



ATT-TP-76461

Fiber optic Connector Cleaning Standards

Abstract

Presented in this document are the AT&T standards for the proper cleaning of fiber optic connectors. This document incorporates all the latest standards for the communications industry and provides the going-forward plan for all AT&T fiber optic cleaning products.

Audience: The primary audience for this document are AT&T Communications Inc subsidiaries in the following disciplines: Local Field Organization (LFO-IN), Special Services (LFO-OUT), Switch Capacity Planner/Engineer, Transport Equipment Engineer (TEE), Facility Equipment Engineer (FEE), Digital Transport Engineer (DTE), Maintenance Engineer, Space Planner, Frame Planner, Long Range Technical Planners, Outside Plant, Fundamental Network Planners, New Technology Introduction, Fiber to the Premises (FTTP), AT&T Laboratories and most importantly, anyone that may be exposed or required to work on or in close proximity to fiber optic systems. This document is to be used both within and outside AT&T LOCAL EXCHANGE companies and their Authorized Vendors.

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This document follows the standards set forth by ATT-770-000-013, *Safety Guidelines for Fiber Communications Systems*, Issue C, dated July 2004.

The AT&T Safety Laser Officer is:

Jay Weir, Area Manager-Corporate Laser Safety Officer
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2. Reasons for Reissue

Issue 3, Section-All: Revisions reflecting AT&T Knowledge Ventures L.P.

Issue 3, Section 1: Copyright Page updated in its entirety.

Issue 3, Section 3: Paragraph B-Updated to show the dry method as standard with the wet process being used with caution under low power services.

Issue 3, Section 3: Paragraph B-Additional cautions added to the list.

Issue 3, Section 3: New Paragraph C-What are cleaning standards?

Issue 3, Section 3: New Paragraph D covering Safety Guidelines.

Issue 3, Section 3: New Paragraph E covering what should be cleaned.

Issue 3, Section 4: Paragraph E-New covering wet cleaning process (alcohol)

Issue 3, Section 4: Paragraph F-New covering preferred alcohol wipe product.

Issue 3, Section 5: Paragraph A-New Section covering the Inspection Process.

Issue 3, Section 5: Paragraph B-New Illustration showing the Cleaning Process Sequence

Issue 3, Section 5: Paragraph D-Update on the use and cautions for Alcohol Based Cleaning

Issue 3, Section 5: Paragraph E changed to F.

Issue 3, Section 5: Paragraph E-New showing illustrations of connector cleaning

Issue 3, Section 6: New Section covering Inspection Scopes.

Issue 3, Section 7: New Paragraph on Dust Caps

Issue 3, Section 7: New Paragraph on Terminators

Issue 3, Section 8: Reference Section updated in its entirety.

Issue 3, Section 9: Contact Section updated in its entirety.

3. Introduction

3A. Attention

***** Attention*****

Optical protection and safety is serious matter. This document will cover the potential risks, hazards and the proactive measures to be taken on fiber optic communications equipment and facilities. Even if the exposure is minimal, every AT&T, CLEC or AT&T Approved Vendor employee must take great care in the product approvals, engineering, installation and maintenance of these optical systems. It is expected that all parties will perform in a manner that protects the human element in the equation at all times. Immediate corrective action will be taken by ATT personnel for any direct exposure of optical communication signals.

Remember:

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



Any individual that has business within AT&T facilities and structures must comply with AT&T rules and dictates. Failure to follow expected standards will warrant immediate and severe action by AT&T Management. Document all breeches of safety.

3B. Cautions

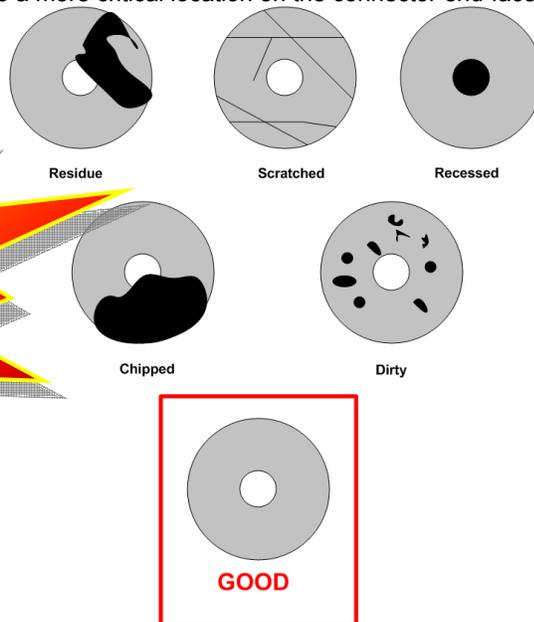
1. First and foremost, it is extremely critical that all technicians working on Fiber Optic technology take proper precautions with regard to laser transmissions that will be concentrated and directed toward the working employee. ***Do not expose eyes to this optical transmission and insure that all end caps and/or terminators are properly placed on all connector ends.***
2. Measure the Power Level of the combined signal (understand that the power level of each channel is additive to the combined signal.) Most Fiber Optic transmissions operate in the negative (-) dB range, but with newer Fiber Optic technologies, especially with long reach transmitters, the potential exists to have a positive (+) dB Power Level.
3. Expect the actual measured power level loss to be 3-dB when traversing each combined path. Insure that your calculations account for this in your optical loss budget.
4. Never remove more than 2-inches of the outer jacket sleeve at any point.
5. Don't splice to reattach or repair damaged cables between the Network Equipment and the Demarcation Point within the Central Office. Always pull a new cable or jumper to correct the problem.
6. Do not place fiber optic cabling over any electrical cables, or place within 6 inches of any electrical cables.
7. Do not crush, compress, place excessive weight, walk on or have over 10-lbs of cable weight placed on this cable.
8. Do not stretch or pull the fiber optic cabling beyond a tension limit of 20 lbs. Pull with constant static tension; do not pull with dynamic (sudden pull) tension loads greater than 5 lbs.
9. If a cable breaks or a connector becomes accidentally disconnected, the following practices should be followed:
 - Do not examine or look directly into broken, severed, or disconnected optical fibers or cables.
 - De-energize the affected part of the optical system if the means to do so is clear.
 - Arrange for a trained service person to de-energize the optical system and repair or replace the optical fiber cable.
10. Immediately notify Management of any condition or situation that has the potential to bypass established safety protocol or cause any potential injury or property damage.
11. Don't even kid around. Even pointing an unlit (dark or unterminated) fiber towards another represents serious grounds for immediate action.
12. Immediately report to management any suspicious, known, abnormal situation or the potential for exposure to optical radiation.
13. Keep all food and beverages out of the work area. If fiber particles are ingested they can cause internal hemorrhaging.

14. Always wear safety glasses with side shields and protective gloves. Treat fiber optic splinters the same as you would with glass splinters.
15. Never look directly into the end of fiber cables until you are positive that there is no light source (either visible or invisible to the human eye) at the other end. Use a fiber optic power meter or AT&T approved video scope.
16. When using an optical tracer or continuity tracer, look at the fiber from an angle at least 6 inches away from the human eye to determine if the light is present.
17. Only work in ventilated areas.
18. Contact wearers must not handle their lenses until they have thoroughly washed their hands. Do not touch your eyes while working with fiber optic systems until you have thoroughly washed your hands.
19. Put all cut fiber pieces in a safe place.
20. Thoroughly clean your work area when you are done.
21. Do not smoke while working with fiber optic systems.

