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# Optical fiber break collection procedure for break source analysis

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## Abstract
This application note briefly introduces optical fiber break source analysis (BSA) and explains procedure for collecting fiber break ends and other relevant information for BSA.

## Keywords
Optical fiber break, Break Source Analysis, Break end collection

## Optical fiber break

When a certain tension is applied, optical fiber breaks at the lowest strength point. Proof testing is a common technique to ensure optical fiber has some minimum strength and eliminate flaws whose sizes are dependent on the stress applied during proof testing. In proof testing, predetermined load is applied on fiber by tensile loading. The fiber breaks at the weak points and the weak parts are eliminated from the fiber. Optical fiber used in telecommunication is proof tested at 1% strain, which is equivalent to 700 MPa stress and corresponds to a surface flaw size of approximately 0.85 µm. Therefore proof testing with 1% strain eliminates surface flaws above 0.85 µm

Fiber break can occur due to intrinsic or extrinsic impurities present in the fiber and surface damage caused during fiber handling and processing. It is very unlikely to see post-proof-testing fiber break during cabling process unless tensile stress of 700 MPa or above is applied on the fiber. However, fiber can break during cabling process if new surface defect is introduced during post-proof testing fiber handling/ processing or by any other means like fiber whip damage [1].

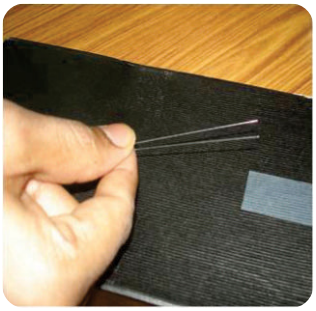
## Optical fibers break source analysis (BSA)

Break Source Analysis (BSA) is an investigative course of action that is utilized to reveal the mechanism responsible for a fractured fiber. Every fiber break leaves some microscopic artifacts, located on the fiber break ends. Depending upon the timing of the damage, the artifacts may be found in jackets, the colouring inks, the fiber coating and the glass. It is the combination and distribution of these artifacts, and often the lack of an artifact, that will reveal the source of a fiber break.

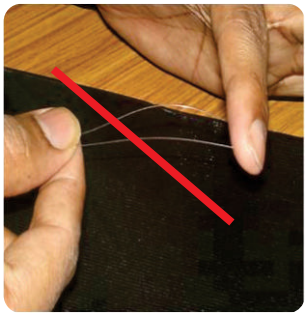
BSA can be performed on any fiber, which breaks right from fiber manufacturing to cable processing. The purpose of BSA is to study the characteristics of the break end to determine the cause of the break. This information is used to determine the source of fiber breaks so factors detrimental to the process can be identified and removed. When a fiber breaks, two ends are collected. Microscopic analysis is performed in determining break causes. The fiber end is viewed under microscope and rotation of the fiber and inspection of characteristics around the break edge reveals the break type.

## Procedure for collection of fiber break ends for BSA

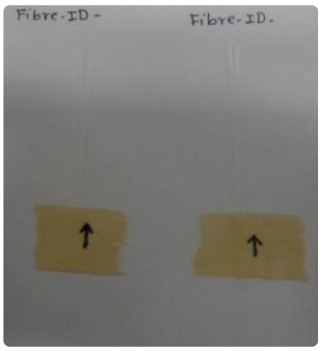
• Both break ends should be collected.
• The Length of each break end should be between 7-10 cm.
• Top-ends of the break should not be touched/ disturbed. Put a 'T' mark to indicate the break end to be analyzed. Figure 1 shows how to handle and paste the break ends.
• Stick the fiber break ends on a paper and keep it in a box to avoid any external damage. Send the box to Sterlite factory or Sterlite's representative.
• Note down the fiber ID and other information as shown in Table 1. Send the information along with the break sample.



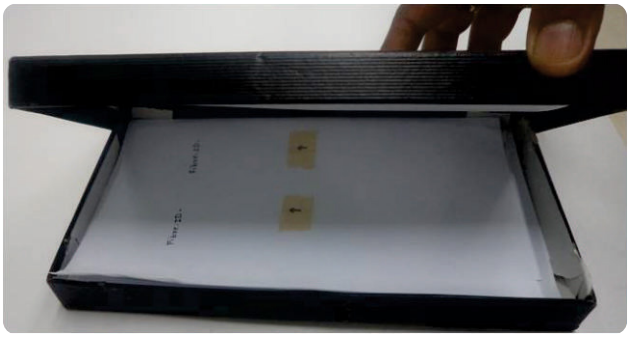
Collect both the break ends



Don't touch the tip of the break ends




Paste the break ends by a paper tape and ' ↑ ' mark



Preserve the break sample in a box

**Figure 1**

## Table 1 Format for collecting information related to in-process fiber break

| | Spool Condition | | Fiber Condition | | | Machine Related | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fiber ID | Damaged Spool Cover | Damaged Spool | Dent | Flange - Side Gap | Bad Winding | Process Name | Processing Speed | Break Location* | Drive Fault | Fiber slip off capstan/ pulley | Any Other Observation |
| XXXX | No | No | No | No | No | Coloring | 3000m/min | 1.1 km | No | ✓ | |

*with respect to shipped fiber spool from top

## References

1. Sudipta Bhaumik, “Whipping damage in optical fiber”, Sterlite Application Note, May’2013.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