened in place of Alcohol.					

NOTE: AT&T prefers to use the Dry Clean process for fiber cleaning, however “Cleaner Fiber Wipe Premoistened” is approved for use when at least 3 dry cleaning attempts have failed to produce acceptable results when inspection procedures are performed. Wet cleaning must always be followed immediately by dry cleaning before the liquid has an opportunity to dry.

6.2. Dry Cleaning Products and Instructions for Use

CAUTION:
Only ATT Approved For Use Test Sets and Cleaning Supplies Should be Used For These Procedures

Dry Cleaning is the AT&T preferred method of cleaning fiber end faces when inspection reveals the necessity for cleaning.

NOTE: Inspection of connectors must be performed before and after cleaning.

6.2.1. Storing Dry Cleaning Products

All optical cleaning products should be kept in a clean and dry environment protected from temperature extremes. It is recommended that all cleaning products be kept in air and moisture tight bags until just before use. Keep alcohol products and dry products stored in separate bags to avoid cross contamination in the event of alcohol leakage. If electrostatic protective, air, and moisture tight bags are available they should work very well. An antistatic bag should always be available to store protective connector caps for future use.

CAUTION:
Do not leave any of these products in direct sunlight such as the dash or seat of a vehicle. Damage can occur to these tools.

6.2.2. Cleaner Fiber Optic MPO

The MPO Cleaner is primarily a dry cloth cleaning tool designed for cleaning the ferrule end faces of MPO multi-fiber connectors that are In-situ or contained within adapters and optical transceivers or fiber jumpers. This tool effectively cleans all fibers at once without the use of alcohol in most cases and is capable of cleaning MPO ferrules with or without guide pins. Procedures are also provided in this document to use the MPO fiber cleaner with alcohol . The PAN for this product can be found at ATT-TELCO-PAN-OUTSIDEPLANT-2005-0031

Figure 37: MPO Cleaner

Ordering Information Item is Non-Stock. Delivery interval is 20 Days

DESCRIPTION - CLEANER FIBER OPTIC MPO

OF Wipes 500

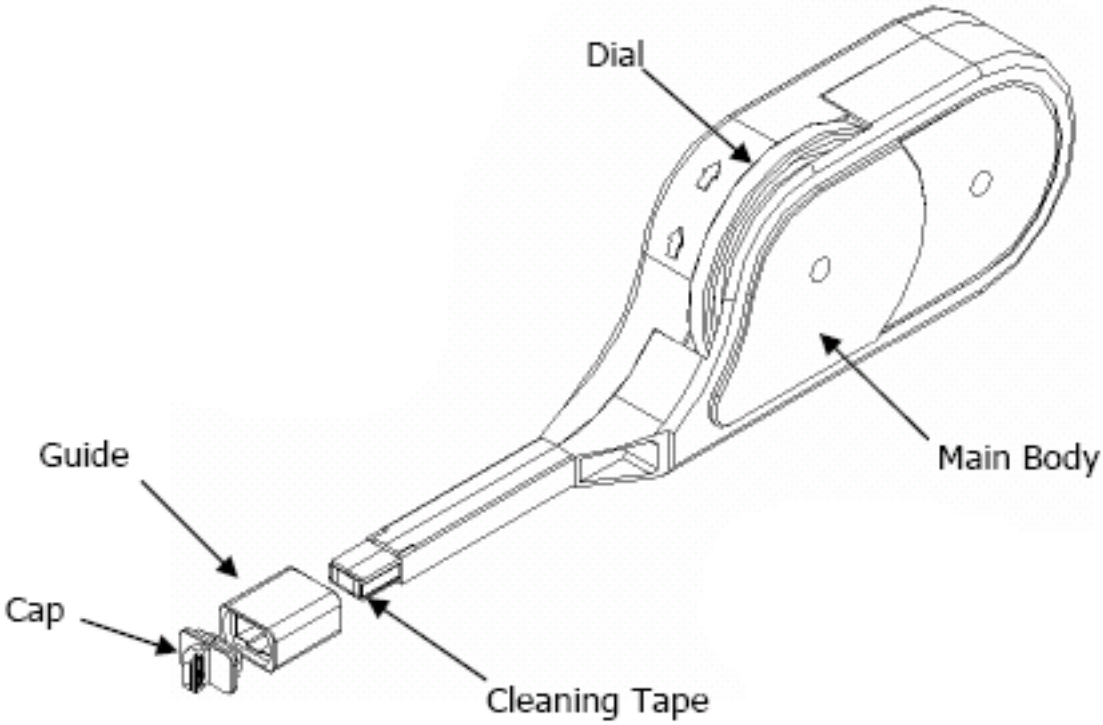
NARRATIVE - AN MPO Cleaner Device designed for cleaning the ferrule end faces of MPO connectors. This device cleans all 12 fibers at once. Capable of cleaning ferrules with or without guide pins.

PID - 310095690

6.2.2.1. User Instructions for CLEANER FIBER OPTIC MPO

It is essential to be familiar with the parts of the cleaner before attempting to use the cleaner. The following illustration labels the parts that are important.

Figure 38: MPO Cleaner Parts



- **Dial** - A toothed thumb wheel to advance the Cleaning Tape. All of the small teeth produce a quiet click as the wheel is turned but the larger teeth produce a louder click that signals the end of a cleaning cycle.

  NOTE: Do not attempt to move the Dial in the opposite direction as this will damage the tool.

- **Main Body** - The body of the unit that is grasped by the user during cleaning.

- **Cleaning Tape** - The Cleaning Tape is pressed against the connector to be cleaned and advanced by turning the Dial.

- **Cap** - The Cap is used during storage of the MOP Cleaner.

- **Guide** - The Guide is removed when cleaning adapters or put in place over the Cleaning Tape for cleaning jumpers or storage.

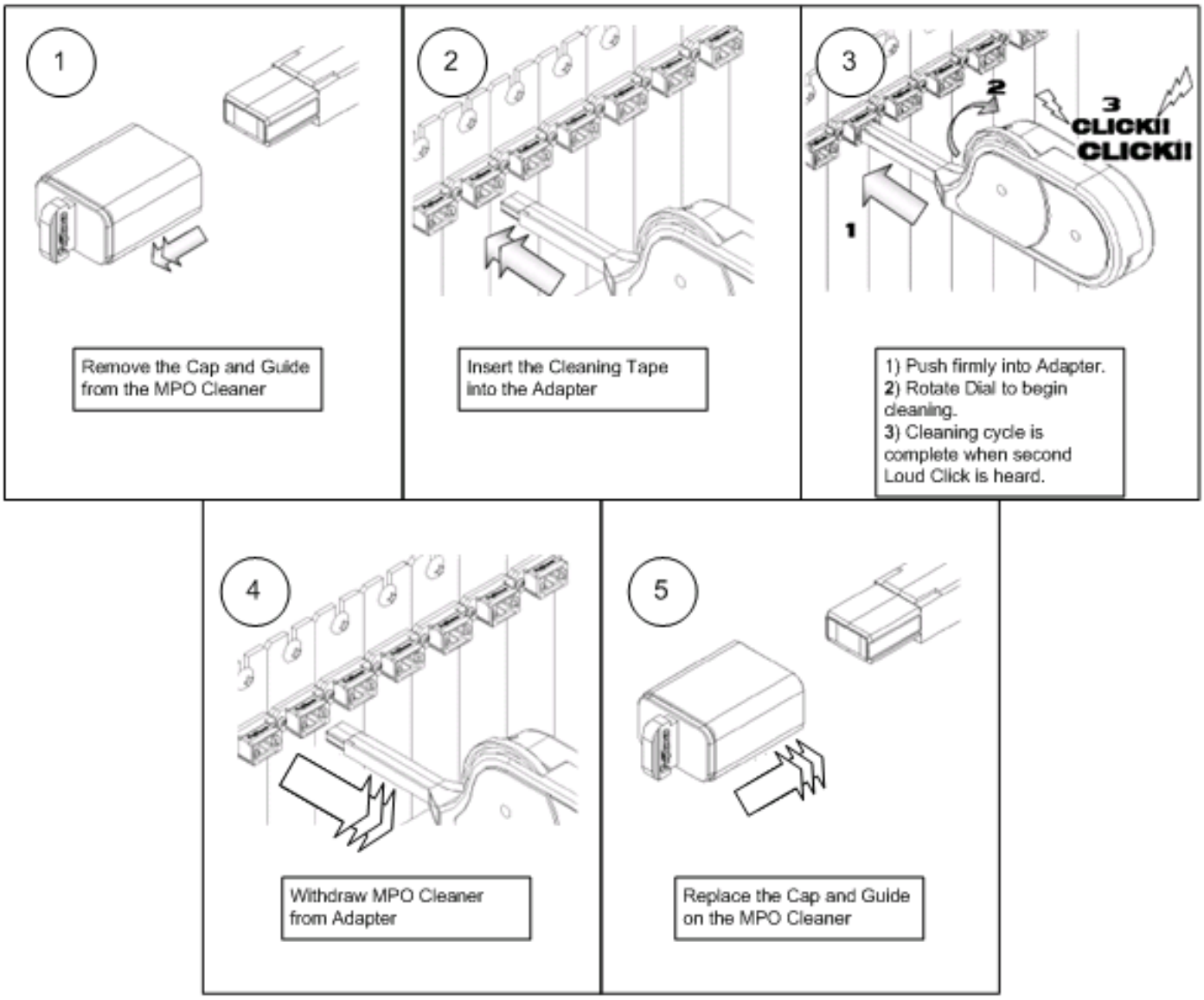
6.2.2.1.1. Cleaning In Adapters with the CLEANER FIBER OPTIC MPO

This procedure is for Dry Cleaning an MPO connector, procedures are provided for the Wet followed by Dry clean at Wet Cleaning an MPO Connector with MPO Cleaner .

NOTE: Inspection of connector must be performed before and after cleaning.

Note: Place all protective caps removed from adapters into a clean anti-static bag.

Figure 39: Clean Connector in Adapter



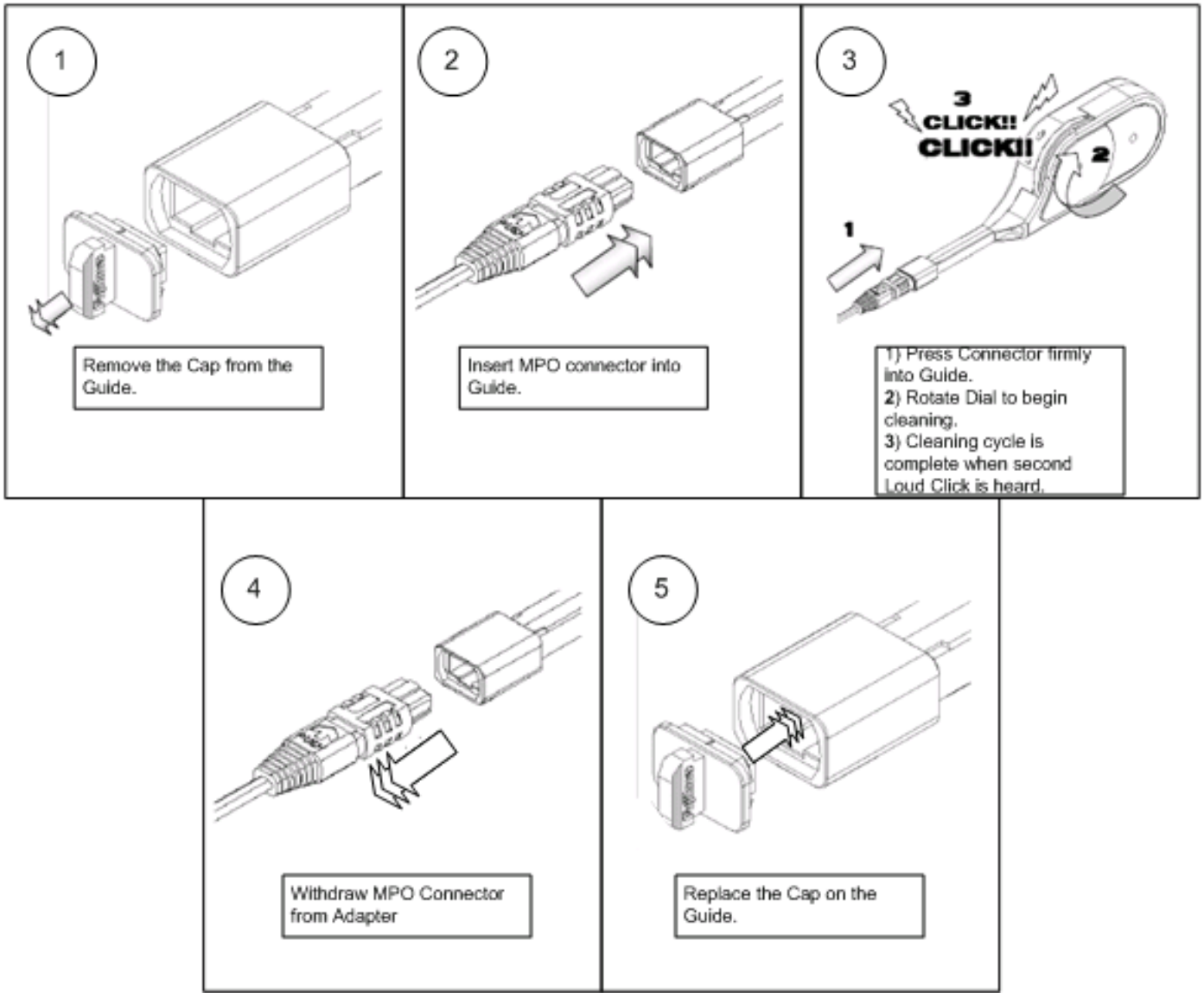
6.2.2.1.2. Cleaning MPO Jumpers with the CLEANER FIBER OPTIC MPO

This procedure is for Dry Cleaning an MPO connector, procedures are provided for the Wet followed by Dry clean at Wet Cleaning an MPO Connector with MPO Cleaner .

NOTE: Inspection of connector must be performed before and after cleaning.

Note: Place all protective caps removed from adapters into a clean anti-static bag for storage.

Figure 40: Clean Connector of MPO Jumper



6.2.3. Ferrule Mate 2.5mm (SC, SCAPC, FC, ST) Male and Female

This disposable cleaning device is for cleaning any 2.5 mm PC or APC connectors. With the simple push of the button, the tool uses a twisting motion to break loose any dirt that has accumulated on the fiber face, and then a sweeps it away when the cleaning tape advances. This process is more effective than cleaning swabs, or sticks, and it leaves no residue. This technology is effective for cleaning connectors that are plugged into the backside of a panel or on the inside of an enclosure. In addition to this unique ability, the Ferrule Mate's dust cap also has a flip-open end for inserting any ferrule or connector for cleaning. The Ferrule-Mate can be used for Dry or Wet cleaning. The Wet Cleaning Procedure can be found in Section " Wet Cleaning an SC Connector with the Ferrule-Mate SFM-250 ".

Figure 41: Ferrule Mate 2.5mm

Ordering Information Item is Non-Stock.

DESCRIPTION - Ferrule Mate SFM-250

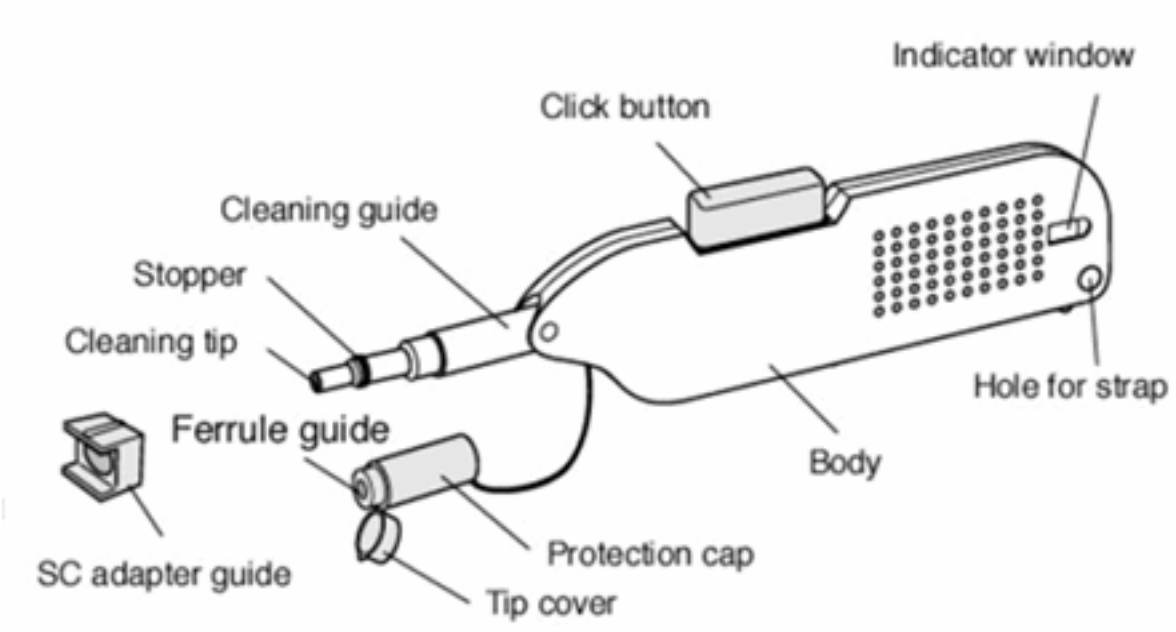
OF Wipes 350

NARRATIVE - Fiber optic cleaning tool suitable for cleaning SC/FC/ST Connectors.