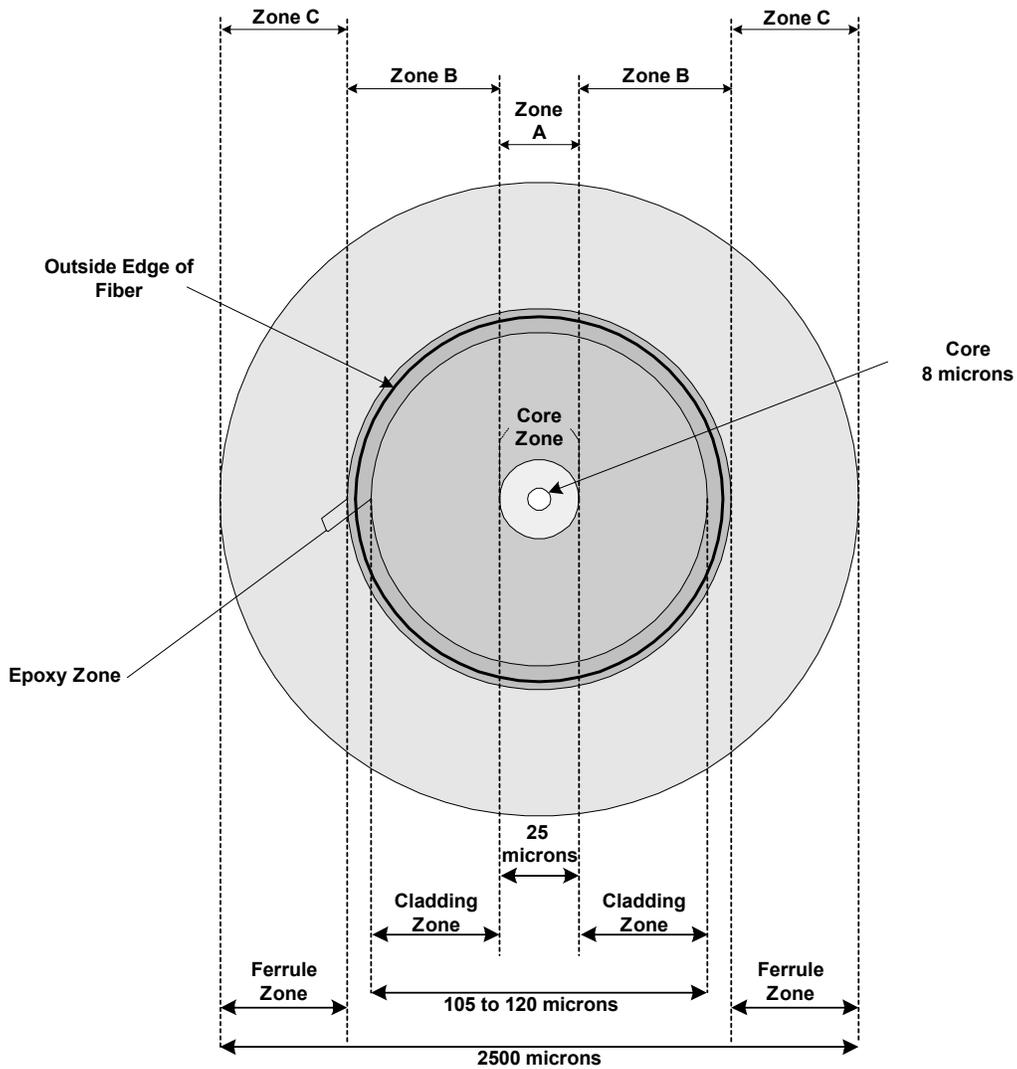
3C. What are the cleaning standards?

Most industry members and Standards groups have divided the connector end-face of single mode fibers into regions: Core Zone, Cladding Zone, Epoxy/Buffer Zone, and Ferrule/Strength Material Zone. All zones are defined relative to the center of a 125-micron fiber in a ferrule. Four concentric circles define the regions. Typically the center circle is 25 microns in diameter and makes up the core zone. The first ring that extends from the core zone to nearly the edge of the fiber, a diameter of 105 microns to 120 microns is the cladding zone. The Epoxy/Buffer zone is a narrow ring (only 5 to 20 microns wide) and extends to just beyond the fiber edge. The last region is the largest zone and extends from the Epoxy/Buffer Zone to the outside of the ferrule, which would be from 130 micron diameter to 250 micron diameter for a 2.5mm ferrule. We will call this the Ferrule/Strength Material zone.

- The **Core zone** is most critical and therefore has the most stringent requirements. Typically it is desirable to have no defects in the 8 micron center of the core zone (the light carrying part of the fiber). However, many specifications allow scratches less than $\frac{3}{4}$ micron in width and pits less than 1.5 microns in diameter in this core zone. **No contamination (movable or engrained) is allowed within this core zone therefore being completely free of defects and contamination.**
- Inspection requirements for the **Cladding zone** dictate **No contamination (movable or engrained) is allowed within this core zone therefore being completely free of defects and contamination.**
- In the **Epoxy/Buffer zone** constraints are more lenient. Any blemish wholly contained within that zone is tolerated. The epoxy ring is approximately 10 microns wide. However, once again, no contamination (movable or engrained) is allowed in this region.
- Most standards for the **Ferrule/Strength Material zone** allow scratches less than 10 microns in width and surface blemishes less than 30 microns in diameter. Contamination is allowed if it is less than 30 microns in diameter and engrained, that is, it cannot be removed by cleaning and therefore could not possibly move to a more critical location on the connector end-face.



Inspections need to be made with up to 400X magnification and no defects found in the Core and Cladding Sections



Zone	Diameter Range	Max Scratch Width	Max Blemish diameter	Contamination
Core	0-25 microns	None	None	None
Cladding	25-120 microns	None	None	None
Epoxy Ring	120-130 microns	Ok within ring	Ok within ring	None
Ferrule	130 – edge of ferrule	10 microns	30 microns	Engrained less than 30 microns in diameter.

3D. Safety is Paramount!

The AT&T Safety Department has created ATT-770-000-013, *Safety Guidelines for Fiber Communications Systems*, Issue 1, dated July 2004. This document forms the foundation for all AT&T fiber optic safety within AT&T Communications Inc. Additional information regarding this practice and other safety related items may be found on the AT&T Internal Web Site: <http://worksafe.sbc.com/index.htm>. This document and other subtending documents will use ATT-770-000-013 as the source reference for fiber optic safety issues.

Warning: Optical protection and safety is a serious matter. This document will cover some of the potential risks, hazards and the proactive measures to be taken on fiber optic communications equipment and facilities. Even if the exposure is minimal, every AT&T, CLEC or AT&T Approved Vendor employee must take great care in the product approvals, engineering, installation and maintenance of these optical systems. It is expected that all parties will perform in a manner that protects the human element in the equation at all times. Don't even kid around. This isn't just a "Star Trek" movie or serial TV show. Pointing an unlit (dark or unterminated) fiber towards another represents serious grounds for immediate action.

Fiber optic systems and their associated optical test sets use semiconductor lasers and Light Emitting Diodes (LED)s that emit energy at wavelengths from 0650 to 1650 nanometers (nm) into the light-guide fiber optic cables. The systems are designed to operate with the light beam totally enclosed within the fiber optic cable and terminating network equipment. A significant period of exposure could occur during installation/maintenance service when fiber optic cables and connectors are disconnected or unterminated or during an infrequent cable break.

