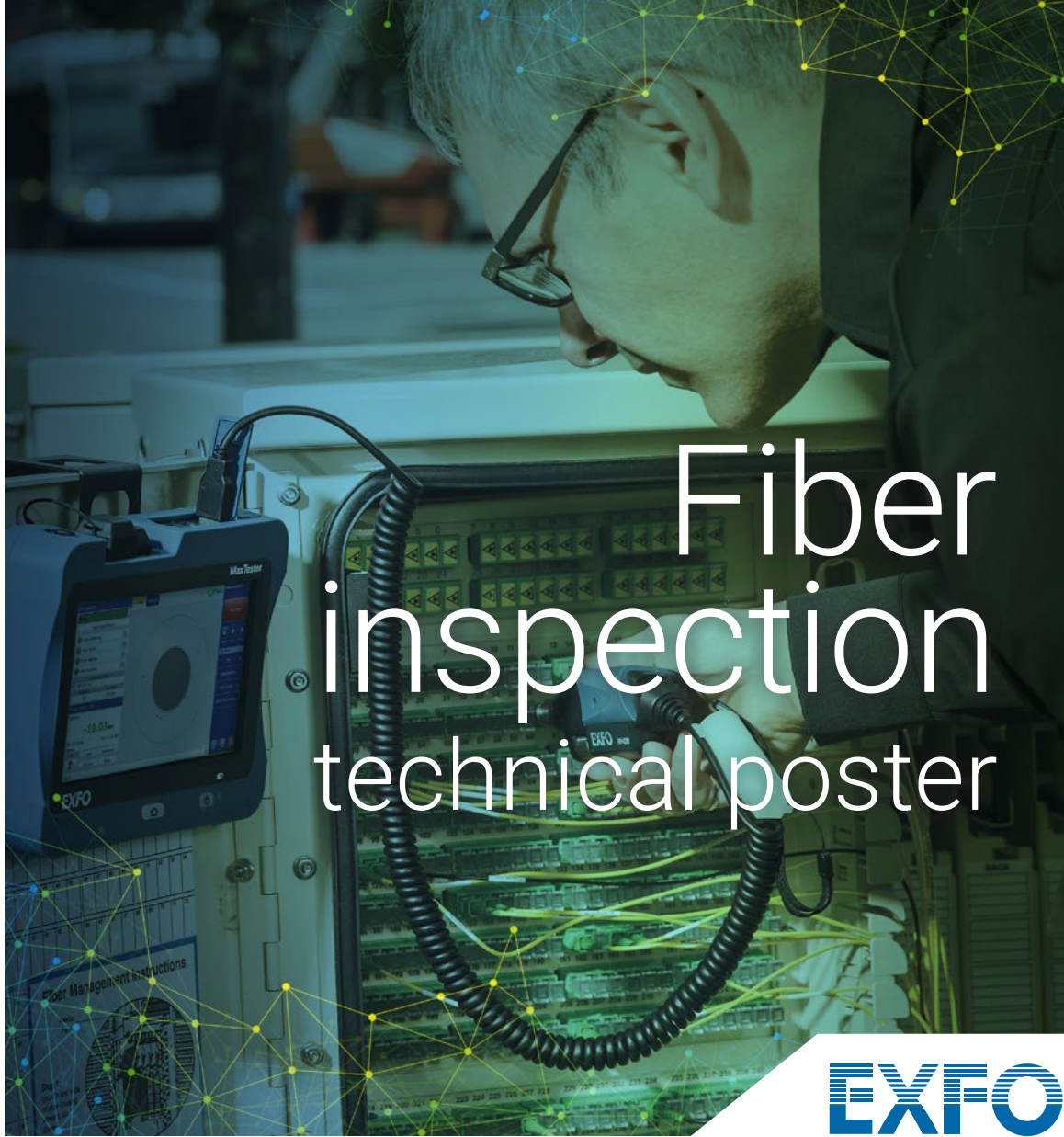


A photograph of a technician with glasses working on a fiber optic network. The technician is using a handheld EXFO device to inspect a patch panel filled with fiber optic cables. To the left, a MaxTester device is mounted on the panel, displaying a circular graph on its screen. The background is a server room with racks of equipment. A green network diagram overlay is visible in the top right corner.