PID: 310111984

6.2.3.1. User Parts Key for Ferrule-Mate SFM-250 Fiber Optic Connector Cleaner

Figure 42: Parts Key for Ferrule-Mate SFM-250



In some cases the Cleaning Cloth on the Ferrule-Mate can become misaligned or fall off of the tip. Simply grasp the Body of the Ferrule-Mate in one hand and the Cleaning Tip in the other. Push the Cleaning Tip and Stopper toward the Body as far as it will go and then return the Cleaning Tip and Stopper to their original positions. Verify the Cleaning Cloth has been realigned across the end.

Figure 43: Realign Ferrule Mate

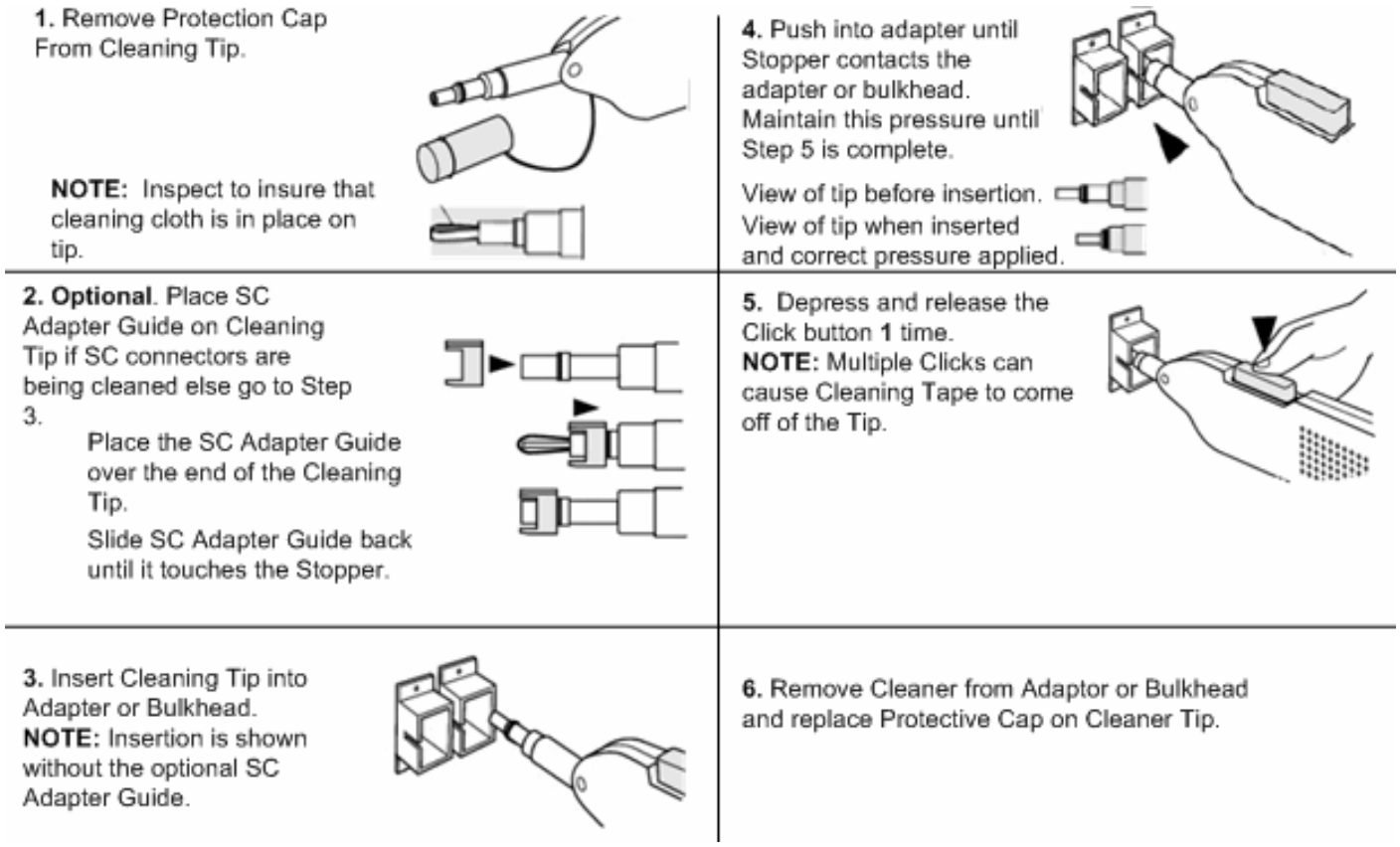
6.2.3.2. Cleaning an SC Connector In an Adapter with the Ferrule-Mate SFM-250

This the Dry cleaning procedure for the Ferrule-Mate, the Wet Cleaning Procedure can be found in Section " Wet Cleaning an SC Connector In an Adapter with the Ferrule-Mate SFM-250 ".

NOTE: Inspection of connector must be performed before and after cleaning.

Note: Place all protective caps removed from adapters into a clean anti-static bag.

Figure 44: Cleaning SC Connector In an Adapter



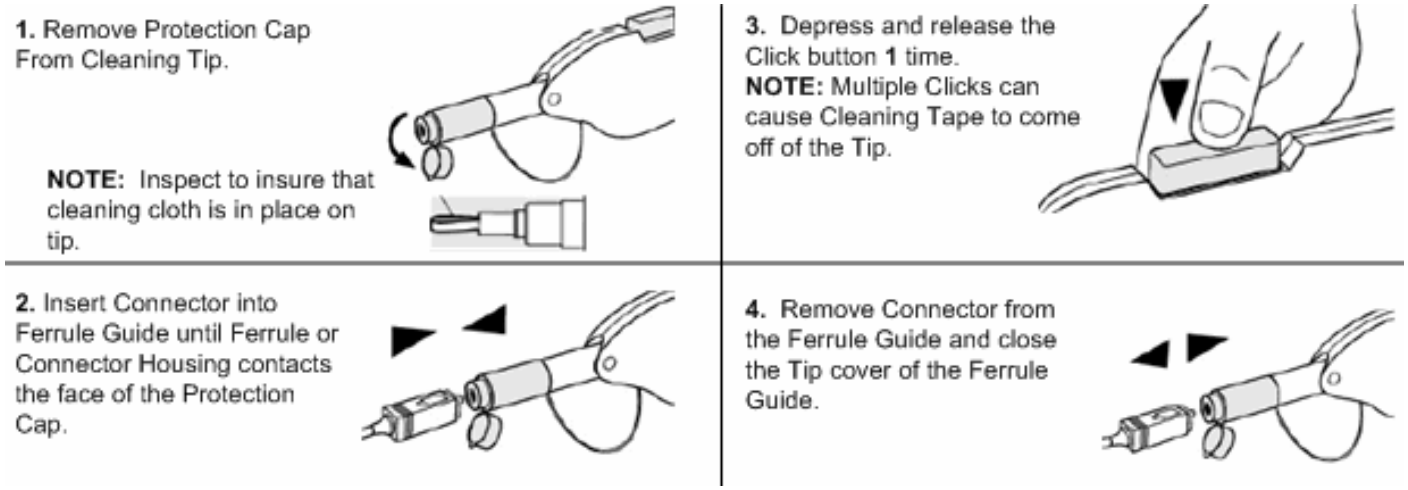
6.2.3.3. Cleaning an SC Connector with the Ferrule-Mate SFM-250

This the Dry cleaning procedure for the Ferrule-Mate, the Wet Cleaning Procedure can be found in Section " Cleaner Fiber Wipe Premoistened ".

NOTE: Inspection of connector must be performed before and after cleaning.

Note: Place all protective caps removed from jumpers into a clean anti-static bag.

Figure 45: Cleaning an SC Connector



6.2.4. Ferrule Mate 1.25mm (LC, MU) Male and Female

This disposable cleaning device is for cleaning any 1.25 mm PC or APC connectors. With the simple push of the button, the tool uses a twisting motion to break loose any dirt that has accumulated on the fiber face, and then a sweeps it away when the cleaning tape advances. This process is more effective than cleaning swabs, or sticks, and it leaves no residue. This technology is effective for cleaning connectors that are plugged into the backside of a panel or on the inside of an enclosure. In addition to this unique ability, the Ferrule Mate's dust cap also has a flip-open end for inserting any ferrule or connector for cleaning. The Ferrule-Mate can be used for Dry or Wet cleaning. The Wet Cleaning Procedure can be found in Section " Wet Cleaning an LC Connector with the Ferrule-Mate SFM-125 ".

Figure 46: Ferrule Mate 1.25mm

DESCRIPTION - Ferrule Mate SFM-125

OF Wipes 350

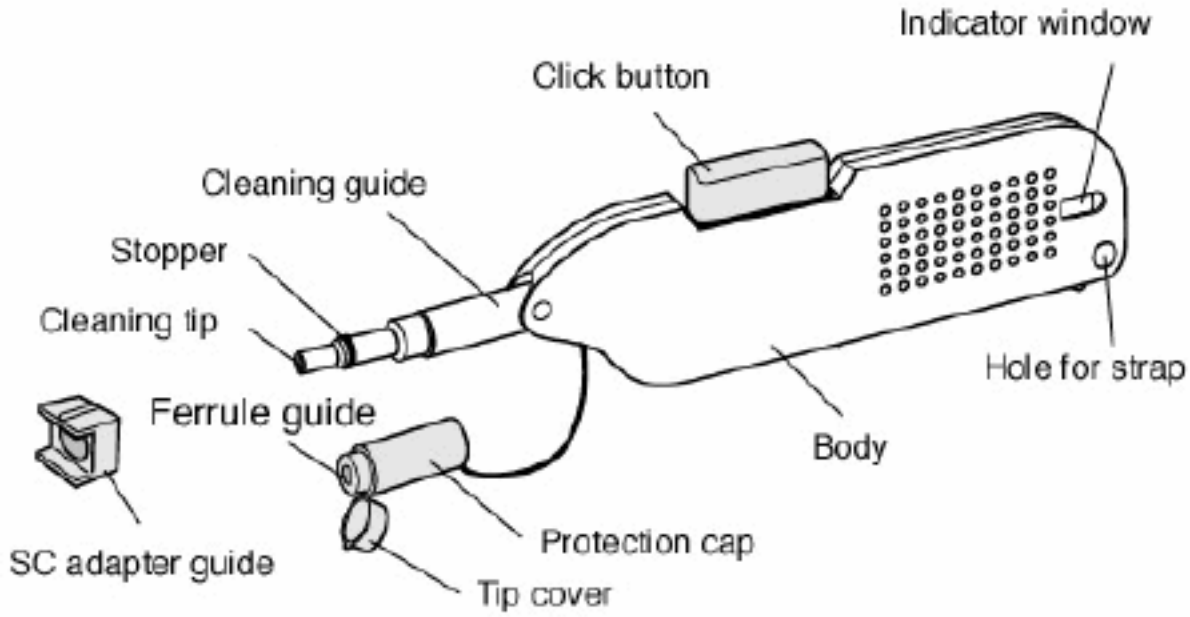
NARRATIVE - Fiber optic cleaning tool suitable for cleaning LC/MU Connectors.

PID: 310111992

6.2.4.1. User Parts Key for Ferrule-Mate SFM-125 Fiber Optic Connector Cleaner

NOTE: The following graphic represents a Ferrule-Mate SFM-125 for 1.25 mm connectors such as LC.

Figure 47: Parts Key for Ferrule-Mate SFM-125 (LC Connectors)



In some cases the Cleaning Cloth on the Ferrule-Mate can become misaligned or fall off of the tip. Simply grasp the Body of the Ferrule-Mate in one hand and the Cleaning Tip in the other. Push the Cleaning Tip and Stopper toward the Body as far as it will go and then return the Cleaning Tip and Stopper to their original positions. Verify the Cleaning Cloth has been realigned across the end.

Figure 48: Realign Ferrule Mate

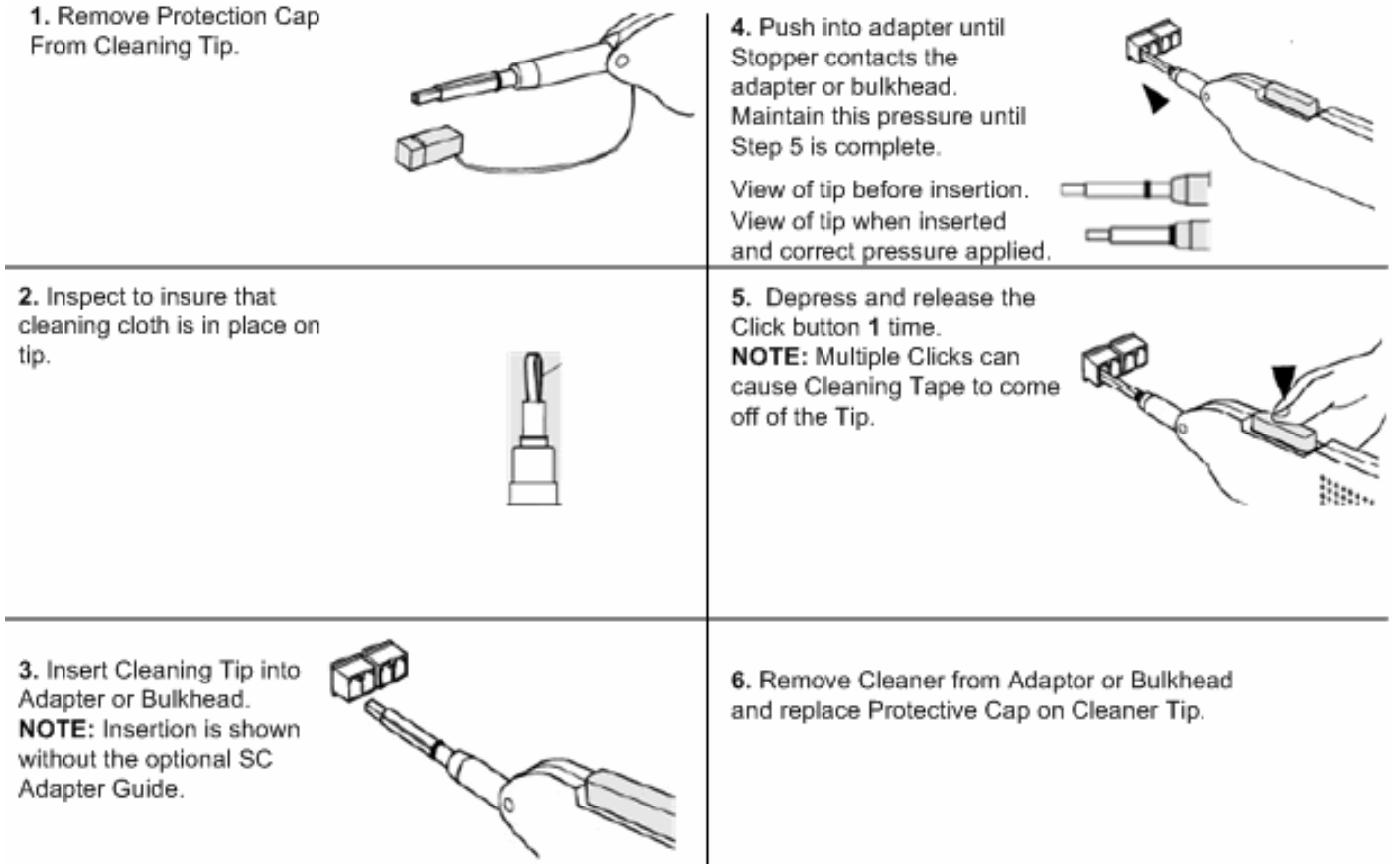
6.2.4.2. Cleaning an LC Connector In an Adapter with the Ferrule-Mate SFM-125

This is the Dry cleaning procedure for the Ferrule-Mate, the Wet Cleaning Procedure can be found in Section " Wet Cleaning an LC Connector In an Adapter with the Ferrule-Mate SFM-125 ".

NOTE: Inspection of connector must be performed before and after cleaning.

Note: Place all protective caps removed from adapters into a clean anti-static bag.

Figure 49: Cleaning LC Connector In an Adapter



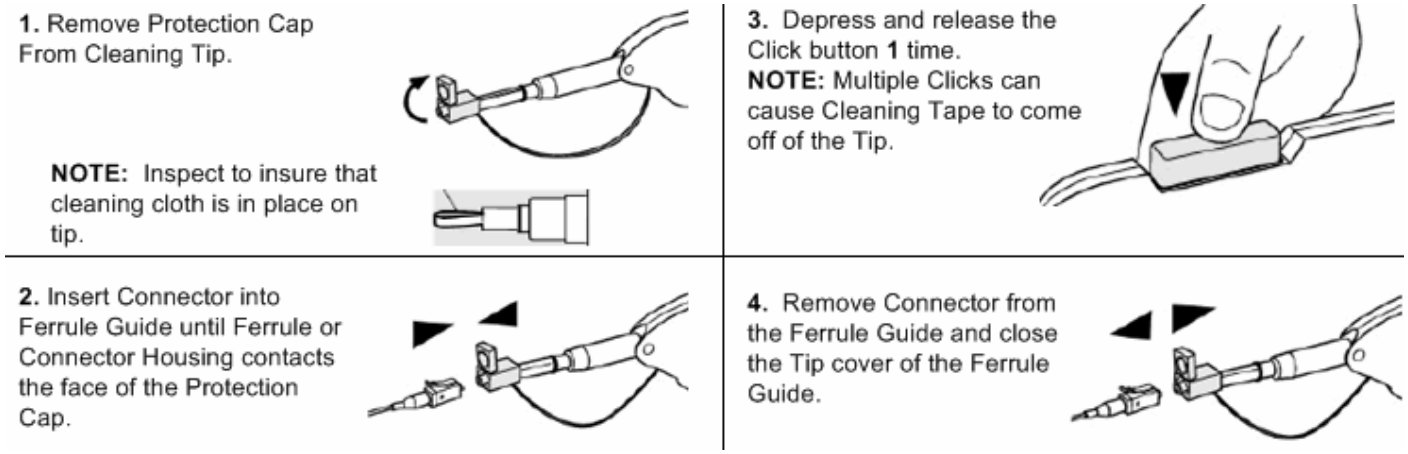
6.2.4.3. Cleaning an LC Connector with the Ferrule-Mate SFM-125

This is the Dry cleaning procedure for the Ferrule-Mate, the Wet Cleaning Procedure can be found in Section " Cleaner Fiber Wipe Premoistened ".