The human eye can only see a small portion of the light spectrum (400-700 nm). Very few of the many telecommunications light frequencies are visible to the naked human eye while the vast majority of transmitted light will be invisible to the human eye. Since these light sources cannot be seen, the human involuntary nervous response will not activate upon exposure to intense light sources that cannot be seen visually. These "invisible" light sources will look dark or not activated while the source is transmitting a potentially harmful path that can injure the human eye. The only instance where a direct visual observation of a light path can be performed is when the individual has both ends of the unterminated fiber cable/jumpers in that individual's hands and can verify that they have no light source whatsoever. Always check the fiber with a AT&T approved power meter or non-direct viewing scope before examining it.

Another important issue of eye safety is getting fiber scraps or ends into the eye. As part of the termination and splicing process, you will be continually exposed to small scraps of bare fiber cleaved off the ends of the fibers. As always, **wear appropriate eye protection**. The employee must undergo a comprehensive eye examination in accordance with ATT-770-000-013, *Safety Guidelines for Fiber optic Communications Systems*, Issue 1, dated July 2004, anytime he/she suspects that eye damage has occurred as a result of fiber optic light exposure.

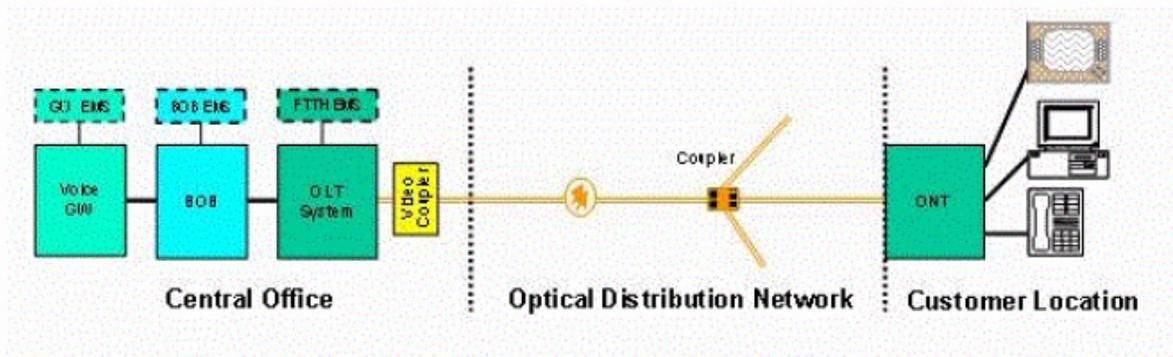
Fiber optic splicing and terminations use various chemical cleaners and adhesives as part of the processes. Normal handling procedures for these substances should be observed. If there are any questions, contact your supervisor for a Manufacturer Service Data Sheet (MSDS).

Always work in ventilated areas. Avoid skin contact as much as possible, and stop using chemicals that cause allergic reactions. Even simple isopropyl alcohol, used as a cleaner, is flammable and should be handled carefully.

Fusion splicers use an electric arc to make splices, so care must be taken to insure no flammable gasses are contained in the space where fusion splicing is performed. Splicing is never done in manholes where gasses can accumulate. The cables are brought up to the surface where all fiber splicing work is performed. The splicing area needs to be kept clean to insure good splicing.

Smoking should also not be allowed around fiber optic work. The ashes from smoking contribute to the dirt problems with fibers, in addition to the chance of explosions due to the presence of combustible substances.

As a representative sample, the below listed illustration is the Fiber-to-the-Premises/Node (FTTP/FTTN). At every optical access and interface point, there is a potential risk to the human form. As a result, safety standards must be followed at each stage and step.

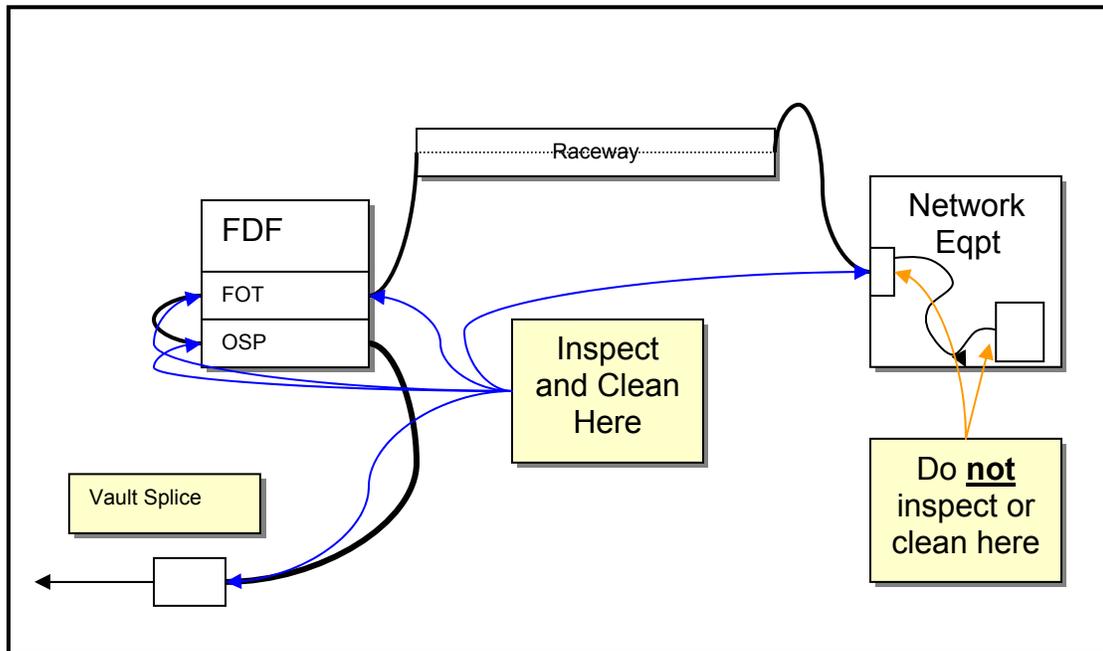


Basic FTTP Terminology

- ONT - Optical Network Termination. Provides interfaces for the customer's telephone, data and video equipment.
- ODN - Optical Distribution Network. Provides the passive optical transmission path between the ONTs and OLT; Composed of Passive Optical Networks (PONs). Each PON can support up to 32 ONTs and consists of fiber-optic cable & optical couplers.
- OLT - Optical Line Termination (OLT). Provides the network interface for the PONs.
- BOB - Broadband Optical Box. Provides routing/switching for the voice and data traffic.
- VGW - Voice Gateway. Provides functions to convert B-PON/ATM voice to TDM voice.
- EMS - Element Management System. Provides management functions for the network elements.
- WDM Coupler - Wave Division Multiplexing Coupler. Inserts Video signal

3E. 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 manufacturers sealed network equipment, wherever it is located, must have the mating pair cleaned and inspected. The example below shows where the connectors must be cleaned:



Under normal circumstances, AT&T personnel and their contractors do not need to open sealed network equipment to clean the connectors within the product. 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-cleaning upon subsequent termination at a later date and time.