Fiber inspection technical poster

EXFO

Fiber inspection technical poster

EXFO

No. 1 cause of network failures is contaminated connectors.
* NTT-Advanced Technology Research, 2010

AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE
If a chain is only as strong as its weakest link, then fiber networks are only as strong as their weakest connector. It is therefore critical to ensure that they are free of contamination and working properly.

- Prevent optical network failures
- Avoid permanent connector damage
- Ensure more accurate testing results
- Decrease unnecessary connector replacements
- Lower maintenance costs
- Future-proof your network for upcoming 40G/100G or higher speeds expansion

Common fiber connector types

Single-fiber connectors		Adapter tips APC		Adapter tips UPC	
Male	Female			Male	Female
		FIP-400-SC-APC	SC Simplex		
		FIP-400-FC-APC	SC Duplex		
		FIP-400-U25MA	FC Simplex		
			ST Simplex	FIP-400-U25M	FIP-400-FC-SC
			E2000 Simplex		FIP-400-ST
		FIP-400-E2000-APC	E2000 Duplex		FIP-400-E2000
			LX-5 Simplex		
		FIP-400-LX5-APC	LX-5 Duplex		FIP-400-LX.5
			MU Simplex	FIP-400-U12M	
			MU Duplex		FIP-400-MU
			LC Simplex		
		FIP-400-LC-APC	LC Duplex	FIP-400-LC-D	FIP-400-LC-SQ

MPO connectors		Jumper		Bulkhead	
		FIP-400-MF-MPO *	MPO 12-24 UPC	FIP-400-MF-MPO *	
		FIP-400-MF-MPO-APC *	MPO 12-24 APC	FIP-400-MF-MPO-APC *	
		FIP-400-MF-MPO-X *	MPO 16-32 UPC	FIP-400-MF-MPO-X *	

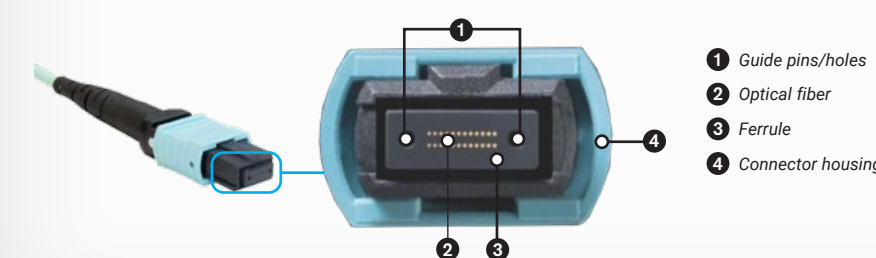
FTTA connectors		Socket		Plug	
		FIP-400-ODC-S	Outdoor connector (ODC) 2 fibers	FIP-400-ODC-2PIN-P-K	
			Outdoor connector (ODC) 4 fibers	FIP-400-ODC-4PIN-P-K	
		FIP-400-MF-QODC-12 *	Outdoor connector Q-ODC-12 UPC	FIP-400-MF-QODC-12 *	
		FIP-400-MF-QODC-12-APC *	Outdoor connector Q-ODC-12 APC	FIP-400-MF-QODC-12-APC *	

FTTH connectors		Drop cable		Terminal port	
		FIP-400-U25MA	OptiTap® (OptiSheath® multipoint terminal, in-line tether extender or flexible service terminals)	FIP-400-OTAP-APC	
		FIP-400-MF-OTIP-MT-APC *	OptiTip® and HiMPOC® up to 12 fibers	FIP-400-MF-OTIP-MT-APC *	

* Requires FIP-400B MF-Ready

Multifiber connectors/MPO-style

- Multifiber connectors can be used in many high-density fiber applications such as FTTH, data centers, FTTA, ROADMs, etc.
- Common types include the MPO, MTP** and OptiTip**



* MTP® is a registered trademark of US Conec Ltd. and OptiTip® is a registered trademark of Corning Cable Systems

Inspecting multifiber connectors requires a special inspection tool. An automated multifiber inspection solution requiring only three clicks, makes it impossible to skip a fiber. It can inspect connectors with 12/24 fibers or 16/32 fibers.



Inspecting a multifiber connector requires a tool that can scan both the x and y axes simultaneously.

Inspection probe field of view (FOV) is key when inspecting multifiber and multimode connectors. The larger the FOV, the greater the number of fibers that can be identified at once.