NOTE: Inspection of connector must be performed before and after cleaning.

Note: Place all protective caps removed from jumpers into a clean anti-static bag.

Figure 50: Cleaning an LC Connector



6.2.5. Alcoa FCC-02R Fiber Optic Connector Cleaner

The AFL FCC-02R is designed to remove dust, dirt, oil and grease from the ferrule end faces of SC, D4, FC, LC, and ST fiber optic connectors. The FCC-02R is designed for 400 wipes.

Figure 51: Alcoa FCC-02R Fiber Optic Connector Cleaner

Ordering Information Item is Non-Stock. Delivery interval: 5 Days.

DESCRIPTION - CLEANER, FIBER OPTIC CONNECTOR FCC-02R

OF Wipes 400

NARRATIVE This is a fiber optic cleaning cartridge for SC, ST, D4 & FC Connectors.

PID - 301039228

The following is a Reel Replacement that is less than 25% of the cost of the complete cleaning unit. Cost per wipe drops by almost 75% by reusing the existing housing and replacing the used cleaner tape.

DESCRIPTION - REEL, REPLACEMENT FCC-4

OF Wipes 400

NARRATIVE - Replacement reel for cleaner, fiber optic connector FCC-02R.

Fiber Optic Connector PID - 301039236

6.2.5.1. User Instructions for Alcoa FCC-02R Fiber Optic Connector Cleaner

While this tool can be used in either hand it is designed to be grasped in the users left with the advance lever facing left as seen below.

Figure 52: cletop_in_hand.gif

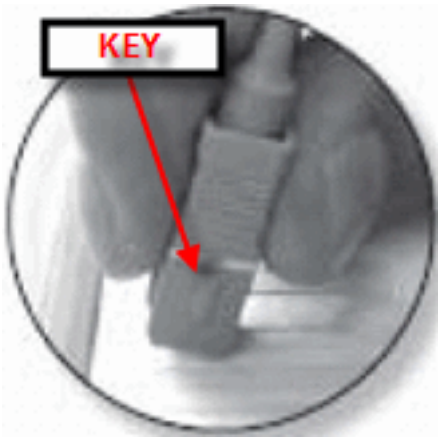
1. Grasp the Alcoa FCC-02R Fiber Optic Connector Cleaner in your left hand with the advance lever facing left and under your thumb.
2. Grasp the fiber connector with your right hand as you would a pencil with the connector end as the writing end.
3. Push the advance lever away from you and down to expose the two cleaning surfaces.

4. Take note of the wiping direction indicated by the arrows on top of the Connector Cleaner.

5. Place the fiber connector on the left most cleaning surface at the end of the slot closest to the wiping direction label.

   - UPC connectors will be placed perpendicular to the cleaning surface
   - APC connectors will be placed at an 8^{o} angle. Grasp the connector between right thumb and forefinger with the key facing left, place the connector in contact with the cleaning surface and slightly lean the top of the connector in the direction you will be wiping.

Figure 53: KEY on SC APC



6. Turn the connector 1/2 turn clockwise and then 1/2 turn counterclockwise.

7. Drag the connector the length of the slot.

8. Repeat steps 5 - 7 in the right most slot.

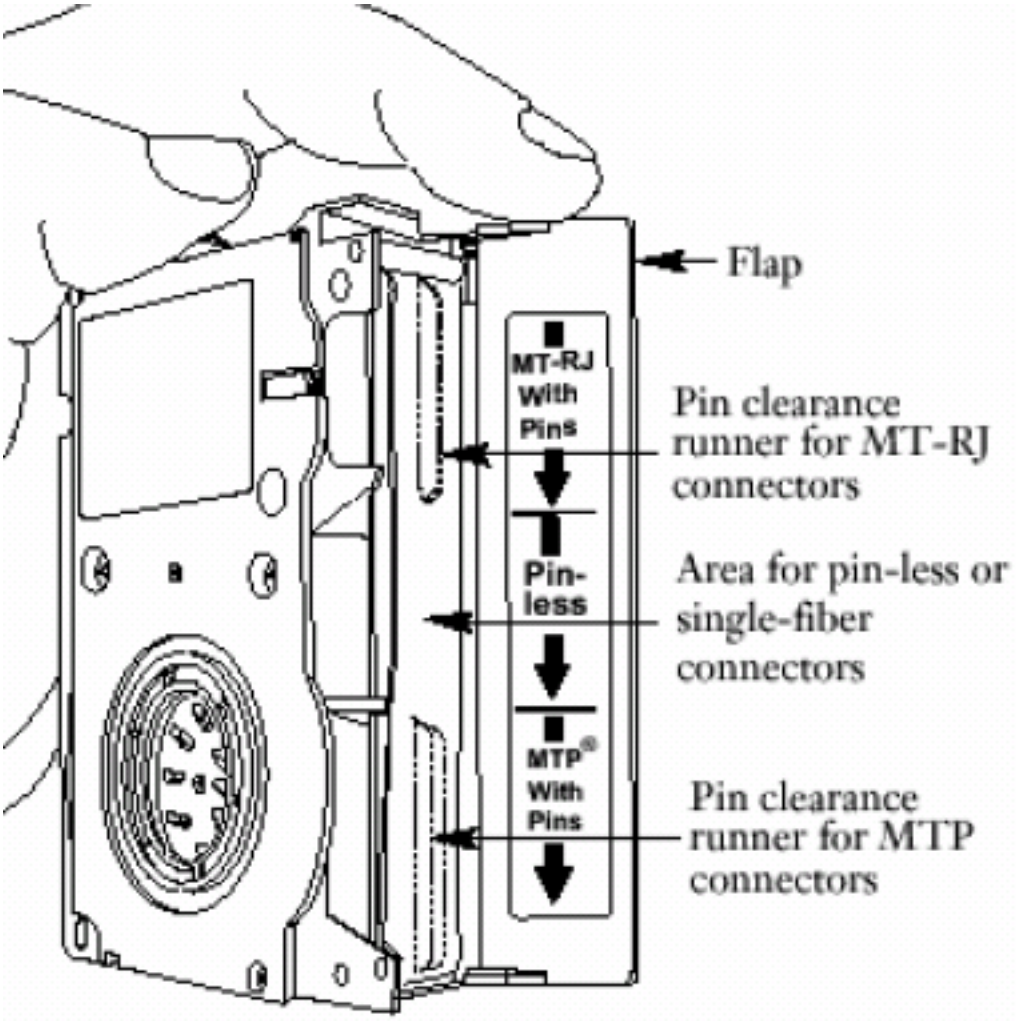
9. Release the advance lever to hide the cleaning surfaces.

10. Re-inspect

6.2.6. Cleaner, Fiber Optic Connector Universal

The Connector Cleaning Cassette uses a special cloth tape over two pin-clearance runners to clean the connector end face of either MT-RJ, MPO, or MTP© connectors which have guide pins. The center section of the cleaning area between the two runners may be used to clean any pin-less connector, including single fiber connectors ST, SC, FC, LC, or D4. This unit is only required when cleaning MT-RJ, MPO, or MTP© jumpers which have guide pins. See Figure 57 "MT-RJ or MTP/MPO connectors with Guide Pins " below for an example.

Figure 54: Universal Fiber Optic Cleaner



Ordering Information Item is non-stock. Delivery interval is 3 days.

DESCRIPTION - CLEANER, FIBER OPTIC CONNECTOR UNIVERSAL

OF Wipes Unable to determine

NARRATIVE The Universal Connector Cleaning Cassette used to clean the connector end face of either MT-RJ, MPO, or MTP connectors that have guide pins. May be used to clean ST, SC, FC, LC, and D4 connectors.

PID - 301053872

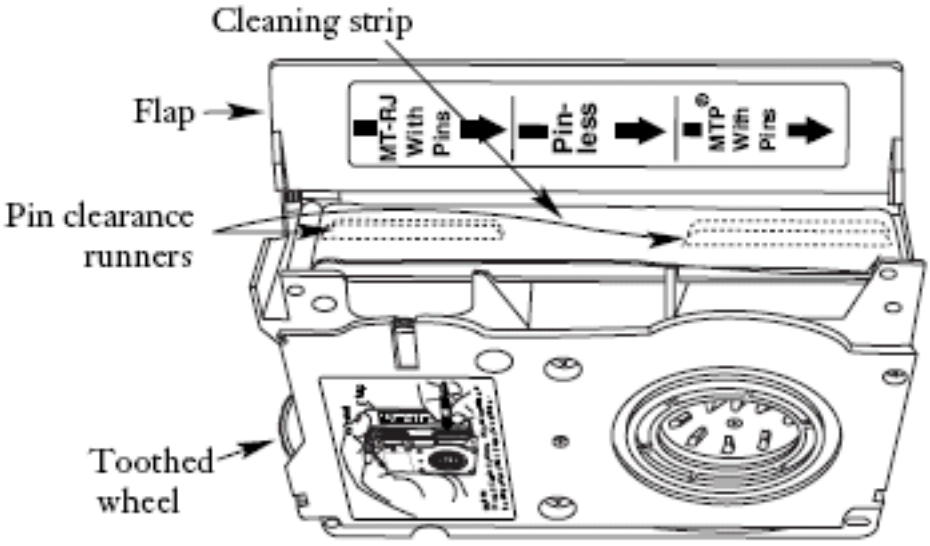
No Replacement Reel available.

6.2.6.1. User Instructions for Cleaner, Fiber Optic Connector Universal

It is essential to learn the physical layout of the Universal Connector Cleaning Cassette before commencing with cleaning operations. The Universal Connector Cleaning Cassette uses a special cloth tape over two pin-clearance runners to clean the connector end face of either MT-RJ or MTP® connectors which have guide pins (see Figure 57 below titled "MT-RJ or MTP/MPO connectors with Guide Pins"). The center section of the cleaning area between the two runners may be used to clean any pin-less connector, including single fiber connectors (ST®-compatible, SC, FC, or D4). The following figure can be used to get familiar with each of the parts of the Universal Connector.

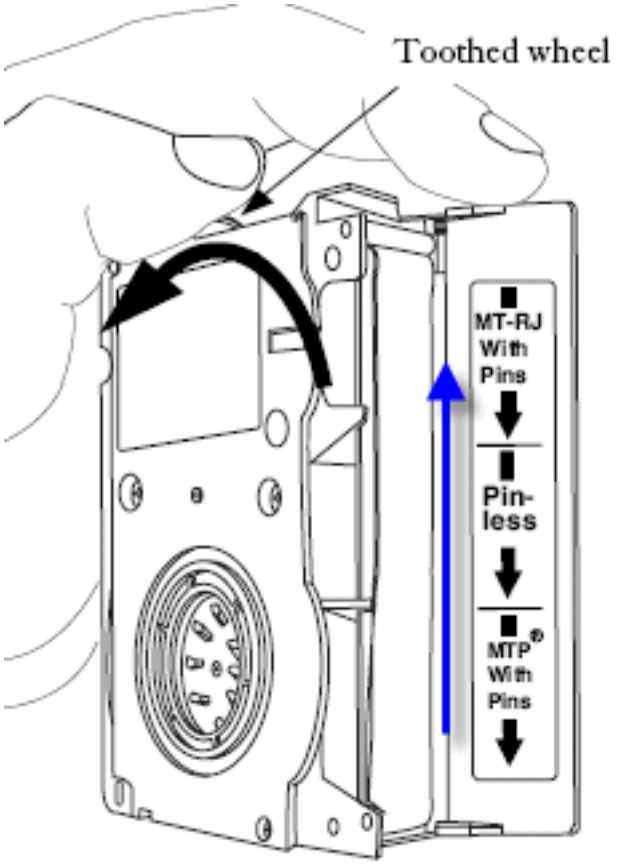
- Cleaning Strip - This is surface that the connector face will pass across to remove contaminants. Always move connector in the direction of the arrows on the flap. Never use the exact same path twice.
- Flap - Protects the "Cleaning Strip" when not in use and labels the 3 different areas of the cleaning strip.
- Pin clearance runners - Appear as humps under the cleaning strip. The Guide Pins of some MT type connectors will straddle these humps.
- Toothed Wheel - This wheel is used to advance the Cleaning Strip to expose a clean surface.

Figure 55:



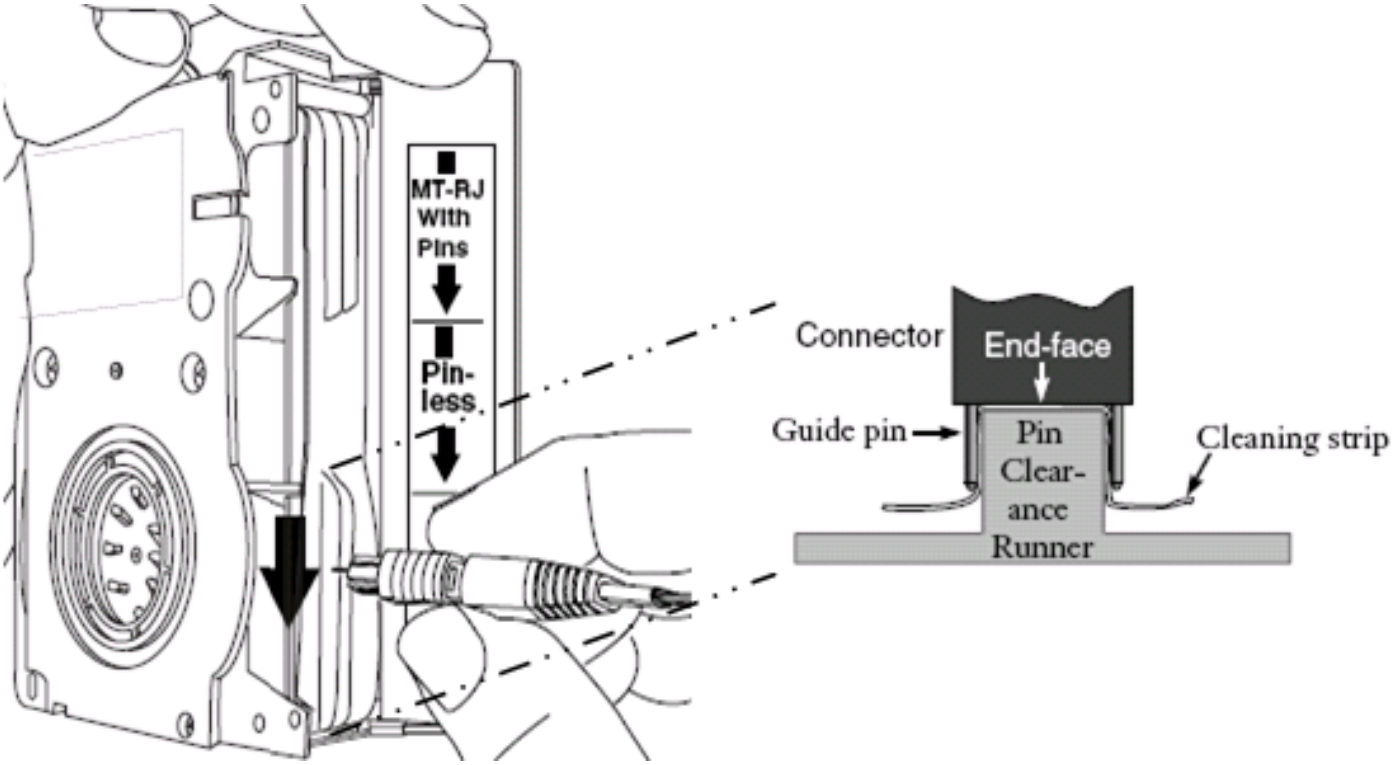
The following figure shows the direction to move the Toothed wheel to advance the Cleaning Strip. One stroke of the Toothed wheel only advances the Cleaning Strip by one third of an inch which means that the user must stroke the Toothed wheel at least 3 times to get a clean ribbon in the area being used. Also note that if the user is cleaning an MTP/MPO connector, the next strokes of the Toothed wheel moves dirty Cleaning Strip into the Pin-less area. If the user picks up the Universal Connector and is not sure what area is clean, it requires 9 - 10 strokes to reveal a completely new 3 inch Cleaning strip.