Based upon recent Telcordia Technologies findings, burnishing or cleaning the ends of the fiber connections is the normal expected process before service is placed on the fiber connections. Burnishing is the process of making the fiber end shiny or lustrous especially after rubbing or used to smooth the surface or turning an edge. (Most AT&T employees do not have this capability). Burnishing is different than the Wet or Dry cleaning process. With the advent of new higher power services, this method must be modified per the following table:

When to Burnish/Clean Fiber Optic Terminations

Power Level	Burnish/Clean	Impact
< + 15 dB ¹	Yes	Dry cleaning will have no effect on the fiber termination
+ 15 to + 29 dB	On an exception basis when field fusion splicing is performed. (See below for method.)	A thorough evaluation must be made to insure there are no working alternatives and the end must be cleaned in order for the service to work adequately
+ 30 dB or greater	No	This high power level will cause the burnished end to seriously degrade and fail

Note: The Dry Cleaning Method is the primary approved cleaning process approved within AT&T. Approved liquid (alcohol) based fiber optic cleaners may be used as an alternative method for low power services under a maximum of +10dBm after three dry cleaning efforts have already been performed without success. Any requests for non-approved cleaner devices will require the specific one-time approval of technical staff, Bernard Cross II – (972) 569-5925, E-Mail: bc6024@att.com.

The Fiber Distributing Frame (FDF) used within AT&T Communications Inc. uses a mating sleeve at the bulkhead of each panel assignment. The cabling from the front and rear are attached using connectors. The connector from the rear is mated with the connector from the front using the sleeve as a guide to mate the two connectors properly. It is very important that both connectors and the sleeve are cleaned prior to connection and that both have either a dust cap or terminator to preclude contamination. Be aware that one connector on one side that is contaminated can contaminate the clean connector on the other side of the bulkhead when they are mated. Irreparable damage can be caused by mating a contaminated connection. Inspection and cleaning steps cannot be overlooked.

Any manufacturer provided fiber jumpers or cables that have connectors outside of network equipment must be inspected and cleaned prior to use.

¹ Single fiber optic transmissions are typically in the –10 to –20 dB power level range. With the advent of combined wavelength technologies such as WDM, CWDW and DWDM, the combined power level may rise to the positive power level readings, since power levels are additive when optical signals are combined.

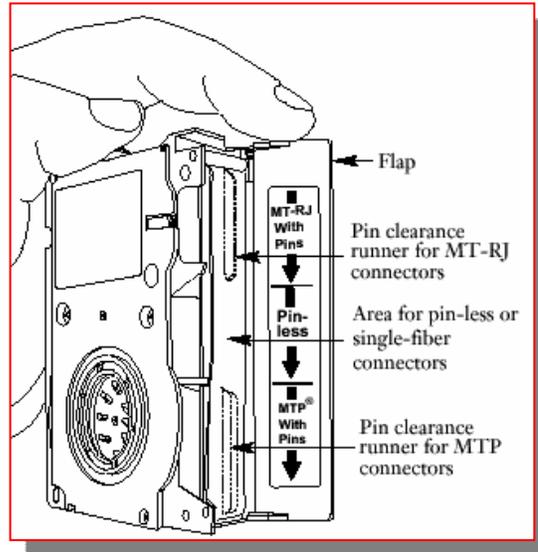
4. Approved Dry Fiber optic Connector Cleaners

4A. Cleaner, Fiber Optic Connector Universal Approval for Use

Reference FLASH Product Announcement from Construction Support Staff dated April 2002, the Cleaner, and Fiber optic Connector Universal manufactured by Corning Cable Systems. This document may be obtained internally within AT&T through the APEX system (apex.AT&T.com) with information available directly from the manufacturer by contacting the following:

Corning Cable Systems
PO Box 489
Hickory, North Carolina 38603-0489
(800) 743-2675

The 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. 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, or D4.



Ordering Information

Item is non-stock. Delivery interval is 3 days. Prices shown are approximate and may vary due to distribution.

DESCRIPTION - CLEANER, FIBER OPTIC CONNECTOR UNIVERSAL

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

AT&T-Midwest, AT&T-West, AT&T-East, and AT&T-Southwest

PID - 301053872

AT&T-East PID - 3582968

PRICE \$63.45

4B. Alcoa FCC-02R Fiber Optic Connector Cleaner Approval for Use

Reference FLASH Product Announcement from Construction Support Staff dated September 2001, the Cleaner, and Fiber optic Connector FCC-02R manufactured by Alco Fujikura Ltd. (AFL). This document may be obtained internally within AT&T through the APEX system (apex.Sbc.com) with information available directly from the manufacturer by contacting the following:

Corning Cable Systems
PO Box 489
Hickory, North Carolina 38603-0489
(800) 743-2675

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



Ordering Information

Item is Non-Stock. Delivery interval: 5 Days

AT&T-Midwest, AT&T-East, AT&T-Southwest and AT&T-West

DESCRIPTION - CLEANER, FIBER OPTIC CONNECTOR FCC-02R

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

PID - 301039228

Approx. Price: \$95.23

DESCRIPTION - REEL, REPLACEMENT FCC-4

NARRATIVE Replacement reel for Cleaner, Fiber Optic Connector

PID - 301039236

Item is stocked

Approx. Price: \$21.43

4C. FiberSwiper Approval for Use

Reference [ATT-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.AT&T.com](#)) with information available directly from the manufacturer by contacting the following:

Neptec Optical Solutions Inc.
675 N. Glenville Drive, Suite 195
Richardson, Texas 75081
(214) 261-9220

The FiberSwiper is a pocket-sized connector cleaner (4.37 long x 2.25 wide and 0.40 high inches). Each cassette holds cleaner cards that clean 13 connectors each (78 cleans total per pack). Each cleaner card has a perforated cover that protects each cleaning slot until used.



Illustration of the FiberSwiper Unit

The following two-digit Pattern Account is assigned to the FiberSwiper and will automatically convert to a predetermined Account Code when ordering the cassette or replacement cards.

SBC Midwest	PA 12
SBC SNET	PA 21
SBC Southwest	PA 08
SBC West	PA 28

Ordering Information:

Item Description	CLEANER FIBERSWIPER
SBC Midwest, SBC Southwest, SBC West PID	400186880
SBC SNET PID	3587883
Supplier Part Number	FIBERSWIPER
Stock/Non Stock	Non Stock
Delivery Interval	5 Days
Price Each	\$11.00
Catalog Narrative	A POCKET SIZED CONNECTOR CLEANER. HOLDS SIX CLEANER CARDS THAT CLEAN 13 CONNECTORS EACH.

Item Description	CLEANER FIBERSWIPER CARDS
SBC Midwest, SBC Southwest, SBC West PID	400186898
SBC SNET PID	3587884
Supplier Part Number	FIBERSWIPER-RC6
Stock/Non Stock	Non Stock
Delivery Interval	5 Days
Price Each	\$5.50
Catalog Narrative	PACKAGE OF SIX REPLACEMENT CLEANER CARDS FOR FIBERSWIPER.

4D. Female Connector Cleaner

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 and the male connectors plus the alignment sleeve must be cleaned respectfully, before the connection is made.

PID	Description	Price
301053468/3582952	CLEANER SPLIT SLEEVE TIP FOR SC	2.54 a pack

Catalog Narrative

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

PID	Description	Price
301116471/3587693	CLEANER SPLIT SLEEVE TIP FOR LC	2.69 a pack

Catalog Narrative

Designed to clean hard to reach areas and 2.5MM adapters. No alcohol or solvents necessary. Five to a pack.

4E. Wet Cleaning (Alcohol Isopropyl) Wipe Products

If an Alcohol based cleaning material is used, this product is the preferred item in order to reduce contamination.

PID 300079076

Description: CLEANER FIBER WIPE PREMOISTENED 200 CASE



4F. Wet Cleaning (Alcohol Isopropyl) Products

Use only as an absolute last resort due to contaminants entering the solution. When wet-cleaning is performed, the best solution is to use the wipe and swap wet-cleaner products found in 4E.

