

# Fusion Splicing Basics

## Do It Right The First Time!

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## Slide 2

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**A1**      Subscribe section has been approved by Sarah on 5.9.17  
Amy, 5/9/2017

# Introduction

- Why Fusion Splice
- Splicing Basics
- Splicing Misunderstandings
- Best Practices
- Core & Active Clad vs Cladding Alignment
- Dissimilar Splicing Challenges
- Splice on Connectors
- Evaluating the Splice



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# Why Fusion Splice

- Provides lowest possible Insertion Loss
- Provides nearly zero reflection
- Connectors cause reflections and loss
- Today's networks require low reflectivity
- Reflections corrupt signal integrity



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# Fusion Splicing Basics

- Splicing provides consistent results
- Excellent insertion loss, typically 0.02dB SMF and 0.01dB MMF
- Should splice where a connector is not necessary to reduce IL & RL
- More reliable than mechanical connectors & has lower IL & RL
- Splice on connectors are suitable for high bandwidth applications



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# Misunderstandings

- Drop test – hammer test
- IP Rating – IP52 (Dust & Water)
- The fine print
- ARC Calibration
- Cleaning

\* Insertion loss is for cut and re-splice of identical fibers.

\* Dust resistance and rain resistance test do not guarantee that the product will not be damaged under these conditions.



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# Misunderstandings

- \* Dust resistance and rain resistance test do not guarantee that the product will not be damaged under these conditions.
- \* Insertion loss is for cut and re-splice of identical fibers.

Need to protect your investment

Splicing is easy until there is a problem

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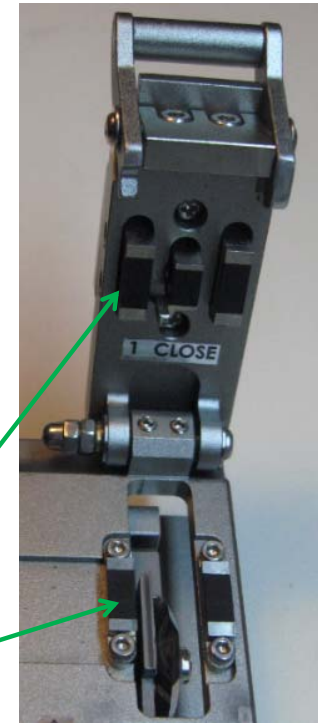


# Splicing Best Practices

Good cleaves are imperative

- Stripping the fiber is most time consuming
- Make sure that the cleaver is clean
  - Glass shards on presser pads
  - Sides of cleaving wheel
  - Use 99% IPA
- Make sure that the fiber is clean
  - Make sure to remove acrylic coating
  - Use 99% IPA on lint free cloth
- Bad cleaves will compromise the quality of the splice

Fiber presser pads



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# Splicing Best Practices

ARC test is required for every splicing session

- Load two cleaved fibers
- Perform ARC calibration
- Fibers shape is analyzed & power is adjusted

Compensates for:

- Barometric pressure changes
- Humidity changes

Auto Mode:

- Uses previous splice settings
- Still need ARC Calibration



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# Splicing Best Practices

## Keep the Splicer Clean

- Mirrors
- Objective lenses
- V-Grooves
- Fiber clamps
- Do not use compressed air!
  - Propellant contamination
  - Lodges contamination even deeper
- Use 99% pure IPA & lint free swabs