Figure 56: Toothed Wheel and Direction of Ribbon Advance



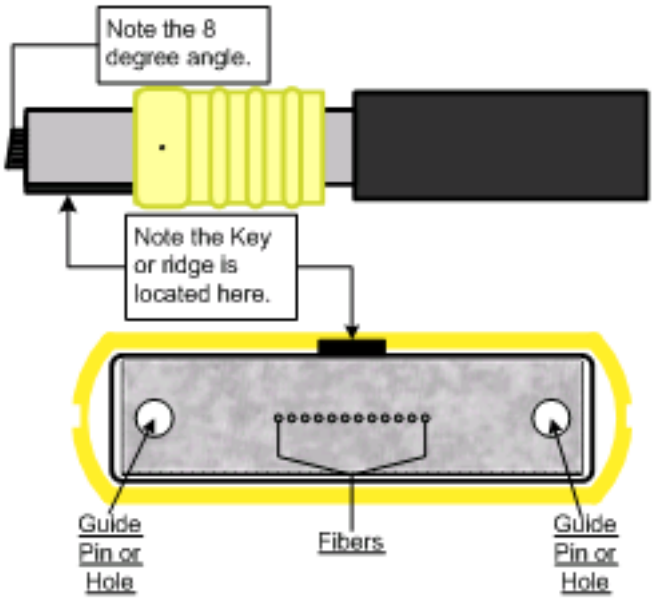
The following figure illustrates cleaning an MTP with Guide Pins type connector. The guide for the MTP/MPO is slightly wider than the guide for the MT-RJ on the opposite end.

Figure 57: MT-RJ or MTP/MPO connectors with Guide Pins



The following figure shows an angle on the surface to cleaned. The user must insure that the surface to be cleaned is held flat against the Cleaning strip on the Universal Connector Cleaning Cassette. The user can readily observe the angle (if present) when viewing the connector from the side as shown below .

Figure 58: MPO Connector with Angle

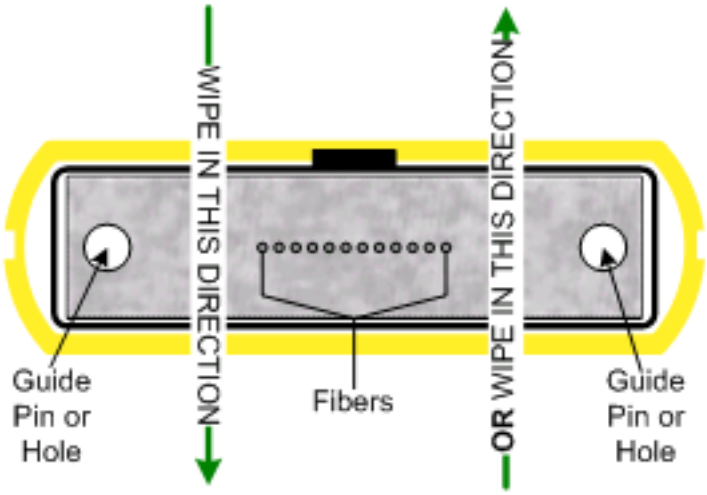


The user should hold an angled MPO connector at an 8^{O} angle to the cleaning surface as shown below to insure complete contact.

Figure 59: Connector Cleaning Angle

The following illustration indicates the proper direction for cleaning a multiple fiber connector (i.e. MPO, MPT, or MT-RJ). Always clean in one direction. Do not clean perpendicular to the arrow shown below as this moves contamination from one fiber to the next. Excessive pressure or scrubbing can damage the fiber.

Figure 60: Wipe Direction



NOTE: This unit is only required when cleaning MT-RJ, MPO, or MTP© connectors which have guide pins. Other cleaning units may be less expensive per wipe and more suited to the task if not cleaning MT-RJ, MPO, or MTP© connectors which have guide pins.

NOTE: Inspection of connector must be performed before and after cleaning.

1. Advance reel 9-10 of the Toothed Wheel strokes to insure a contaminant free cleaning surface.
2. Open the flap on the cleaning cassette.
3. Use the label on the inside of the flap to choose the appropriate cleaning area.
4. Use a single wipe along the cleaning tape in the direction indicated on the flap label.
5. Reinspect
6. If required after inspection, advance the tape with 3 strokes of the Toothed Wheel and repeat Steps 2 through 4.

6.2.7. FiberSwiper

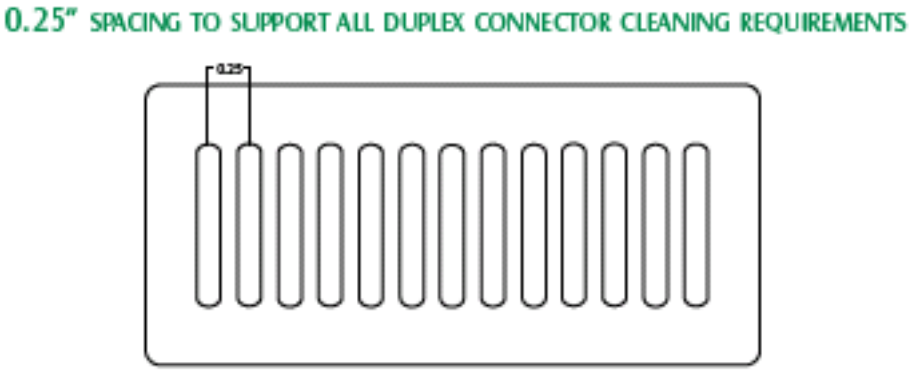
Reference ATT-TELCO-PAN-2003-3327 , FiberSwiper Connector Cleaner Approval for Use, Issue 1, dated December 2003 manufactured by Neptec Optical Solutions Inc. This document may be obtained internally within AT&T through the APEx system (apex.sbc.com).

The FiberSwiper is a pocket-sized connector cleaner (4.37 long x 2.25 wide and 0.40 high inches). The FiberSwiper® offers a compact ESD-dissipative case for storage and use of six cards, each containing 13 individual slots for cleaning (78 cleans total per pack). Each cleaner card has a perforated cover that protects each cleaning slot until used.

- Pocket-sized connector cleaner (same thickness as a CD jewel case) 111(L) x 57(W) x 10.2(H) mm
- ESD material is used in the fabrication of the FiberSwiper® to eliminate static for use in sensitive areas
- Each FiberSwiper® holds 6 cards that clean 13 connectors each (78 cleans/6-pack)
- A perforated cover protects each cleaning slot until used
- Removes and retains oil, dirt and other contaminants without solvents for superior results over competing products
- One swipe cleaning requirement per connector end for a more cost effective solution

Figure 61: FiberSwiper

Figure 62: FiberSwiper Refill



Ordering Information Item is Non-Stock.

DESCRIPTION - CLEANER FIBERSWIPER

OF Wipes 78

NARRATIVE - A POCKET SIZED CONNECTOR CLEANER HOLDS SIX CLEANER CARDS THAT CLEAN 13 CONNECTORS EACH

PID - 400166880

The following are Replacement Cleaner cards. This represents a 50% cost savings from buying a new kit.

Ordering Information Item is Non-Stock.

DESCRIPTION - CLEANER FIBERSWIPER CARDS

OF Wipes 78

NARRATIVE PACKAGE OF 6 REPLACEMENT CLEANER CARDS FOR FIBERSWIPER

PID - 400166898

6.2.7.1. User Instructions for FiberSwiper

Use the following instructions along with the corresponding illustrations for the FiberSwiper connector cleaner.

NOTE: Inspection of connector must be performed before and after cleaning.

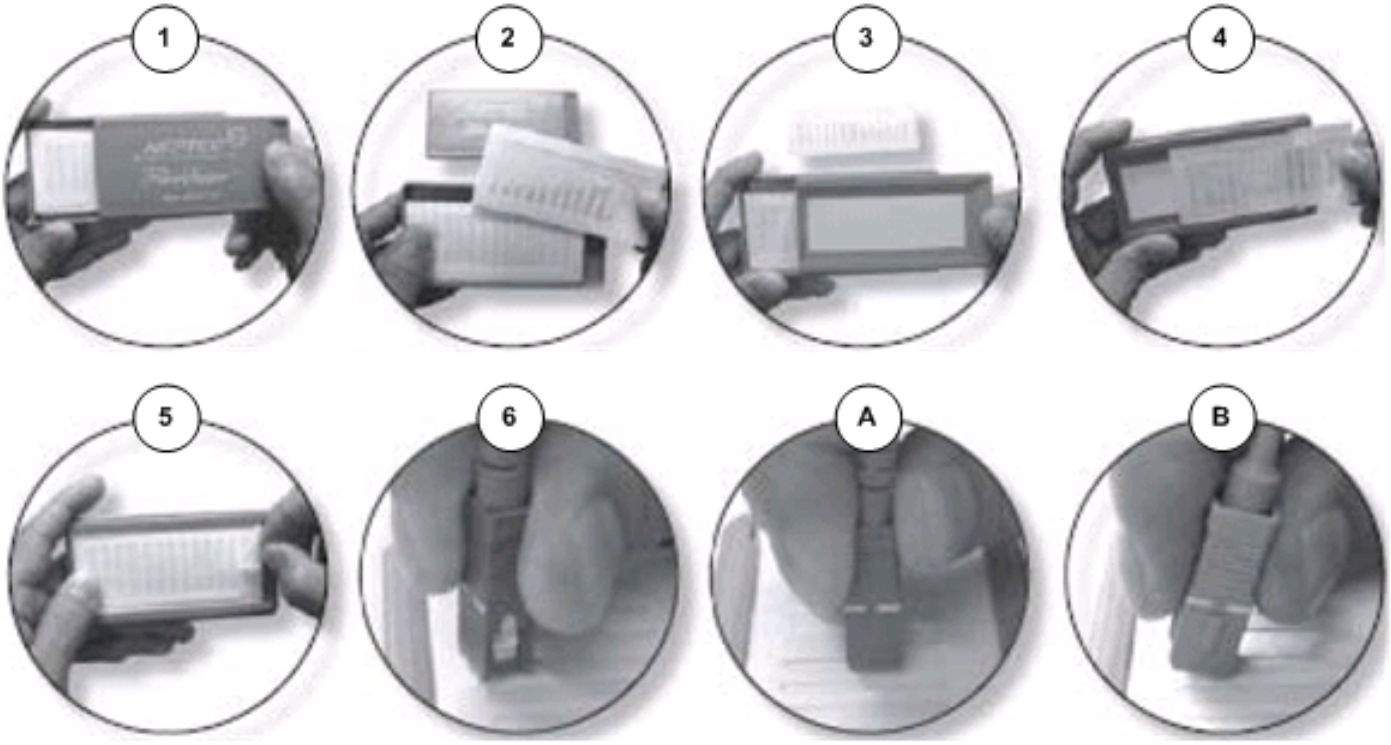
1. Using the built in thumb slot, remove the lid from the base.
2. Remove one cleaning card from the base.
3. Turn the lid upside down to expose the pad and slide back on to the base.
4. Insert the cleaning card into the lid over the pad, by sliding it into the side rails.
5. Place the entire unit on a flat surface with the cleaning card facing up and remove the plastic protecting shield from the cleaning slot to be used.
6. With the end face of the connector

    A. For UPC connectors (almost all of what AT&T uses) hold the connector perpendicular to the cleaning surface, place the connector into one end of the slot, twist one half turn while applying slight downward pressure, and then swipe along the slot to the opposite end using slight pressure.

    B. For APC connectors hold the connector at a slight angle (as seen below in B) and orient the connector with key on the left and then swipe along the slot to the opposite end using slight pressure

7. Re-inspect

Figure 63: FiberSwiper Cleaning Illustrations

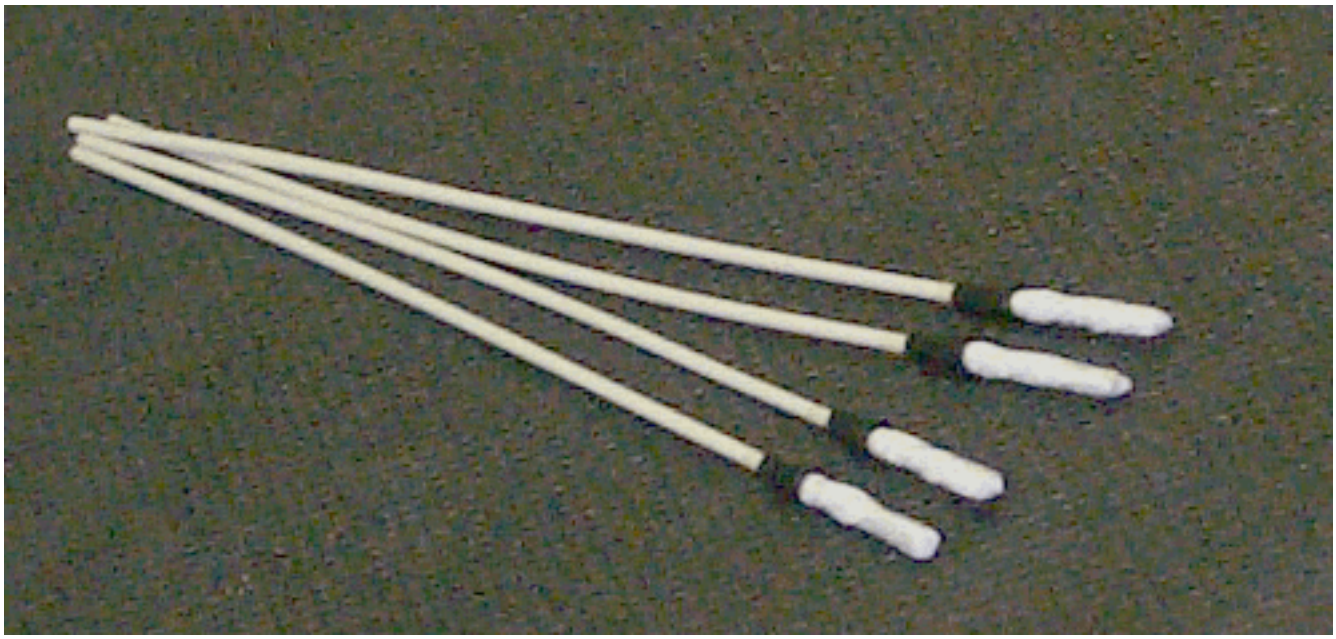


6.2.8. In-situ Connector Cleaner SC

Most fiber panels have alignment sleeves that mate the two male connectors with one another at the panel wall. There are other instances where the male connector seats into a female connector (especially on network equipment). When a female connector is present, another cleaner product needs to be used for this purpose. The male connectors, In-situ connectors and the alignment sleeve must be cleaned before the connection is made. This is primarily a Dry Clean product however it can also be used when dampened with alcohol without adverse effects to the cleaner tip.

NOTE: This item can also be used for cleaning Alignment Sleeves and Ferrules .

Figure 64: Connector Cleaner SC



Ordering Information Item is Non-Stock.

DESCRIPTION - CLEANER SPLIT SLEEVE TIP

OF Wipes Per Pack 5

NARRATIVE - Designed to clean hard to reach areas and 2.5MM adapters. No alcohol or solvents necessary.

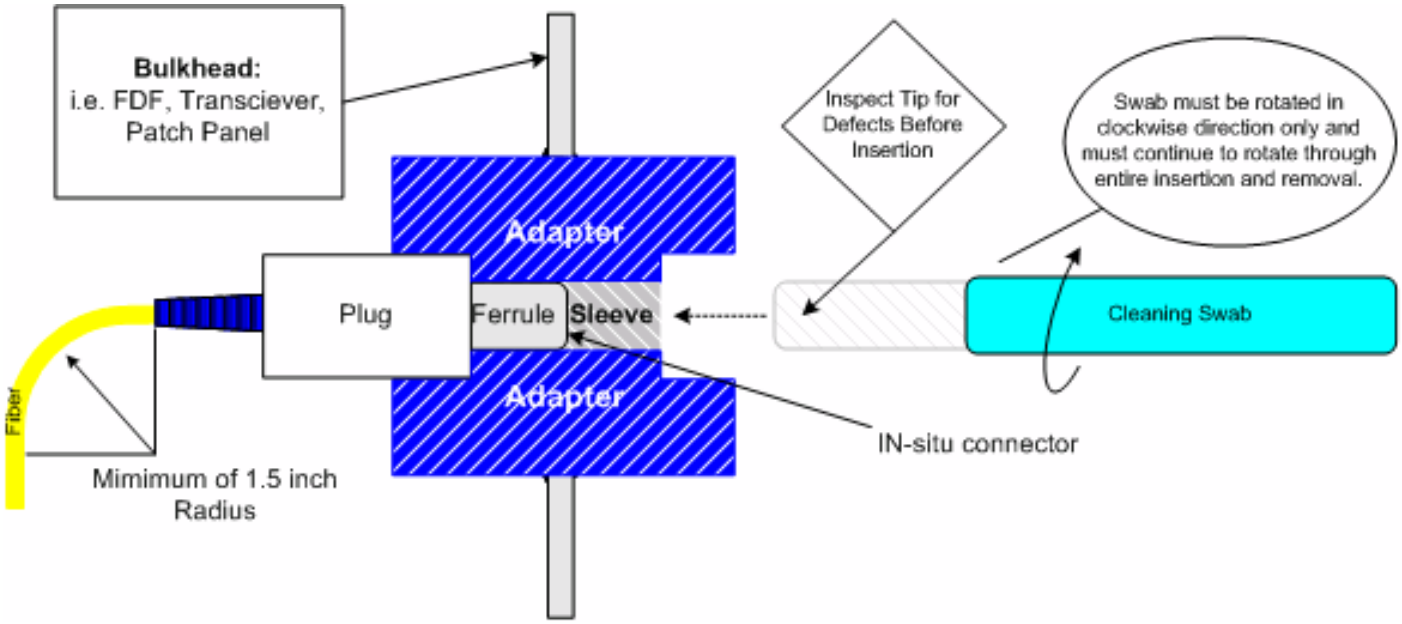
PID - 301053468

6.2.8.1. User Instructions for In-Situ Connector Cleaner SC

NOTE: Inspection of connector must be performed before and after cleaning.