PID 300079050

Description: ALCOHOL ISOPROPYL 1 PT BTL



PID 300098308

Description: CLEANER FIBER DISPENSER PUSH TOP BTL

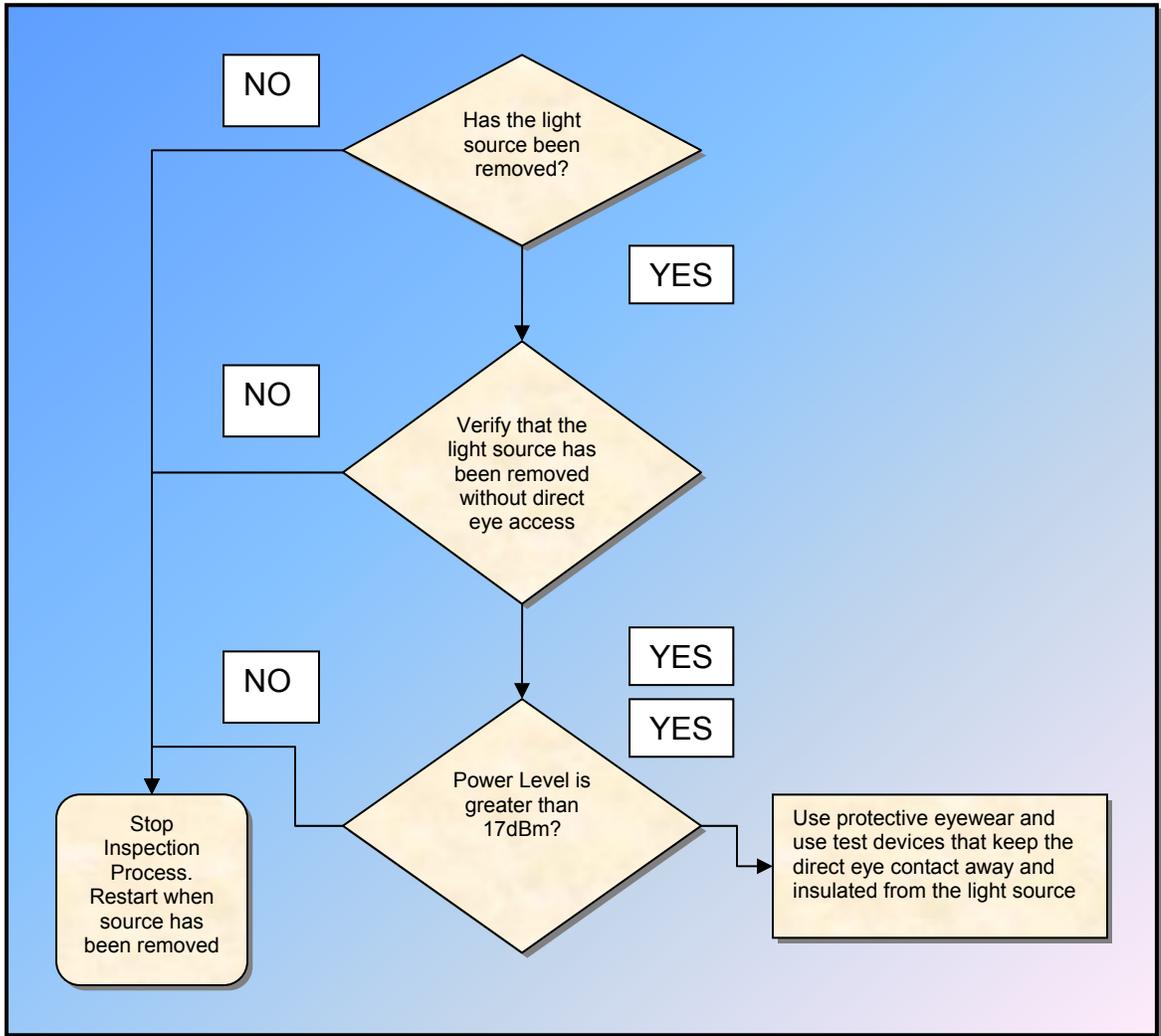


5. Fiber optic Inspection, Cleaning and Handling Activities

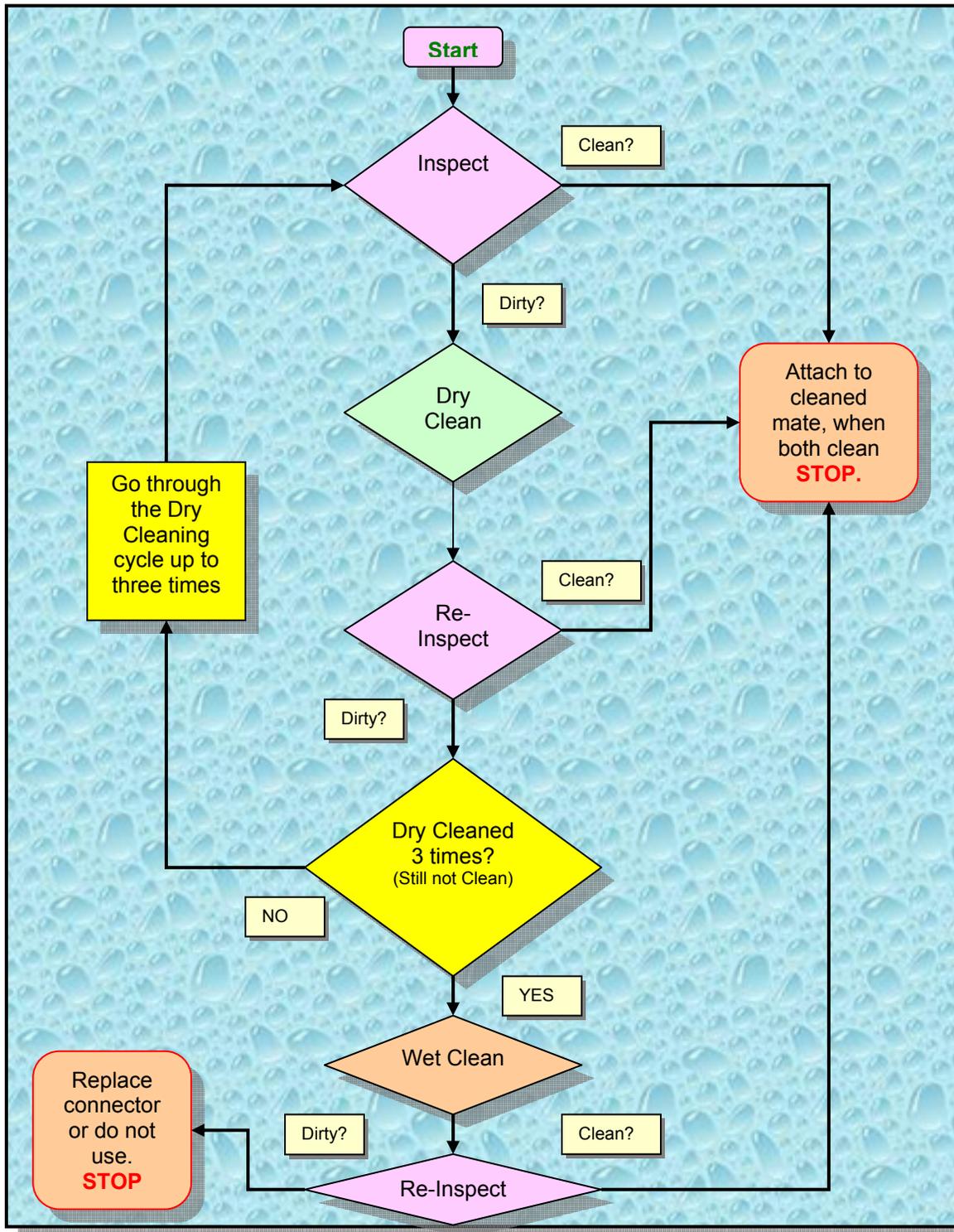
5A. The Inspection Process

Warning: 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 directly to this optical transmission and insure that all end caps and/or terminators are properly placed on all connector ends. Under no circumstances will the AT&T technician look into or clean a lit fiber. It is mandatory to ensure that any piece of fiber being worked on by the AT&T Technician is "dark" before cleaning. This means disconnecting the service drop from the serving terminal or in the case of having to clean the bulkhead connector of the serving terminal, disconnecting the feeder at the PFP (Primary Flexibility Point). Disconnecting the "feeder" at the PFP creates another connection that requires inspection and possibly cleaning. We can use the AT&T approved Video Scopes to inspect an energized fiber.