Solutions

Microscope

- Only inspects male connectors
- Not always secure enough to inspect live fibers
- Risk of eye exposure to laser radiations
- No pass/fail analysis, result subject to human interpretation

Manual inspection probe and display

- Inspects male and female connectors
- Very secure, no direct eye exposure to laser radiations
- Requires many manipulations
- Final result still subject to human interpretation

Automated inspection probe and test platform with analysis software

- Fast and hassle-free requiring minimal fiber handling skills
- Removes all subjectivity from the test process—no risk of misinterpretation
- Integrated solutions for multistep capabilities (optical, T&D, copper)

Where to inspect/clean

The following items should always be on your inspection/cleaning list:

- Patch panel (e.g., splitter cabinet)
- Test jumpers
- Cable connectors

When to clean

The very first step is connector inspection. This applies to all testing phases—construction, activation and maintenance. **Connectors should be cleaned only if the inspection reveals that they are dirty.**

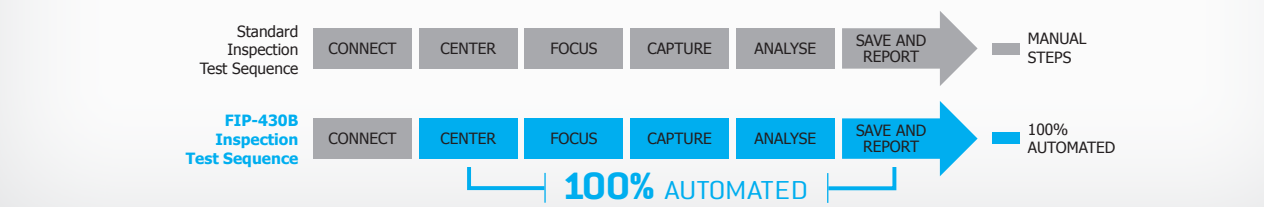
How to inspect

Using a manual inspection probe.

1. Connect the probe to the connector and select the corresponding IEC standard.
2. Set magnification to high.
3. Find the fiber image, center it and adjust the focus.
4. Start the analysis using the Capture button.
5. View the Pass or Fail result.
6. Clean or replace the connector depending on the result.
7. Save the analysis report.

Using an automated inspection probe.

When using a fully automated solution such as EXFO's ConnectorMax FIP-430B or FIP-435B, the only step is to connect the probe tip to the connector under test and let the tool do all the hard work.