NOTE: Please keep opened packages of swabs in separate clean and moisture free bag. This bag could be placed inside a larger bag of cleaning materials to keep all together with the exception of alcohol cleaners.

Figure 65: In-situ Cleaning



1. Check tip of cleaner for obvious defects (i.e. rip of white cloth, contamination or foreign objects adhered to the white cloth or body).
2. Insert the cleaner into the sleeve parallel to the sides and without touching the sides.
3. Press firmly (200 - 300 g) but do not bend stick.

   NOTE: A torn cloth can expose the fiber to damage.
4. Rotate the stick (clockwise only) 4 - 5 times while pressing as above.

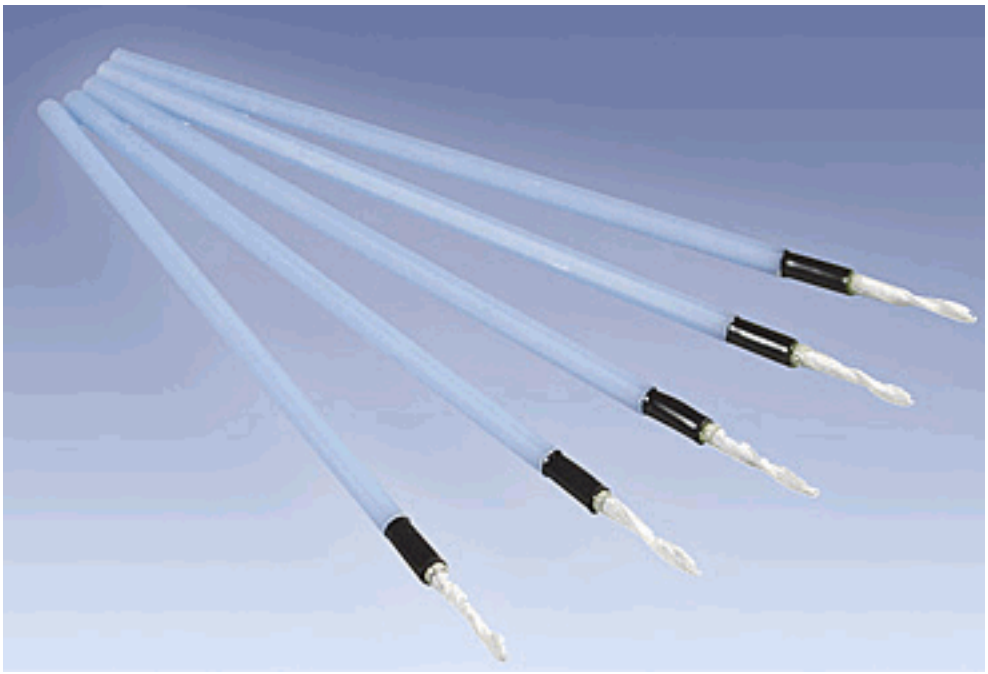
   NOTE: Never rotate the stick in a counter clockwise direction.
5. Continue to rotate stick while withdrawing from sleeve.
6. Used Cleaner must be discarded after a single use. Do not perform a second wiping with this stick.

6.2.9. In-Situ Connector Cleaner LC

Most fiber panels have alignment sleeves that mate the two male connectors with one another at the panel wall. There are other instances where the male connector seats into a female connector (especially on network equipment). When a female connector is present, another cleaner product needs to be used for this purpose. The female, male connectors and the alignment sleeve must be cleaned before the connection is made. This is primarily a Dry Clean product however it can also be used when dampened with alcohol without adverse effects to the cleaner tip.

NOTE: This item can also be used for cleaning Alignment Sleeves and Ferrules .

Figure 66: Connector Cleaner LC



Ordering Information Item is Non-Stock.

DESCRIPTION - CLEANER SPLIT SLEEVE TIP FOR LC

OF Wipes Per Pack 5

NARRATIVE - Designed to clean hard to reach areas and 1.25MM adapters. No alcohol or solvents necessary.

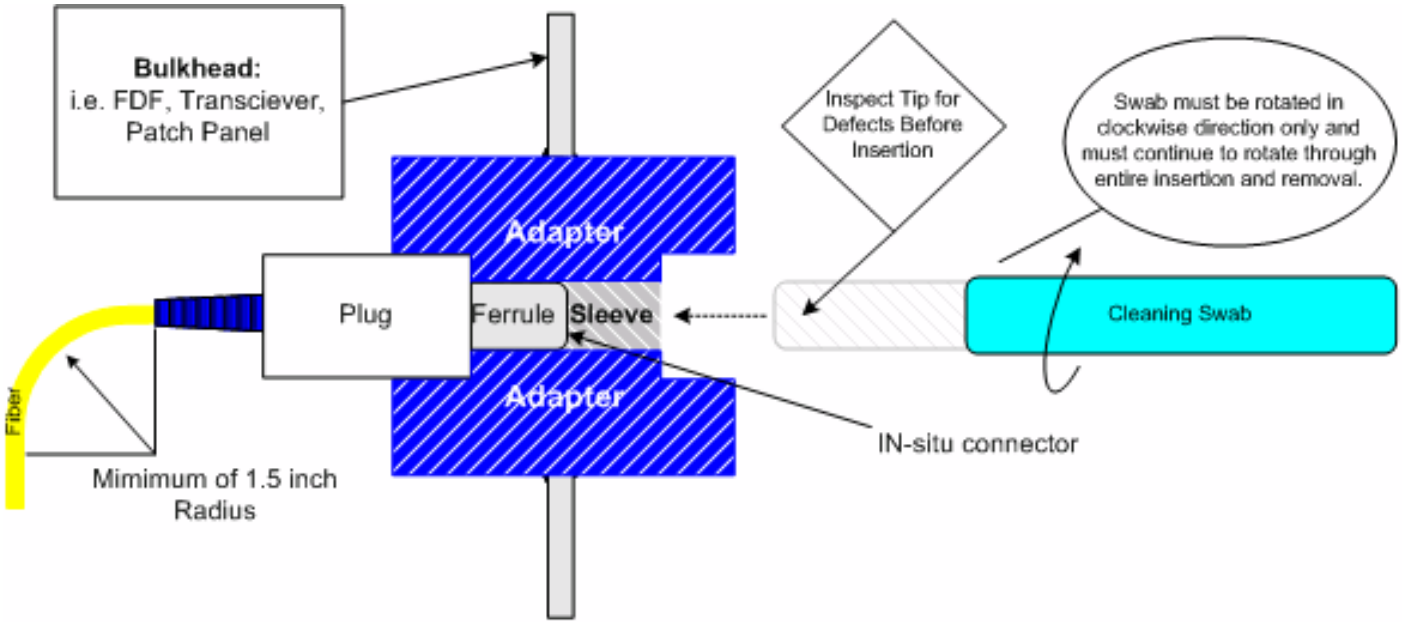
PID - 301116471

6.2.9.1. User Instructions for In-Situ Connector Cleaner LC

NOTE: Inspection of connector must be performed before and after cleaning.

NOTE: Please keep opened packages of swabs in separate clean and moisture free bag. This bag could be placed inside a larger bag of cleaning materials to keep all together with the exception of alcohol cleaners.

Figure 67: In-Situ Cleaning



1. Check tip of cleaner for obvious defects (i.e. rip of white cloth, contamination or foreign objects adhered to the white cloth or body).
2. Insert the cleaner into the sleeve parallel to the sides and without touching the sides.
3. Press firmly (200 - 300 g) but do not bend stick.

   NOTE: A torn cloth can expose the fiber to damage.
4. Rotate the stick (clockwise only) 4 - 5 times while pressing as above.

   NOTE: Never rotate the stick in a counter clockwise direction.
5. Continue to rotate stick while withdrawing from sleeve.
6. Used Cleaner must be discarded after a single use. Do not perform a second wiping with this stick.

6.3. Wet Cleaning Products

IMPORTANT:
Wet cleaning of fiber end faces should only be used after 3 dry cleaning attempts have failed to produce acceptable results. Wet cleaning must always be followed by dry cleaning before the liquid has a chance to dry.

6.3.1. Cleaner Fiber Wipe Premoistened

If an alcohol based cleaning material is used, the pre-moistened wipe is the preferred item in order to reduce contamination. This is a pre-moistened, lint-free, non-abrasive 3" x 4" wipe saturated with 99% Isopropyl Alcohol and 1% deionized water.

CAUTION:
Do not store where temperatures may exceed 120^{o} F/49^{o} C. Prolonged exposure to sunlight or other sources of heat can cause bursting of packet. Chemical contact with flames or very hot surfaces can cause ignition.

Figure 68: Pre-Moistened (Alcohol) Wipes

Ordering Information Item is Non-Stock.

DESCRIPTION - CLEANER FIBER WIPE PREMOISTENED 200 CASE

OF Wipes Per Pack 400

NARRATIVE - PreMoistened Individually wrapped wipes.

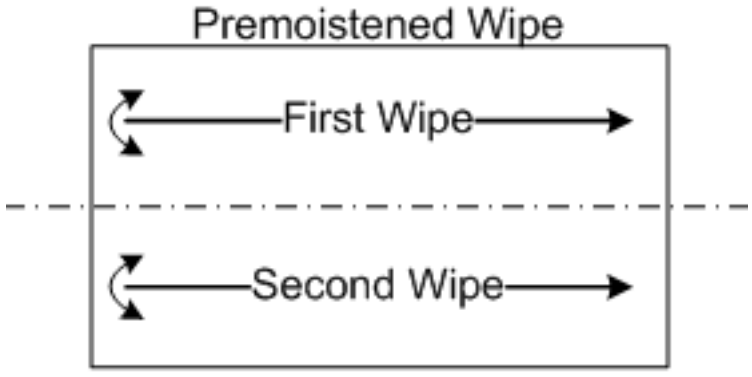
PID - 300079076

6.3.1.1. User Instructions for Cleaner Fiber Wipe Premoistened

NOTE: Inspection of connector must be performed before and after cleaning.

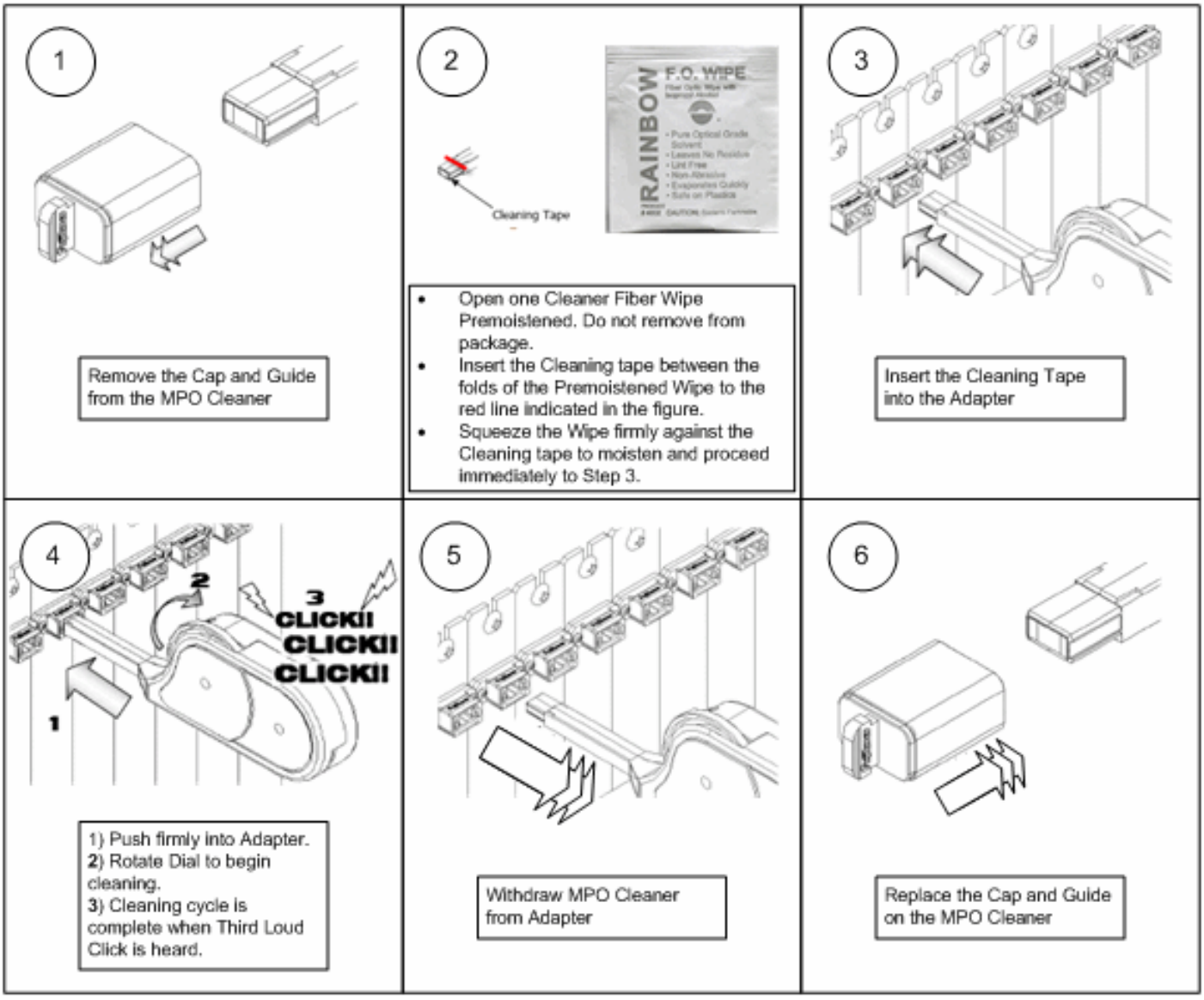
1. The user must have a Dry Type cleaner (i.e. Alcoa FCC-02R Fiber Optic Connector Cleaner immediately available for use.
2. Open a PreMoistened Individually wrapped wipe by tearing or cutting across the top of the package.
3. Grasp the wipe by one corner and carefully remove from package while avoiding contact with one side of the wipe.
4. Do not unfold wipe. This provides a padding to avoid excessive pressure against the connector end face and provides protection from contamination such as oils from hands.
5. Either hold the wipe in your hand or place on a suitable flat surface. (Avoid prolonged contact with Alcohol)
6. Choose a path near one edge, place connector in contact with the wipe at one end, twist the connector one quarter turn clockwise, then one quarter turn counter clockwise, and wipe the connector along the length of the pad. (See Figure “Premoistened Wipe Usage”)
7. Choose a path near the opposite edge , place connector in contact with the wipe at one end, twist the connector one quarter turn clockwise, then one quarter turn counter clockwise, and wipe the connector along the length of the pad a second time. (See Figure “Premoistened Wipe Usage”)
8. Immediately (Do Not allow the connector to air dry) use a Dry Type cleaner such as Alcoa FCC-02R Fiber Optic Connector Cleaner to dry the connector end face.
9. Dispose of PreMoistened Individually wrapped wipe.

Figure 69: Premoistened Wipe Usage



6.3.2. Wet Cleaning an MPO Connector with MPO Cleaner

Figure 70: MPO Cleaner Wet/Dry Clean



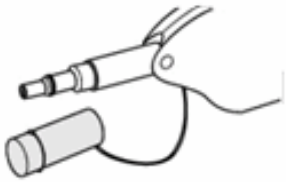
6.3.3. Wet Cleaning an SC Connector In Adapter with the Ferrule-Mate SFM-250

NOTE: Inspection of connector must be performed before and after cleaning.

Note: Place all protective caps removed from adapters into a clean anti-static bag.

Figure 71: Wet Cleaning an SC Connector with the Ferrule-Mate SFM-250

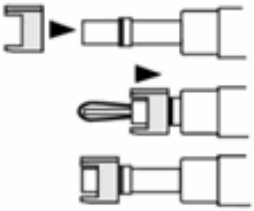
1. Remove Protection Cap From Cleaning Tip.



2. Optional. Place SC Adapter Guide on Cleaning Tip if SC connectors are being cleaned else go to Step 3.

Place the SC Adapter Guide over the end of the Cleaning Tip.

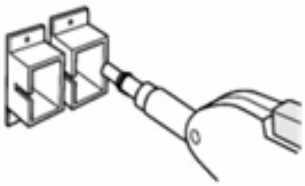
Slide SC Adapter Guide back until it touches the Stopper.



3. Open one Cleaner Fiber Wipe Premoistened. Do not remove from package.

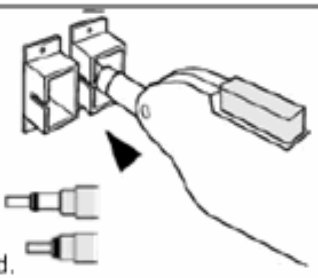
4. Push Ferrule-Mate cleaning tip back to expose ¼ to ½ inch of Cleaning Cloth, place between fold of Cleaner fiber Wipe Premoistened, and pinch to wet Cleaning Cloth. Release cleaning tip and immediately proceed to Step 5 .