The following flow chart has been developed to support this process:



5B. The Overall Cleaning Process Sequence



5C. Dry Cleaning Process

The Dry Cleaning process is the expected standard method of cleaning fiber ends. An additional process involves wet cleaning through the use of alcohol on an exception basis and only with low combined power services below +10 dBm.

AT&T has standardized on several manufacturers "Dry Cleaning" products in order to achieve more consistent uniform cleaning results. The Dry Cleaning process is covered below:

- ✓ Remove the dust cap or terminators or open the connection.
- ✓ Open the Dry Cleaning device.
- ✓ Identify a clean section of material that has not been used for previous cleaning.
- ✓ Press the connector ferrule, end of connector, end-face on the cleaning material.
- ✓ Insure that the optical plug is pressed snugly against the cleaning tape surface.
- ✓ Drag the connector ferrule optical end against the dry cleaning material the length of the material.
- ✓ Perform this drag effort a second time for each termination ferrule.
- ✓ Temporarily secure this cleaned ferrule end from any contact or finger touch.
- ✓ Clean the other connector, terminator or material ferrule that will mate with the cleaned connector.
- ✓ Connect both cleaned connectors together.
- ✓ Secure the Dry Cleaning device from the elements.
- ✓ Do not follow any instructions by any manufacturer that authorizes the use of Freon air spray.

5D. Wet Cleaning Process

The Dry Cleaning process is the expected AT&T standard method of cleaning fiber ends. An additional process involves the use of wet cleaning through the use of alcohol followed by Dry Cleaning on an exception basis and only with low combined power services below +10 dBm. **Great caution** must be exercised using the wet process by insuring that the alcohol is free of contaminants and the cleaning material is clean. The wet cleaning process dictates the need to keep the alcohol secured from the open environment and have a specific shelf life to insure that the contaminants suspended in the solution are not transferred to the connector. Wet cleaning must be followed immediately by the Dry Cleaning method to remove alcohol residue before it hardens.

Failure to perform proper cleaning may cause one of the two following conditions:

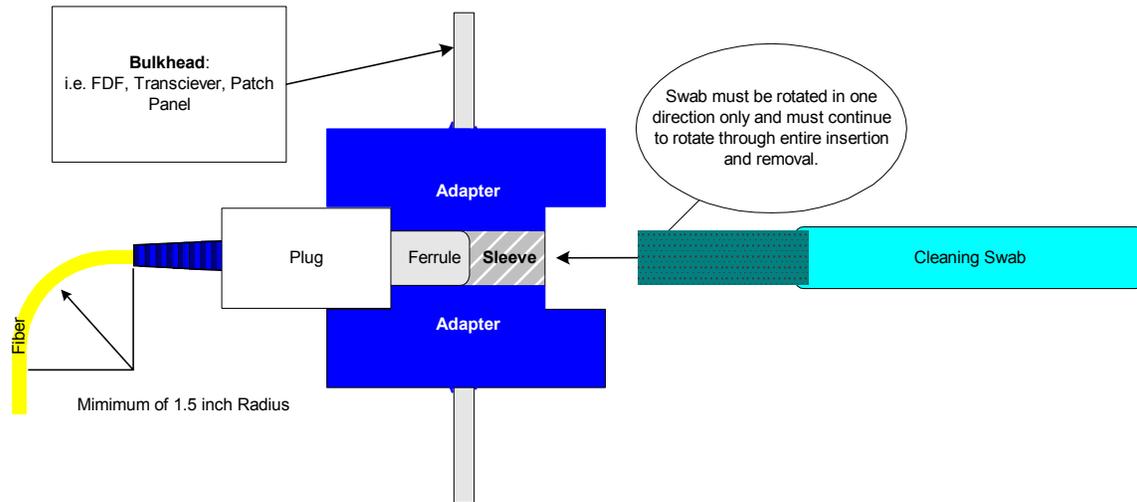
1. Alcohol residue may be a contributor to combustible conditions in high heat areas.
2. If contaminants are left on the face of the connector, with high power systems especially higher than 10 dBm may char the contaminants creating a film that degrades the optical signal path.

Always insure that this cleaning method is immediately followed by the dry cleaning process to remove all alcohol and particulate contaminants from the face of the ferrule.

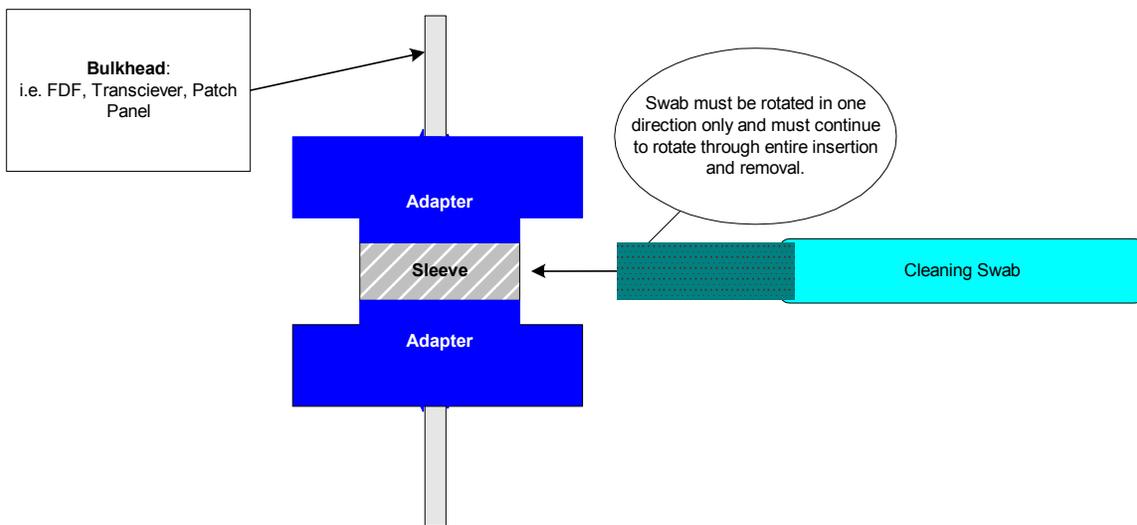
Use the alcohol solution bottle (4F) only as an absolute last resort due to contaminants entering the solution. When wet cleaning is performed, the best solution is to use the wipe and swab wet cleaner products found in 4E.