Contaminated/Defective connectors

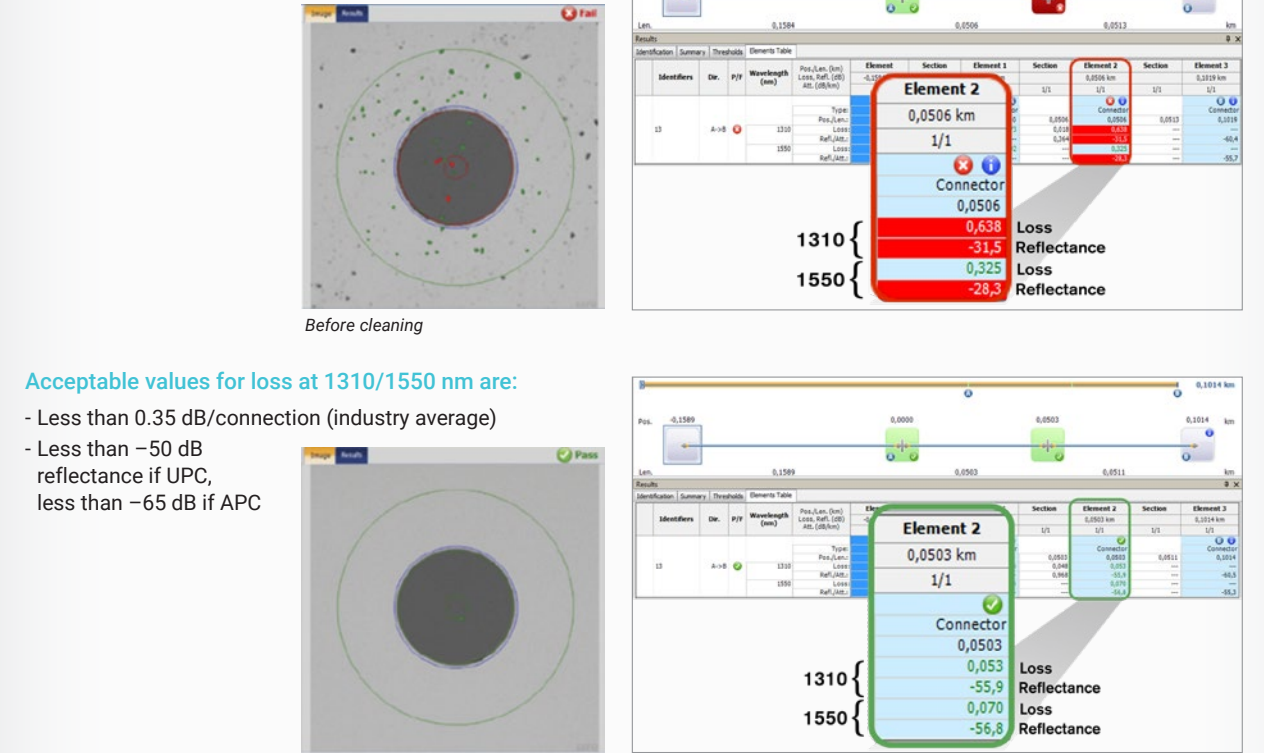
1. Impact on higher data rates

Higher speed networks (i.e., 40G, 100G), such as in data centers or metro-core networks, have very limited loss budget. 1 or 2 dB loss from a dirty/bad connector can lead to link failure.

2. Impact on general test results

Since dirty connectors typically exhibit more reflectance and loss, the ORL and IL readings taken by an OTDR, OLTS or PM/LS will be higher. Every system has a maximum ORL, and clean connectors help keep reflectance at a minimum (e.g., single Raman-amplified systems).

Contaminants in a connection will impact reflectance and loss.



3. Impact on OTN bit error rate tests (BERT)

Dirty connectors affect the signal-to-noise ratio at the receiver, and most PIN receivers react the same way to noise (i.e., a proportional increase in BER).

- Erratic readings during 40G/100G OTN BERTs
- Forward error correction (FEC)
- Alarm indication signal (AIS)
- Backward defect indicator (BDI)
- Unnecessary Tx/Rx troubleshooting

Connector inspection criteria

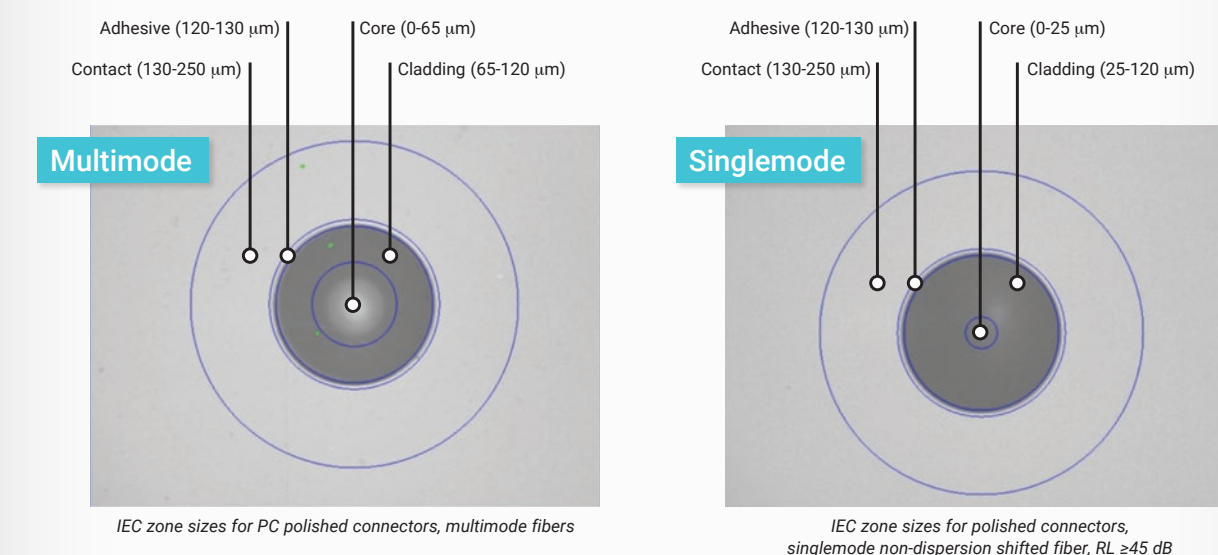
Standards-based criteria

IEC 61300-3-35
Fiber-optic interconnecting devices and passive components—basic test and measurement procedures
webstore.iec.ch