5. Insert Cleaning Tip into Adapter or Bulkhead.
NOTE: Insertion is shown without the optional SC Adapter Guide.

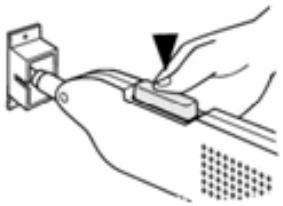


6. Push into adapter until Stopper contacts the adapter or bulkhead. Maintain this pressure until Step 7 is complete.

View of tip before insertion.
View of tip when inserted and correct pressure applied.



7. Depress and release the Click button **2** times.
NOTE: Multiple Clicks can cause Cleaning Tape to come off of the Tip.



8. Remove Cleaner from Adaptor or Bulkhead and replace Protective Cap on Cleaner Tip.

6.3.4. Wet Cleaning an LC Connector In Adapter with the Ferrule-Mate SFM-125

NOTE: Inspection of connector must be performed before and after cleaning.

Note: Place all protective caps removed from adapters into a clean anti-static bag.

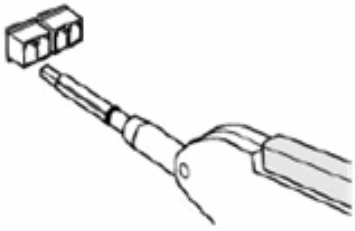
Figure 72: Wet Cleaning an LC Connector with the Ferrule-Mate SFM-125

1. Remove Protection Cap From Cleaning Tip.

2. Open one Cleaner Fiber Wipe Premoistened. Do not remove from package.

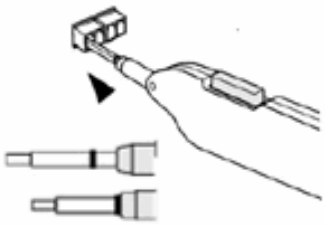
3. Push Ferrule-Mate cleaning tip back to expose ¼ to ½ inch of Cleaning Cloth, place between fold of Cleaner fiber Wipe Premoistened, and pinch to wet Cleaning Cloth. Release cleaning tip and immediately proceed to Step 4.

4. Insert Cleaning Tip into Adapter or Bulkhead. **NOTE:** Insertion is shown without the optional SC Adapter Guide.

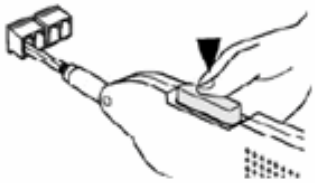


5. Push into adapter until Stopper contacts the adapter or bulkhead. Maintain this pressure until Step 5 is complete.

View of tip before insertion.
View of tip when inserted and correct pressure applied.



6. Depress and release the Click button 2 times. **NOTE:** Multiple Clicks can cause Cleaning Tape to come off of the Tip.



7. Remove Cleaner from Adaptor or Bulkhead and replace Protective Cap on Cleaner Tip.

6.3.5. Female Connector Cleaner SC or LC

Use the same Swabs that are used for Dry Cleaning Cleaner Fiber Wipe Premoistened .

6.3.6. User Instructions for Female Connector Cleaner SC or LC

NOTE: Inspection of connector must be performed before and after cleaning.

1. Determine if an SC or LC In-situ Connector Cleaner is needed and have at least two ready for use.
2. Check tip of In-Situ Connector Cleaner for obvious defects (i.e. rip of white cloth, contamination or foreign objects adhered to the white cloth or body).
3. Lightly dampen white cloth on tip with alcohol. This may be accomplished by:

   A. Open a “Cleaner Fiber Wipe Premoistened” as seen above (do not remove wipe from foil package).

   B. Insert white cloth tip of the In-Situ Connector Cleaner into the package between folds of alcohol wipe if possible and squeeze firmly (this will apply a sufficient amount of alcohol).

   C. Withdraw the In-Situ Connector Cleaner and place Cleaner Fiber Wipe Premoistened and package aside.

   NOTE: An alternate method would be to use one of the two products listed under “Bottled Alcohol”. Only a single drop shall be applied to the cleaner.

4. Insert the cleaner into the adapter sleeve parallel to the sides and without touching the sides.
5. Press firmly (200 - 300 g) but do not bend stick.

   NOTE: A torn cloth can expose the fiber to damage.

6. Rotate the stick (clockwise only) 4 - 5 times while pressing as above.

   NOTE: Never rotate the stick in a counter clockwise direction.

7. Continue to rotate In-Situ Connector Cleaner while withdrawing from sleeve.
8. Immediately use a second In-Situ Connector Cleaner to perform a Dry Cleaning operation using instructions in either the instructions found in “In-Situ Connector Cleaner LC” or “In-Situ Connector Cleaner SC” section of this document.
9. Used In-Situ Connector Cleaner must be discarded after a single use. Do not perform a second wiping with this stick.

NOTE:
Over saturating the swab with alcohol could result in excess liquid being dropped inside the Alignment Sleeve which could cause negative results.

CAUTION:
Only AT&T Approved For Use Test Sets and Cleaning Supplies Should be Used For These Procedures

7. Four Types of Ferrule Polish

The ferrule (made of metal or ceramic) is the central part of the male connector and is designed to both align and protect the fiber core during connection. The ferrule tip is polished to ensure a smooth finish on the fiber end. Polish can also minimize connector loss or back reflection, depending on the angle used. There are four types of polish: PC, super PC (SPC), ultra PC (UPC) and angled PC (APC).

PC Designed to eliminate connector loss caused by gaps between two fiber ends, physical contact polish (PC) was the first type available. Originally flat, PC ferrules were later slightly curved--a principle then applied to FC, SC, ST and D4 connectors--to optimize connection. The result: typical insertion loss values of 0.2 dB for singlemode fibers and maximum return loss values of 35 dB.

APC APC was the next polish developed. For this connector, the ferrule end was cut to an 8° angle, eliminating almost all reflections at the connector end and giving a final return loss specification of 60 dB.

NOTE: APC connectors shall not be mated with UPC, SPC, or PC connectors including those on test equipment as this may cause irreparable damage to both connectors.

SPC SPC polish appeared next and was applied to FC and ST connectors, which provided return loss values of 40 dB while maintaining 0.2 dB insertion loss.

UPC Further work introduced UPC connectors, bringing return loss on non angled connectors down to 55 dB in singlemode fibers. This performance was obtained by perfecting the polishing technique and adjusting the curvature at the ferrule end. UPC polish is available for almost all singlemode connectors such as FC, SC, and ST.

Compatibility Due to their 8° angled design, APC connectors are not compatible with PC, SPC or UPC types. **Do Not Mate APC** connectors with other types. If an APC connector is inadvertently mated with another type connector, both should be inspected immediately for damage.

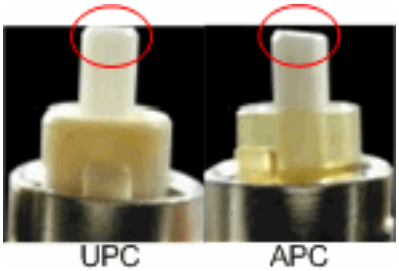
PC, SPC and UPC connectors are all compatible and any cross between them will typically generate an insertion loss of 0.2 dB. Return loss is more difficult to predict when different polishes are cross-connected, but it generally falls somewhere between the individual return loss specifications for each polish. For example, an FC/SPC to FC/UPC connection might give an insertion loss of 0.2 dB and a return loss of approximately 48 dB.

Test instruments equipped with UPC connectors would be capable of measuring PC, SPC and UPC systems without affecting their normal performance, however test instruments equipped with APC connectors are not capable of accurately measuring SPC and UPC systems.

Notice the distinct difference in angle between the UPC and APC endfaces.

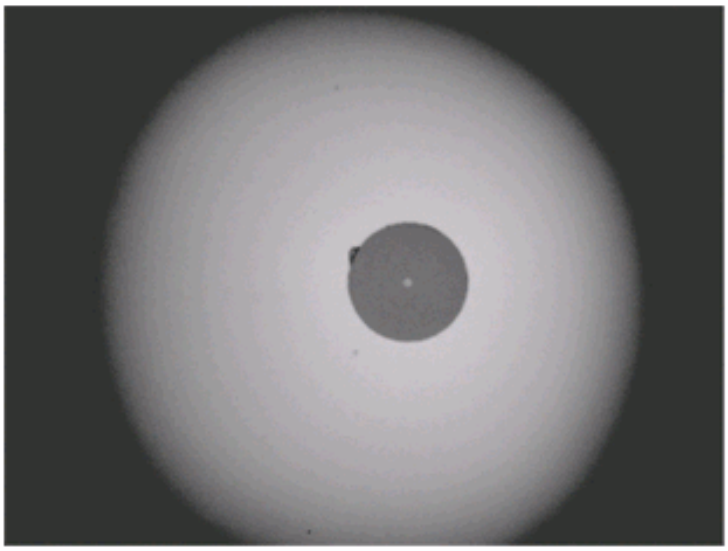
CAUTION:
Mating APC with any other type connector will cause damage to both connectors.

Figure 73: UPC & APC End Face Comparison

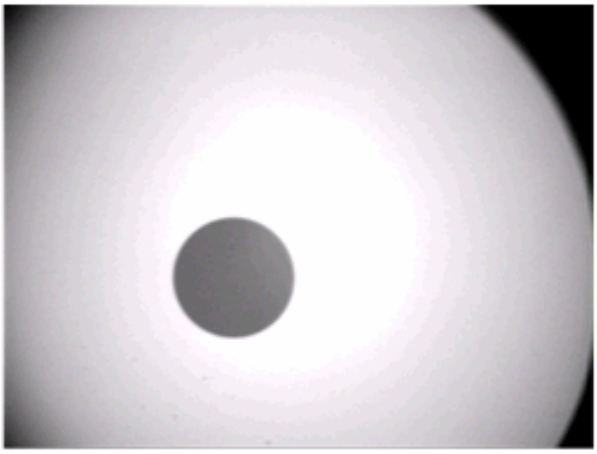


8. What Will I See?

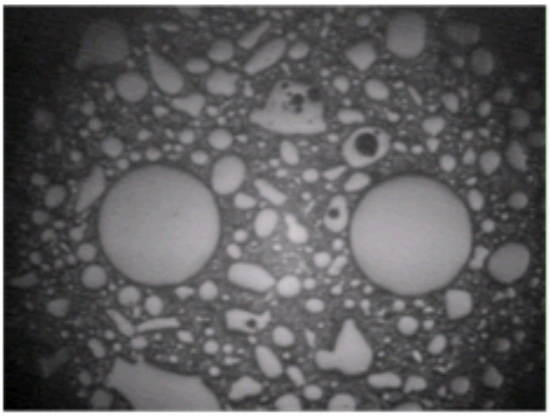
The following pictures are four typical connector views you may see when inspecting fibers. Please note that the core is not always visible.



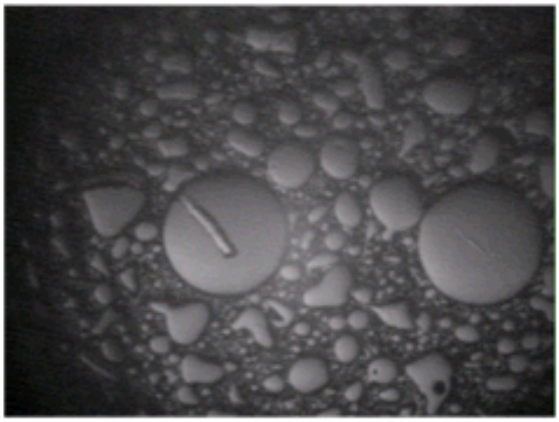
An LC connector with the core visible.



An LC connector with the core invisible.



An MPO connector with two of the eight fibers visible and the cores invisible.



An MPO connector with two of the eight fibers visible and the cores invisible. These fibers are dirty.

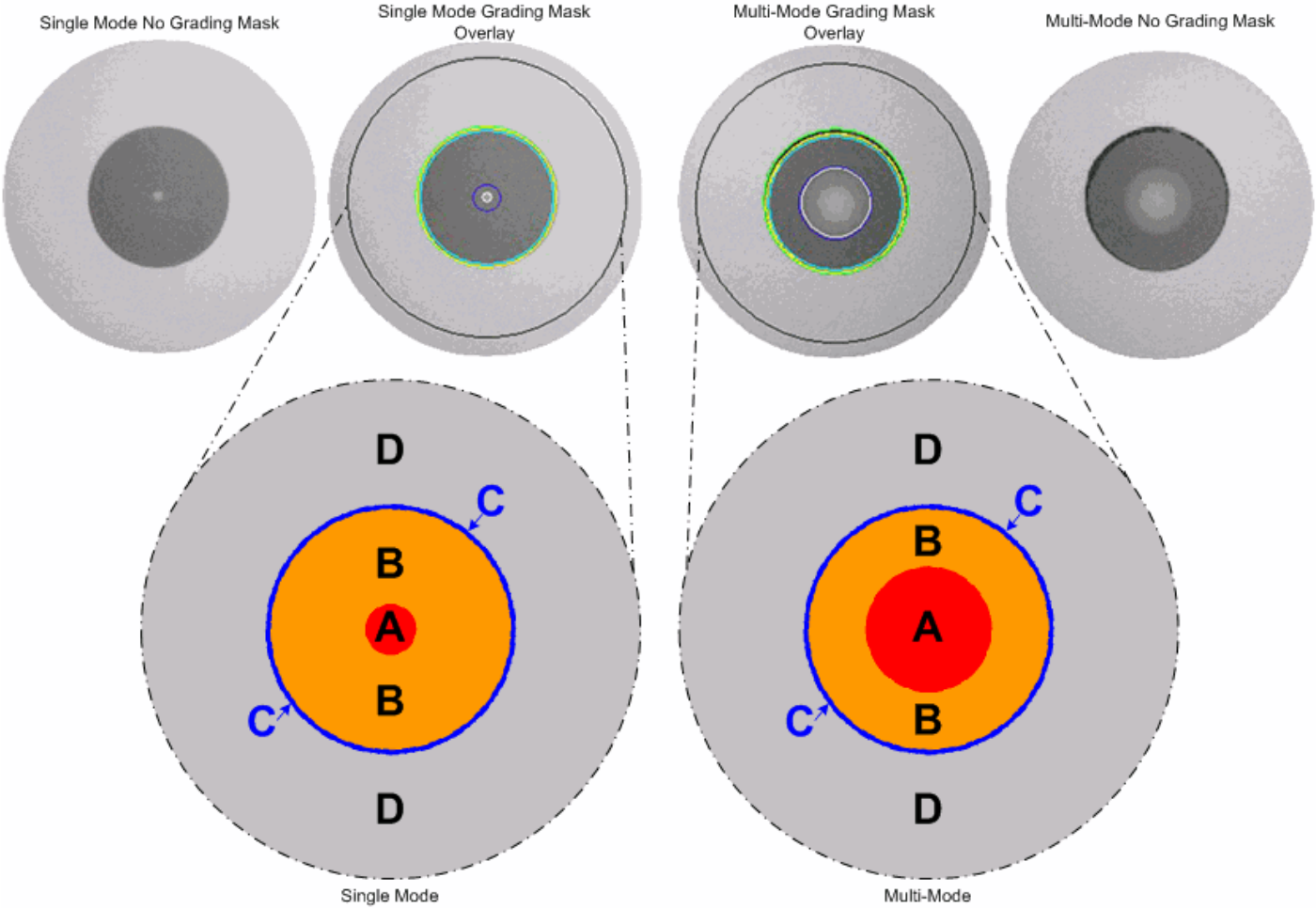
8.1. Single Mode or Multi-Mode ?

The following figure is made up of actual fiber pictures and then below that are labeled blow ups to compare Single Mode fiber to Multi-Mode fiber in an LC connector to allow the user to see the difference between the core sizes. The Cladding and Epoxy Ring maintain the same size in both. Single Mode or Multi-Mode can be found in most types of connectors. If you can not determine if a connector is Single Mode or Multi Mode, it should be handled as if is Single Mode.

Table 6: Size Comparison Between Single and Multi Mode

	Core*	**Critical Zone (A)**	**Cladding (B)**	**Epoxy (C)**	**Contact (D)**
Single Mode	8 to 10 µm	0 to 25 µm	25 to 120 µm	120 to 130 µm	130 to 250 µm
Multi-Mode	50 or 62.5 µm	0 to 50 or 62.5 µm	25 to 120 µm	120 to 130 µm	130 to 250 µm
*The Core is not detailed in the Single Mode Blow Up, however it is a part of Zone A.					

Figure 75: Comparison of Single Mode to Multi-Mode Fiber End Faces



9. Optical Connector End Face Criteria

Inspection of the surface finish of the optical connectors shall show the end-face to meet the criteria outlined in the following section when inspected at 200x magnification. If required, the ferrule end-face shall be cleaned in accordance with Section Quick Guide For Cleaning Tools . The end-face must be inspected prior to testing, mating, or installation of any optical connector. If a clean dust cap was placed on a connector, the end-face must be reinspected and if necessary cleaned prior to mating or installation.

The inspection equipment used for evaluating the optical fiber end-face cleanliness must have sufficient resolution and accuracy to be able to detect/measure the size of defects described in the end-face criteria in this section.

A template may be used to help assess defect size. It can be built by scaling the dimension of every zone and defect sizes until it coincides with the fiber diameter described for Zone C.

Choose one of the following links to go direct to the criteria section that interests you.

- Single Mode Single Fiber Ferrule Connector End Face Criteria
- Single Mode Multi Fiber Ferrule Connector End-Face Criteria
- Multi-Mode Single Fiber Ferrule Connector End Face Criteria

9.1. Single Mode Single Fiber Ferrule Connector End Face Criteria

This section applies to Single Mode single fiber ferrule connectors (for example FC, SC, LC, ST…). The following illustration shows an actual picture of a fiber on the left side with a mask superimposed and on the right the mask is labeled with Zones A, B, C, and D. The Zones and the criteria for each zone are defined in the table following the figures.