5E. Illustrations of Fiber Connector Cleaning

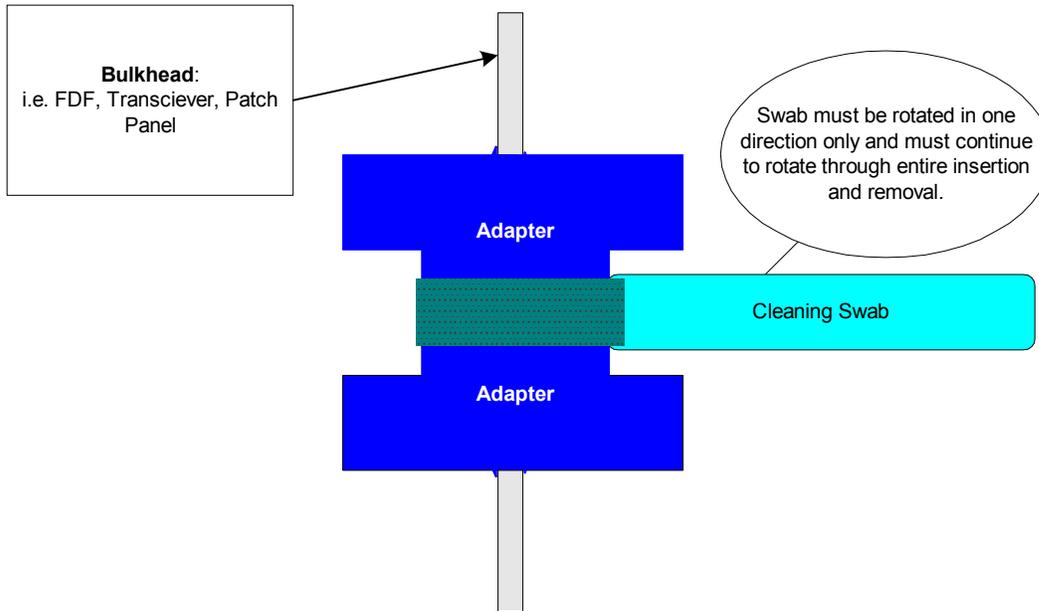
5E.1 Cleaning connector thru Bulkhead



5E.2 Cleaning Sleeve Insertion



5E.3 Cleaning Sleeve in contact



5F. Example of a Manufacturer Document for Cleaning



NEPTEC
OPTICAL SOLUTIONS, Inc.



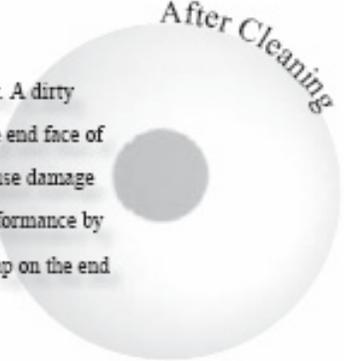
FiberSwiper™



Before Cleaning

INSTRUCTIONS

Clean each connector before it is inserted into an adapter. A dirty connector will contaminate an adapter receptacle and the end face of the fiber you are plugging in to. Dirty connectors can cause damage to the end face in the form of scratches and decrease performance by increasing insertion loss. Place a clean, protective dust cap on the end of each connector when not in use.



After Cleaning



Using the thumb slot, remove the lid by sliding it out.



Remove one cleaning card from the base storage area.



Turn the lid over to expose the rubber pad and slide back into the base.



Insert the cleaning card into the lid, over the pad, by sliding it into the side rails.



Place the FiberSwiper™ on a flat surface. Pull up the plastic from the slot to be used, verifying no contamination contacts the cleaning surface.



With the end face perpendicular to the surface, place the connector into the slot and twist half turn using pressure, then swipe according to polish.



For UPC connectors, swipe the connector along the path of the cleaning slot using slight pressure.



For APC connectors, hold the connector at a slight angle (as seen) and orient the connector with the key on the left and swipe using slight pressure.

6. Approved Fiber optic Scopes

6A. Noyes VS300 View Safe Inspection Scope

Purpose This Product Announcement Flash (May 2002) has been issued to announce that the VS300 View Safe Inspection Scope and the VFS-1 Video Fiber Inspection Scope manufactured by Noyes Fiber Systems are now rated Approved for Use in AT&T-Midwest, AT&T-West, AT&T-East, and AT&T-Southwest.

Background For those involved in the installation and use of terminated fiber, patch cords, and couplers, realize that the quality of the fiber end-face has a significant impact on insertion losses. Specifically, scratches, pits and dust, or contamination generally are associated with poor transmission performance. Hence the need for optical inspection to determine the presence and significance of these defects.

VS300 View Inspection Scope



VS300 View Inspection Scope

The VS300 eliminates the concerns for eye safety resulting from the reliability and verifiability issues of laser filters, particularly while inspecting connector end-faces in long haul and DWDM installations.

The VS300 utilizes a miniature camera and a micro-display.

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.

The magnification of the unit is equivalent to 400x (23 degree field of view comparable to 8" monitor viewed at a distance of 20") and provides 600x when its video output is displayed on a 12" monitor. The unit has an energy saving automatic shutoff.

Specifications for VS300

Optical Specifications

Magnification	400X equivalent to 8" monitor for 20" distance, 600X on 12" monitor
Adapter Mount	Thread-on (Universal)
Safety Filter	Not Required - No optical path to user
Video Output	NTSC

General Specifications

Operating Temperature	0 to +50°C
Storage Temperature	-20 to +60°C
Humidity	0 to 90% (non - condensing)
Power Supply	2 AA alkaline batteries, optional AC adapter
Battery Life	10 hours continuous
Indicators	Low Battery
Weight	0.94 lbs. (0.42 kg)
Size	(H x W x D) 3 1/2" x 1 1/2" x 8 1/2" (8.9 x 3.8 x 21.6 cm)

The VS 300 Inspection Scope includes 2 internal batteries, neck strap, 2.5mm universal adapter cap, warranty registration card, and user's guide.

CATALOG DESCRIPTION – SET TEST, SCOPE, FIBER OPTIC INSPECTIONS VS300

CATALOG NARRATIVE - MICROSCOPE, FIBER OPTIC INSPECTION. 400X POWER, INSPECTS FIBER OPTIC ENDFACES. INCLUDES ST, SC, FC. SOFT CASE. ACCEPTS SAME ADAPTERS AS SET TEST, OPTICAL POWER METER, PID: 301001269.

PRICE: \$650

Item is non-stock. Delivery interval 28 days.

	AIT	PB/NB	SWBT	SNET
PID Number		301056362		3583041
Major Item Code (MIC)				
Product Line Code (PLC)	48189			

6B. Noyes VFS2 Inspection Scope

Covered under [ATT-PAN-2003-3248](#), dated October 2003.



The VFS2 is a small versatile video fiber scope. The unique "optical-knuckle" allows the user orient the probe head in virtually any direction. This feature allows the user to view connectors that may be located in tight or difficult locations. The VFS2 resolves 34 micron scratches. The precision adaptor 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.