IPC 8497-1
Cleaning methods and contamination assessment for optical assembly
www.ipc.org

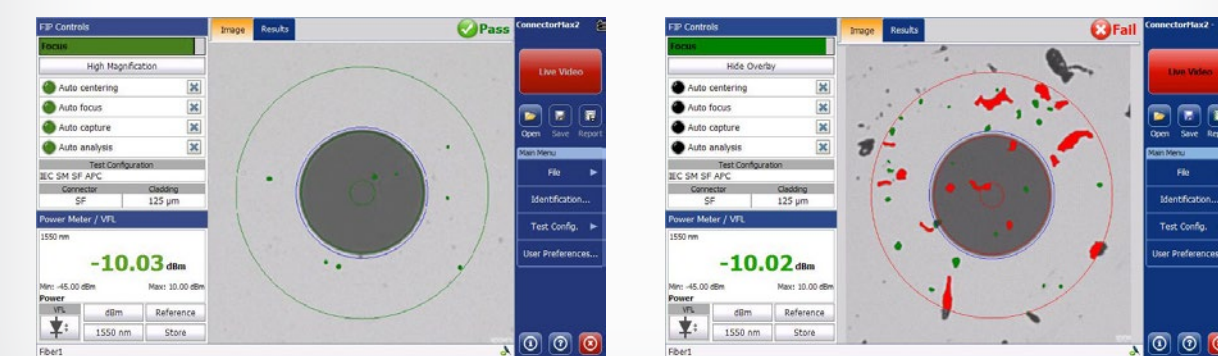
A connector endface has multiple zones

- Dimensions will depend on the connector and fiber type
- Multimode and singlemode connectors have different sizes
- Zone tolerances will differ



Connector endface pass/fail analysis

Thanks to the powerful processing capabilities of EXFO test platforms, technicians can perform IEC and IPC automatic pass/fail analysis via ConnectorMax2, the most powerful field-analysis tool on the market. In just a few seconds, a full connector certification test is performed and a test report is generated. All this at the touch of a button—no training required.



Boost accuracy with autofocus

Ever heard of false-positives?

Have you ever noticed that some failing connectors can result in a pass verdict if the analysis is performed on an out-of-focus image? This is called a false-positive result.

Automatic focus adjustment and optimization

Autofocus

- Ensures that each connector image is captured with maximum quality
- Boosts the accuracy and repeatability of inspection test results
- No defects or residues affecting performance are ignored
- Facilitates the identification of defects
- Prevents false-positives

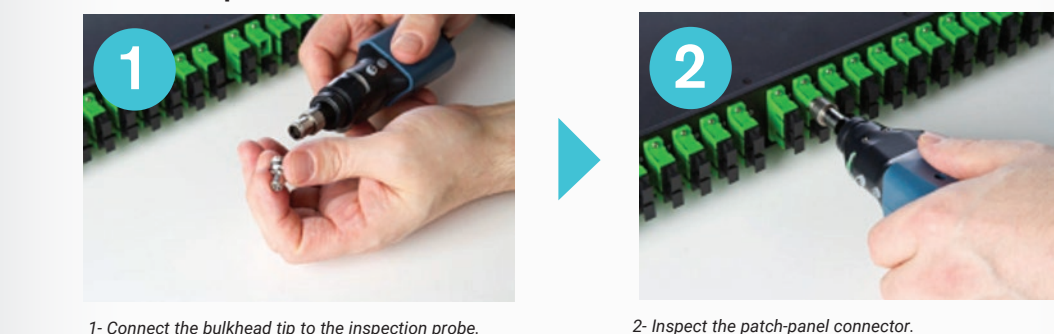
Focus protection

- Prevents image capture in the event of improper focus adjustment
- No defects or residues affecting performance are ignored
- Prevents false-positives