Figure 76: Single Mode Fiber End Face with Mask

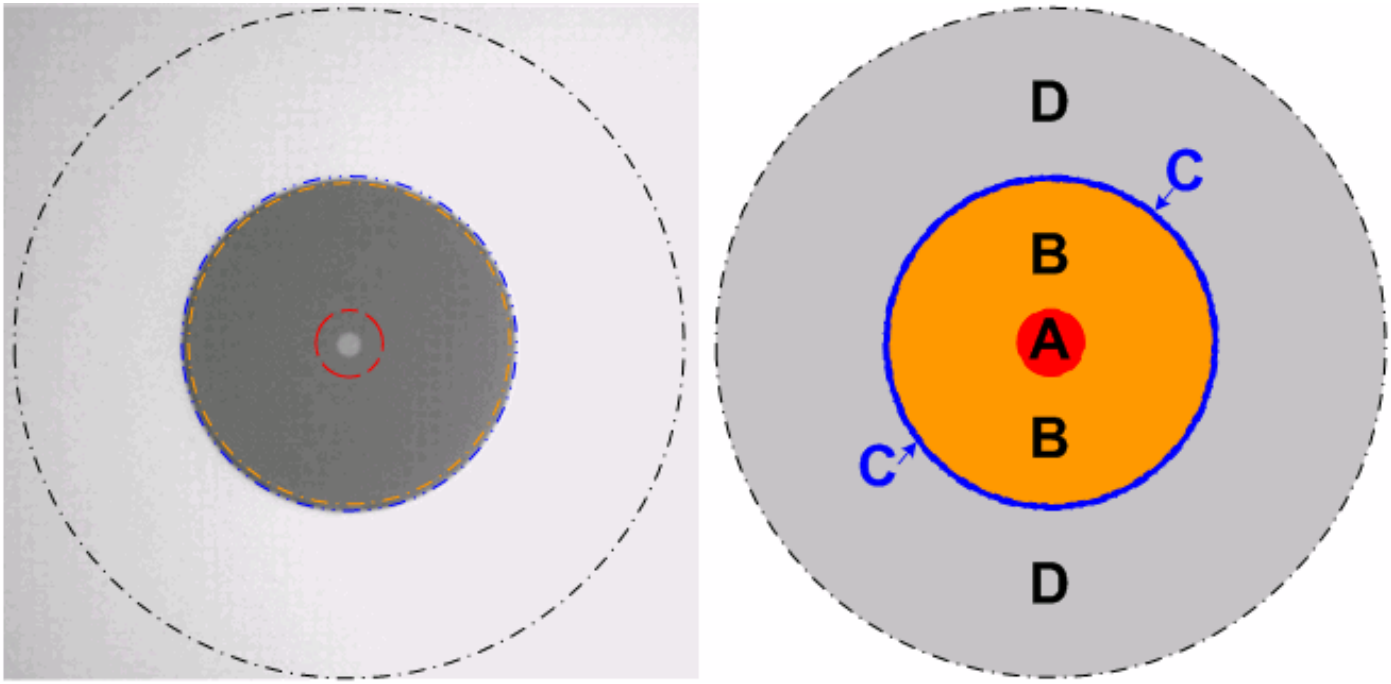


Table 7: Single Mode Criteria

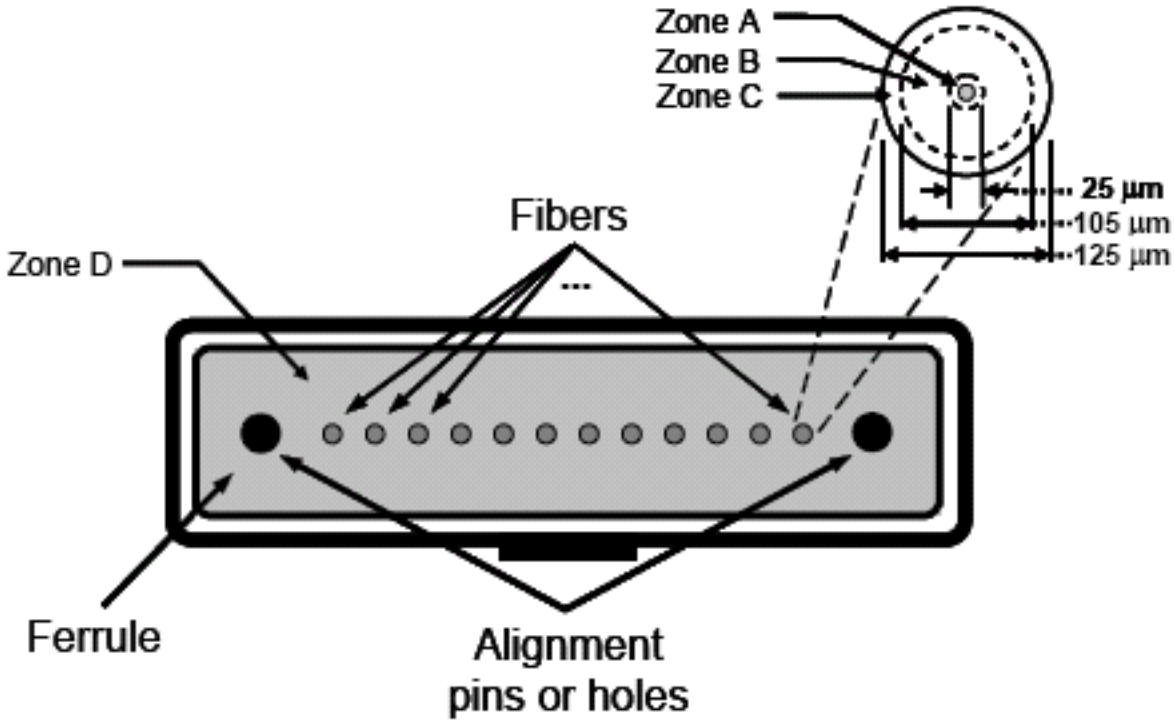
			Allowable Defects and Scratches[2, 3]	
Zone	**Description**	**Diameter**	**Defects (diameter)[4, 5]**	**Scratches (width)[6]**
A	Critical Zone	25 µm	None visible @ 200X	None visible @ 200X
B	Cladding Zone	25 to 120 µm	any <2 µm 5 from 2 - 5 µm None > 5 µm	None > 3 µm[1]
C	Adhesive Zone	120 to 130 µm	none > 10 µm	any scratch ok
D	Contact Zone	130 to 250 µm	none > 10µm	any scratch ok
Inspection is Performed at 200X				
Superscript #s indicates Notes Below				

1. When inspecting after polishing or while performing quality assurance of a new connector, a limit of five fine scratches (<3 µm) may be set in Zone B in order to establish that a reliable process is being used by the manufacturer.
2. Any contaminants that are removable must be cleaned from the end-face.
3. Any defects or scratches that extend across multiple zones are subject to the most stringent criteria.
4. The size of a defect equals the smallest circle that completely encompasses the defect.
5. Defects are defined as “permanent non-linear features”. This includes contamination, pits, etc.
6. Scratches are defined as “permanent linear features”.

9.2. Single Mode Multi Fiber Ferrule Connector End-Face Criteria

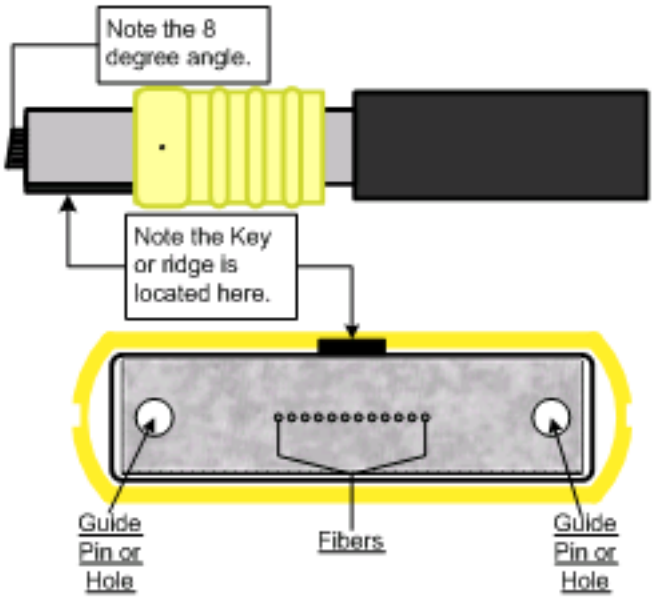
This section applies to multi fiber ferrule connectors (for example, MPO, MTP, MT-RJ…). The following illustration shows the end of a Multi Fiber Ferrule with 12 fibers and a blow up of a single fiber with Zones A, B, C, and D labeled. Zone A is the Critical or Core Zone, Zone B is the Cladding Zone, Zone C is the Epoxy or Adhesive Zone, and Zone D is the Contact Zone.

Figure 77: MPO End Face



The following graphic shows the 8 degree angle that is present on some MPO connectors along with the key or ridge that keeps the angle and the order of the fibers correctly aligned. The angle also becomes important when using a cassette type (i.e. Cleaner, Fiber Optic Connector Universal) or flat wipe (i.e. Cleaner Fiber Wipe Premoistened). The user must slightly angle the connector in relation to the cleaner to insure full contact.

Figure 78: MPO Single Mode Angle



The following illustration shows a picture of a single fiber in an MPO connector on the left side with a mask superimposed and on the right the mask is labeled with Zones A, B, C, and D. Zone A is the Critical or Core Zone, Zone B is the Cladding Zone, Zone C is the Epoxy or Adhesive Zone, and Zone D is the Contact Zone. The core is commonly not visible when viewing MPO connectors.

Figure 79: MPO with Template

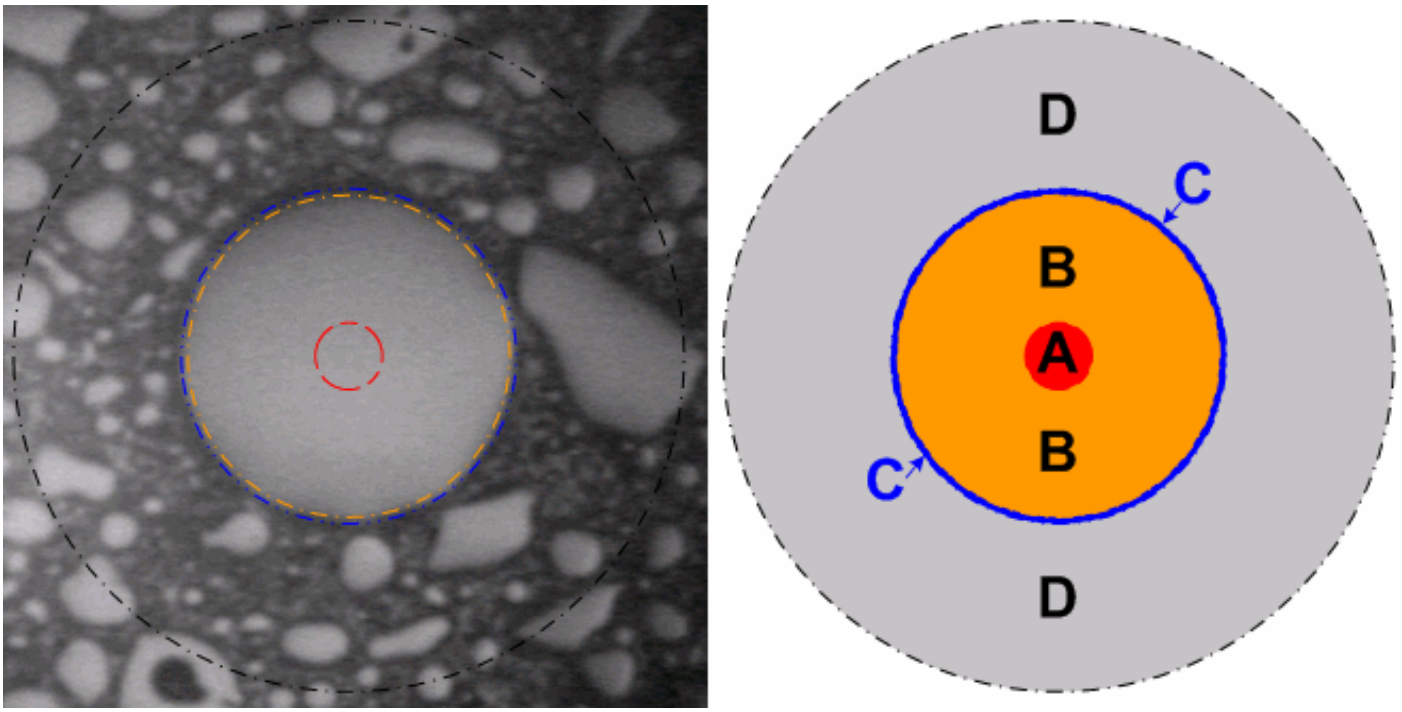


Table 9: Single Mode MPO Criteria

			Allowable Defects and Scratches[2, 3]	
Zone	**Description**	**Diameter**	**Defects (diameter)[4, 5]**	**Scratches (width)[6]**
A	Critical Zone	0 to 25 µµm	None visible	None visible
B	Cladding Zone	25 to 120 µm	any <2 µm 5 from 2 - 5 µm None > 5 µm	None > 3 µm[1]
C	Adhesive Zone	120 to 130 µm	See NOTE 7	See NOTE 7
D	Contact Zone	130 to 250 µm	See NOTE 7	See NOTE 7
Inspection is Performed at 200X				
Superscript #s indicates Notes Below				

1. When inspecting after polishing or while performing quality assurance of a new connector, a limit of five fine scratches (<3 µm) may be set in Zone B in order to establish that a reliable process is being used by the manufacturer.

2. Any contaminants that are removable must be cleaned from the end-face.

3. Any defects or scratches that extend across multiple zones are subject to the most stringent criteria.

4. The size of a defect equals the smallest circle that completely encompasses the defect.

5. Defects are defined as “permanent non-linear features.” This includes contamination, pits, etc.

6. Scratches are defined as “permanent linear features.”

7. Criteria for Zones C and D should be ignored after cleaning due to the appearance of the glass filled plastic ferrule. Also, because the core & cladding slightly protrude from the plastic ferrule, a small amount of edge-chipping is allowed. This accounts for any shadowing along the cladding edge that can result on the image as well.

9.3. Multi-Mode Single Fiber Ferrule Connector End Face Criteria

This section applies to Multi-mode single fiber ferrule connectors (for example FC, SC, LC, ST…). The following illustration shows an actual picture of a fiber on the left side with a mask superimposed and on the right the mask is labeled with Zones A, B, C, and D. The Zones and the criteria for each zone are defined in the table following the figures.

Figure 80: Multi-Mode with Template

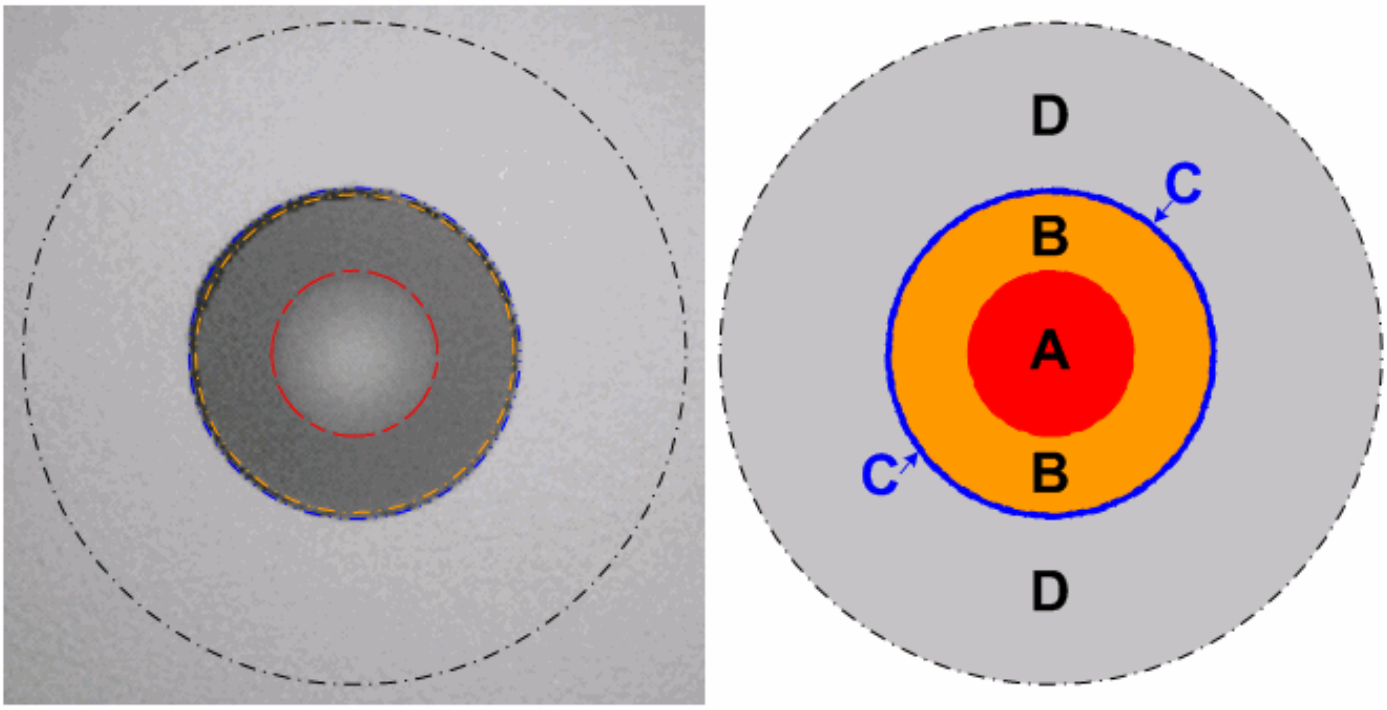


Table 11: Multi-Mode Single Conductor Criteria

Zone	Description	Diameter	Allowable Defects and Scratches[2, 3]	
			Defects (diameter)[4, 5]	Scratches (width)[6]
A	Core Zone (MM Fibers Only)	0 to 66 µm	5 <5 µm none >5 µm	5 <2 µm none >2 µm
B	Cladding (MM Fibers Only)	66 to120 µm	any <2 µm 8 from 2 - 5 µm none >5 µm[7]	none >2 µm[1]
C	Adhesive Zone	120 to 130 µm	any defect ok	any scratch ok
D	Contact Zone[8]	130 to 250 µm	none > 10 µm	any scratch ok
Inspection is Performed at 200X				
Superscript #s indicates Notes Below				

1. When inspecting after polishing or while performing quality assurance of a new connector, a limit of five fine scratches (<3 µm) may be set in Zone B in order to establish that a reliable process is being used by the manufacturer.
2. Any contaminants that are removable must be cleaned from the end-face.
3. Any defects or scratches that extend across multiple zones are subject to the most stringent criteria.
4. The size of a defect equals the smallest circle that completely encompasses the defect.
5. Defects are defined as ‘‘permanent non-linear features.’’ This includes contamination, pits, etc.
6. Scratches are defined as ‘‘permanent linear features.’’
7. MT, MPT, or MPO ferrules (e.g., ribbon) have allowable edge chipping from 115 to 125 µ**?**).
8. Zone D criteria does not apply to MT-ferrule or MPO connectors.