Optical specifications	
Field of view	350 microns diagonal (208 microns vertical, 285 microns horizontal)
Magnification	250x on 3.5" display, 350x on 5" display
Resolution	3/4 micron scratch
Video Output	NTSC

VFS 2 Probe specifications	
Operating temperature	0 to +50° C Storage
Storage temperature	-20 to +60° C
Humidity	0 to 90% (non-condensing)
Probe weight	0.44lb (0.2kg)
Probe body size (L x W x D)	6.26 x 1.26 x 1.26 in (15.9 x 3.2 x 3.2 cm)
Probe head size (with FC adaptor) (L x W x D)	3.12 x 1.01 x 0.83 in (7.9 x 2.58 x 1.59 cm)

Item Description	SET TEST, SCOPE, VIDEO FIBER OPTIC VFS2
SBC Midwest, SBC Southwest, SBC West PID	301108528
SBC SNET PID	3586864
Supplier Part Number	VFS-2
Stock/Non Stock	Non Stock
Delivery Interval	28 Days
Price Each	\$1585.00
Catalog Narrative	VIDEO FIBER SCOPE THAT ALLOWS THE USER TO VIEW CONNECTOR ENDFACES. KIT INCLUDES CARRYING CASE, VFS2 PROBE, 3.5 INCH VFS2 DISPLAY, AC ADAPTOR/CHARGER, AND THE FOLLOWING ADAPTER TIPS: 2.5 MM UNIVERSAL, FC, SC, ST, D4, AND LC. 2 YR WARRANTY

7. Dust Caps and Terminators

7A. Dust Caps

Dust Caps are standard products that are required on every fiber optic connector termination for any network equipment of fiber panel and/or frame used by AT&T Communications Inc. Dust Caps physically provide a snap fit over the side, but not touching the connector. The Dust Cap provides adequate protection from contaminants and particulate matter. While these caps are suitable for use in protection, it must be assumed that the actual external connector that the Dust Cap is on is not clean. It is expected that before any panel or network equipment is placed into service, each connector with a Dust Cap will be physically inspected and cleaned as necessary. When completed, the Dust Cap may either be replaced, a terminator can be installed or the connector can be mated with another cleaned connector. If the connector is assumed "Dirty" then it follows that the Dust Cap must be assumed dirty and therefore only acceptable as protection from being damaged by external objects.

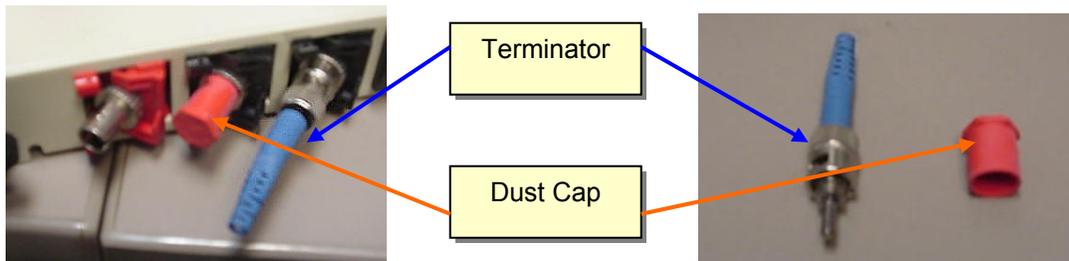
7B. Terminators

Terminators are simply connectors that terminate the signal and do not permit the signal to be degraded or reflected back upon itself. These items must be inspected and cleaned prior to use as well. For optical facilities with transmission speeds of OC-48 (2.5 Gb/s) or higher, the use of fiber optic terminators are required, but may be used at slower speeds. In addition, terminators are required on any fiber path unterminated connector that has a power level in excess of +17.8dBm.

These fiber optic terminators are to be placed on all unterminated ports of splitters that are in use with these transmission speeds in order to reduce the negative effects of optical signal reflectance. It is recommended these terminators be placed on all non-terminated ports of these splitters when they are not connected with a fiber jumper. In any case, any active signal, regardless of transmission speed or capacity, should have the end dust caps placed on all non-terminated access points in the circuit.

The SC-UPC terminators are provided by Corning Cable Systems and may be found on ATT-PAN-20001026 dated March 2000 to be replaced by ATT-PAN-2004-3342, date Jul 2004.

Terminator, Fiber optic SC-UPC	357M \$62.32	300029758/ 9506360	ATN-58-TM Fiber optic SC Ultra PC Terminator
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8. References

8A. AT&T References

Document	Description	Issue & Date
ATT-002-316-101	Wire Center Planning M&P	Current
ATT-770-000-013	Safety Guidelines for Fiber Communications Systems	Current
ATT-TP-76200	Network Equipment – Building Systems (NEBS)	Current
ATT-TP-76300	Installation Guide within the Central Office	Current
ATT-TP-76400	Detail Engineer Requirements for the C.O.	Current
ATT-TP-76450	Common Systems Standards for the AT&T Communications Network	Current
ATT-TP-76450-001	Common Systems Checklist	Current
ATT-TP-76450-002	Common Systems Product Exception and Evaluation Request	Current
ATT-TP-76461	Fiber optic Connector Cleaning Standards	Current
ATT-TP-76461-001	Fiber optic Cleaning Guidebook	Pending July 2004
ATT-TP-76462	Engineering Fiber optic systems in the Network	Pending July 2004
FLASH-OSP SPT Staff	Noyes VS300 View Safe Inspection Scope	May 2002
FLASH-OSP SPT Staff	Corning Cable Systems Cleaner, Fiber optic Connector Universal	Apr 2002
FLASH-OSP SPT Staff	AFL: Cleaner, Fiber optic Connector FCC-02R	Sep 2001
ATT-PAN-2003-3327	FiberSwiper Connector Cleaner	Dec 2003
ATT-PAN-2004-3341	Magnetic Isle Cord	Pending
ATT-PAN-2004-3342	Security Device & Markers	Feb 2004
ATT-PAN-2004-3343	High-Power optical safety Protection Eyewear	Feb 2004
ATT-PAN-2003-3248	Noyes VFS2 Inspection Scope	Oct 2003
PAN-20001026	Fiber optic Splitters and Terminators	Mar 2000

8B. External References

Document	Description	Issue & Date
Section 1910.133 (a) & (b)	OHSA, Eye Protection Standards	Current
Section 1910.6	OHSA ² , Eye and Head Protection	Current
ANSI Z136.1-2000	ANSI ³ , Safe Use of Lasers	Current
ANSI Z136.2-1997	ANSI, Safe Use of Optical Fiber Communications Systems utilizing Laser Diode and LED Sources	Current
ANSI Z87.1-1989	ANSI, Eye and Head Protection	Current
ANSI Z535.3-1991	ANSI-Criteria for Safety Symbols	Current
ANSI Z535.4-1991	ANSI-Product Safety Signs and Labels	Current
IEC 60825-1	IEC ⁴ , Safety of laser products, Edition 1.2: Equipment classification requirements and users guide	Current
IEC 60825-2	IEC, Safety of laser products, Edition 2: Safety of optical fibre communications systems	Current
GR-449-CORE	Telcordia, Generic Requirements for Fiber Distributing Frames	Current
Title 21, Parts 1000-1299	FDA ⁵ , Code of Federal Register, Radiation Emissions	Current
NR-NTA2005-8-05	NTA ⁶ , WDM and its affect on Eyes and Skin	Current
SRP-006-073	Corning Cable Systems-Cleaning with the Universal Connector Cassette (In each Package)	Issue 2, Feb 2001
FiberSwiper Instructions	Neptec-FiberSwiper Instructions (In each Package)	Current
AFL Instructions	AFL-Optical Fiber Connector Cleaner (CLETOP) Instruction Manual (In each Package)	Current

² (OHSA) Occupational Health and Safety Administration, U.S. Department of Labor

³ (ANSI) American National Standards Institute

⁴ (IEC) International Electrotechnical Commission

⁵ (FDA) U.S. Food and Drug Administration, U.S. Department of Health and Human Services

⁶ (NTA) National Telecommunications Alliance

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