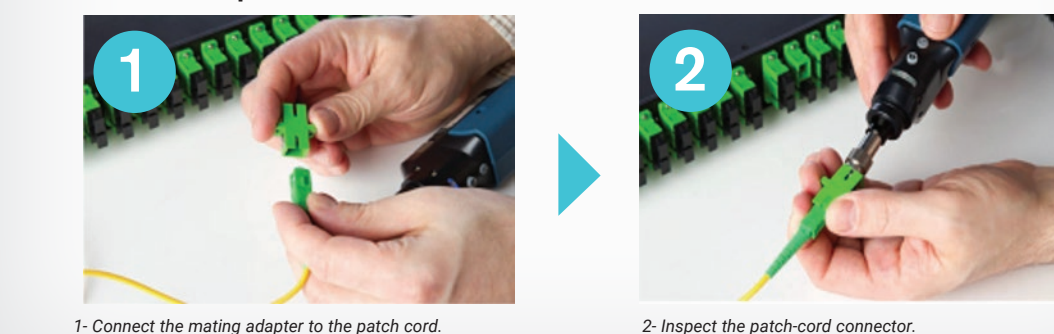
No tip swapping: Save time and manipulations

The ConnectorMax fiber inspection probe series uses the same tip to inspect a patch panel and a patchcord.

Bulkhead inspection



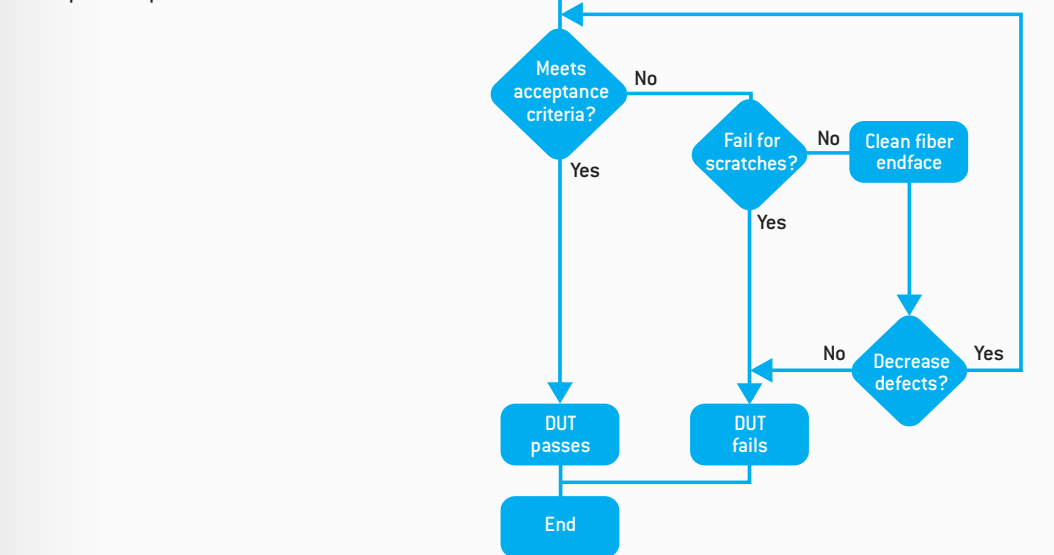
Patchcord inspection



Cleaning connectors

Suggested inspection/cleaning procedure

If the fiber fails inspection, the user shall clean the fiber and repeat the inspection process.



Dry cleaning

Dry cleaning using a mechanical cleaner is recommended as the first step. If, after two dry cleaning attempts, soil is still present on the connector, try hybrid cleaning.



How to dry clean

Insert the jumper and push the outer shell to begin cleaning. A click sound will indicate that the cleaning is complete.

Some mechanical cleaners are compatible with male and female jumpers as well as with MPO and other connectors.

Hybrid cleaning

Hybrid cleaning is a mix of the wet and dry cleaning methods and involves using a solvent. The first step is to clean the connector endface with a solvent and then dry any remaining residue with either a wipe or a swab.

If, after using the hybrid cleaning method, the connector still fails to meet the acceptance criteria, consider replacing the connector.



How to clean using the hybrid method

1. Wet a corner of the wipe with solvent.
2. In a smooth linear motion, trace the endface of the jumper twice over the wet area.
3. In a smooth linear motion, trace the endface of the jumper three times over the dry area.



SEE THE FULLY AUTOMATED PROBE IN ACTION
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