10. Items To Be Cleaned

NOTE:
ASK, Could it come in contact with the Connector End Face or Ferrule? IF Yes, Inspect, Clean, Inspect It.

Here are a few items to consider:

- Test Fiber Cords or Jumpers
- Test Sets adapters and probes
- Inspection Scope adapters and probes
- Alignment Sleeves

The test cords used with test sets and the test sets are frequently the most overlooked connector components for cleaning. The typical practice of testing fiber at the job site rarely includes routine inspection and cleaning of the reference cords that the technician carries with the optical test sets; that is, unless an obvious insertion loss problem develops during the test process. Often, after such an insertion loss problem has developed while testing, the reference (test) cord may have already encountered physical damage. In many cases, the damage may not even be detectable when inspecting the connector end faces with an Optical Scope. The problem that can occur is the reference (test) cord connectors may pick up contamination in the form of dust particles, or microscopic materials ground off from the mating adapter's alignment sleeve. All of these contaminants affect the final test outcome due to attenuation caused either from obstructing light in the fiber or from the air gap created between the two mating connectors. The reference (test) cord connectors can then transfer this debris from port to port, compounding the issue during repetitive tests and potentially threatening the quality of the installed connectors. The transference or these materials can affect the immediate test and can also permanently damage both connectors creating unnecessary replacement costs of expensive equipment such as Optical Transceivers.

Technicians shall take the following actions to maximize the life of cord sets:

- Inspect the connector of the Optical Test set before every use.
- Clean the connector of the Optical Test set before every use as necessary.
- Inspect the connector of the equipment (i.e. OCn cards, Fiber Cross connects) that the test cord will be mating with before every use.
- Clean the connector or the equipment (i.e. OCn cards, Fiber Cross connects) that the test cord will be mating with before every use as necessary.
- Place connector protectors (dust covers or terminators) on test cords between use.

- Replace the reference or test cords at such time that the connectors cannot be suitably cleaned for use between tests or the test signal is degraded when the test cord is used.

- Clean the sides of the ferrule for your test or reference cords or jumpers.

11. Grading The Fiber End Face

Grading the fiber end face is performed with the aid of an inspection scope and consists of:

- Identify the location of each zone (Core or Critical, Cladding, Epoxy, and Contact) on the fiber end face.
- How large is the contaminant or scratch and in which zone is it located.
- How many contaminants or scratches are located in each zone.

11.1. Grading Examples

If you are in HTML view, you may view the following files by right clicking on the file of your choice and then selecting “Open In New Window”. You will be greeted with a “Password” window to which you will respond by clicking the “Read Only” button.

If you are in HTML view, you may download the following files to your computer by right clicking on the file of your choice and then selecting “Save Target As”.

Fiber Grading_spencer_scenario1ss.pps
You may download this file from the online version of this document.
Note: You must have the proper application in order to open the file.
Fiber Grading_spencer_scenario2ss.pps
You may download this file from the online version of this document.
Note: You must have the proper application in order to open the file.
Fiber Grading_spencer_scenario3ss.pps
You may download this file from the online version of this document.
Note: You must have the proper application in order to open the file.

11.2. Identify the location of each zone (Core or Critical, Cladding, Epoxy, and Contact) on the fiber end face.

Use the Overlay or Template from the vendor of the scope being used to find the zones. This is accomplished by displaying the fiber end on the scope and then centering the overlay on top of the image. This will give an approximate location of each of the zones. Refer to “Grading Examples” previously illustrated.

11.3. How large and How many contaminants, defects, or scratches and in which zone are they located.

When the zones have been identified, make a note of which zone is affected by debris. Place the calibrated dot that provides the closest match to each particle and make a note. Consult the table in the appropriate section for the criteria.

- Single Mode Single Fiber Ferrule Connector End Face Criteria
- Single Mode Multi Fiber Ferrule Connector End-Face Criteria
- Multi-Mode Single Fiber Ferrule Connector End Face Criteria

NOTE:
ALL movable contaminants must be removed from the viewing area.

12. Miscellaneous Cleaning Procedures

CAUTION:
Inspection should ALWAYS precede cleaning or mating of optical connectors to prevent damage or contamination of the connector.

Fiber optic connectors must be inspected and cleaned before every mating in order to insure optimum performance. If a clean dust cap is placed on a connector, the end face must still be inspected prior to mating or installation.

Alignment sleeves and adapter housings must be cleaned if they have been contaminated with a dirty connector.

If a connector is mated while contaminated, especially with hard contaminant particles, fiber end-face damage may occur or the contaminant may get firmly bonded to the fiber end-face. This type of contaminant requires polishing to remove the contamination.

12.1. Procedures

This section is divided into the two parts:

- Adapter or Bulkhead Cleaning
- Ferrule Cleaning

12.1.1. Adapter Cleaning

This section applies to the cleaning of unmated single ferrule fiber optic adapters (The metal or plastic body that mates two connectors of same or different types). The process steps described in this section are for the blind cleaning of an adapter sleeve.

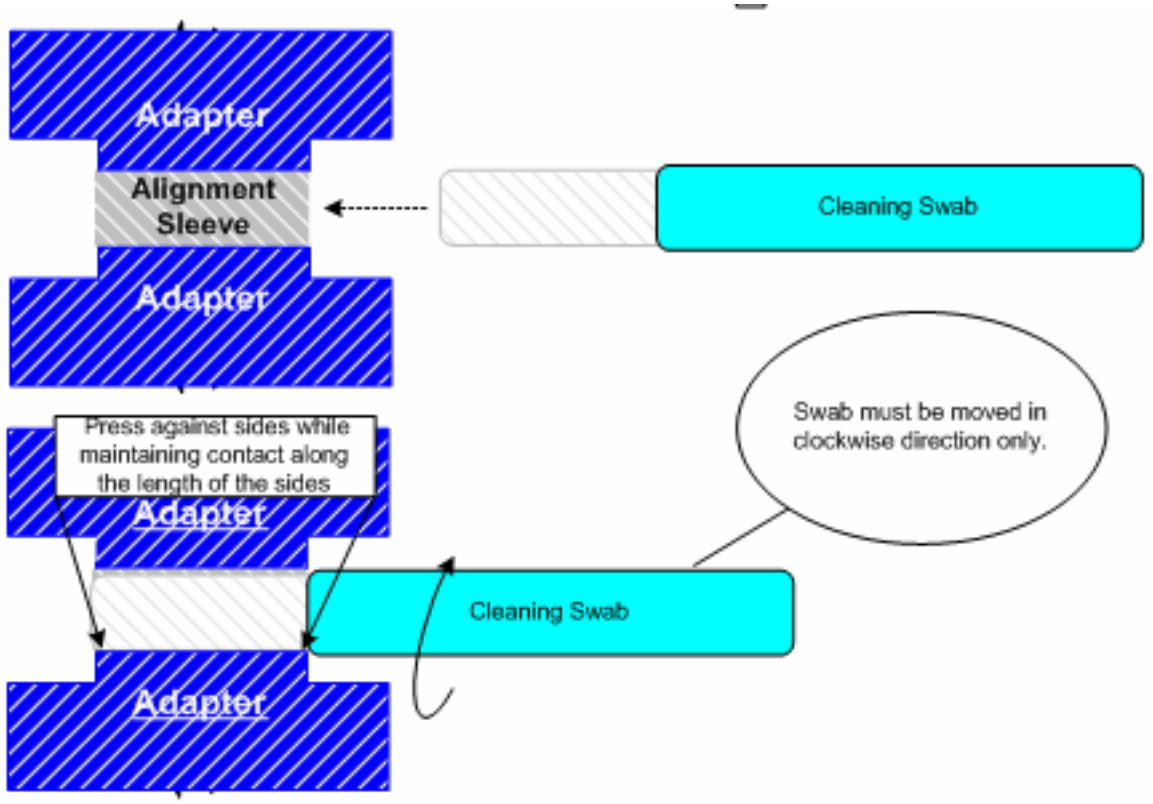
This section is further divided into two sections:

- Single Ferrule adapter Cleaning
- Multi-Ferrule adapter Cleaning

12.1.1.1. Single Ferrule Adapter Cleaning

Refer to figure “Cleaning Alignment Sleeve” for a picture view of single ferrule adapter cleaning. Refer to In-Situ Connector Cleaner LC or In-Situ Connector Cleaner SC for recommended cleaning supplies.

Figure 82: Cleaning Alignment Sleeve



1. Remove the protective caps from the adapter housing and store in a clean ESD plastic bag.
2. Take a new and clean alignment sleeve cleaner (swab) and insert into the adapter.
3. The alignment sleeve is slightly larger than the Cleaning Swab so it must be pressed against the side very lightly while maintaining contact along the length of the sides of the adapter and moved around the circumference.
   Note: Excessive pressure on the swab toward the side of the alignment sleeve can cause bending and loss of contact inside the adapter.
4. Remove the swab from the adapter.
5. If the adapter is not to be used immediately, place clean dust caps on. Otherwise, insert clean connectors into the adapter.

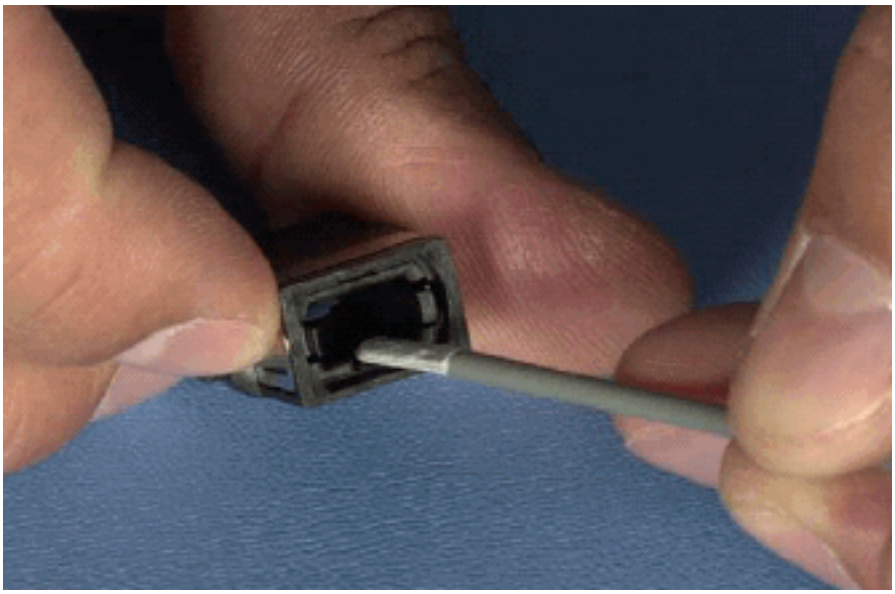
Important Notes:

- Solvents (i.e. IPA) or compressed air should not be used for adapter cleaning.
- Each swab is used once and disposed of to reduce the risk of cross-contamination between adapters.

12.1.1.2. Multi-Ferrule Adapter Cleaning

Refer to figure “Multiple Fiber Ferrule” for a view of multi-fiber ferrule adapter cleaning. Refer to In-Situ Connector Cleaner LC or In-Situ Connector Cleaner SC for suggestions of recommended cleaning supplies.

Figure 83: Multiple Ferrule Adapter



This section applies to the cleaning of unmated multi-ferrule fiber optic adapter. The process steps described in this section are for the blind cleaning of the adapter as there are currently no tools to inspect the cleanliness of the adapter sleeve.

1. Remove the protective caps from the adapter housing and store in a clean ESD plastic bag until the cleaning of the adapter housing and alignment sleeve is completed.

2. Take a new, clean alignment sleeve cleaner (swab) and insert into the adapter to clean all the internal surfaces of the adapter. Check for any apparent dirt remaining in the adapter. Repeat the process if necessary.

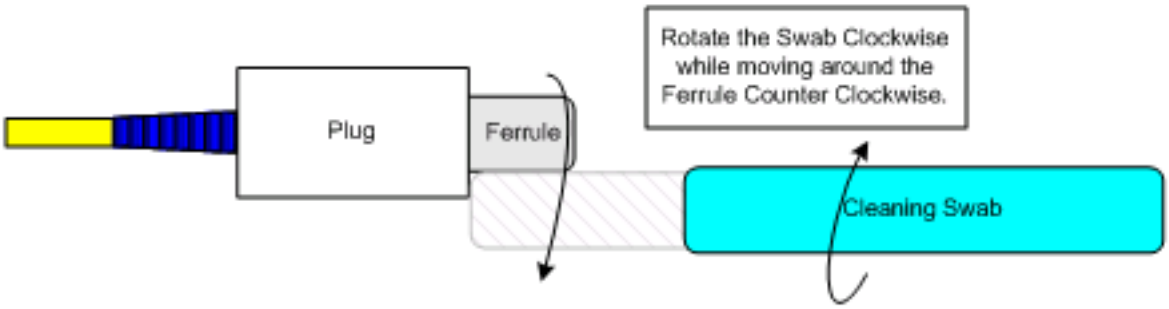
3. If the adapter is not to be used immediately, place a clean dust cap on the adapter. Otherwise, insert a clean connector into the adapter.

   Important Note: • Solvents (i.e. IPA) should not be used for adapter cleaning, as there is no way to determine if residues are still present after cleaning and the solvent could get trapped in the many crevices of the adapter.

12.1.2. Ferrule Cleaning Single

Refer to figure “Cleaning the Ferrule” for a view of single ferrule cleaning. Refer to In-Situ Connector Cleaner LC or In-Situ Connector Cleaner SC for suggestions of recommended cleaning supplies.

Figure 84: Cleaning the Ferrule



1. Remove the protective caps from the ferrule and store in a clean ESD plastic bag until cleaning the ferrule is completed.
2. Take a new and clean swab and place the side of the swab against the side of the Ferrule as shown in the figure above.
3. Move the swab counter clockwise around the Ferrule while twisting the swab clockwise.

13. Contact List

Name	SBCUID	Phone #	Department / Responsibility
Jack Spencer	js9082	214 320 7955	NOP/Author
Michael C. Allen	ma1562	(614)223-8031	Sr. Technical Mgr.
David C. Arreguin	da3906	(210) 246-8572	Area Mgr Lightspeed
Byron Atkinson	ba2593	(847)248-2686	Senior Technical Mgr.
Marty Chance	mc7975	(916) 977-8765	Senior Technical Mgr.
Paul Fearn	hf4977	(214) 320-7954	NOP
Steven J Gloeckle	sg4681	(847) 248-3015	Tech Staff - NSE
Tony Hanson	ah0265	(972) 454-6455	Area Mgr ESAC SW
Zaffar Iqbal	zi1916	(916) 972-2837	AM-Technology Support
Kent McCammon	km2131	(925) 824-1028	LIGHTSPEED & ADVANCED ACCESS TECH
Keith Pacini	kp3134	(312) 220-2611	Area Mgr ESAC MW
Booker Tyrone	bt7957	(512) 372-5621	Lead Member of Technical Staff
Mike Yeilding	my1515	(925) 823-4747	Lead Network Engineering Manager NP&E GES Common Systems

14. Revision Log

DATE	ISSUE	DESCRIPTION
01/24/2008	4	Major rewrite of entire document to bring into compliance with industry standards.

Acronyms

A.1. DOCUMENT SPECIFIC ACRONYMS

N/A

A.2. NETWORK ACRONYMS DICTIONARY

Refer to ATT-000-000-020, Network Acronyms Dictionary.