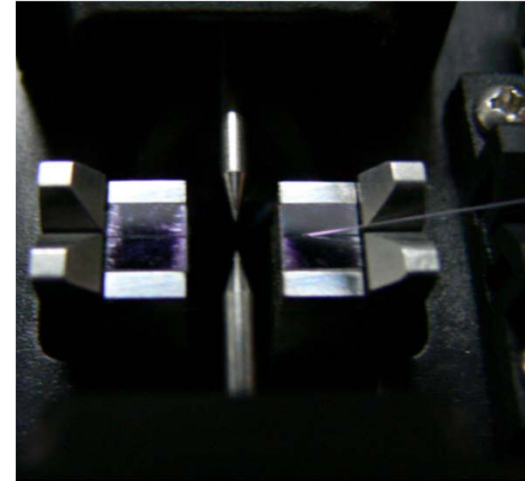
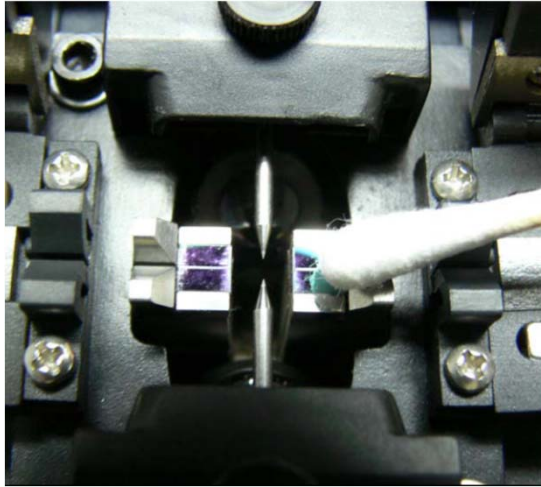


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# Splicing Best Practices

## V- Grooves

- Use 99% pure IPA & lint free swabs
- Use fiber optic cable to remove stubborn debris – hardened gel



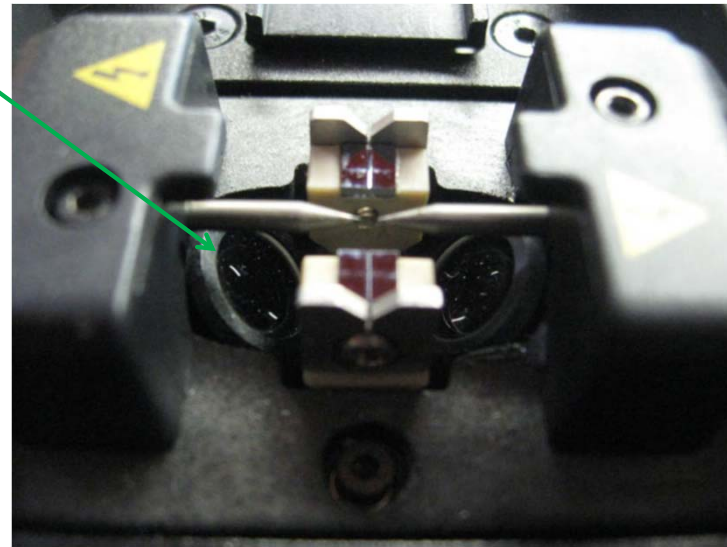
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# Splicing Best Practices

## Objective Lenses (2)

- Do not use IPA
- Use lint free swab
- Start in center of lens and clean in a circular motion pushing contamination to the edge
- Easier to do when electrodes are removed
  - Do not touch electrodes
  - Stabilize electrodes if removed
  - ARC calibration if removed

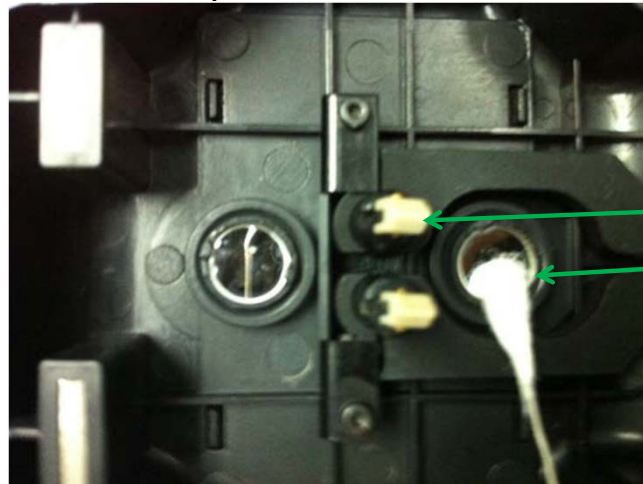


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# Splicing Best Practices

## Windshield Mirrors and Clamps

- Use 99% pure IPA and lint free swab
- Active clad and V-Groove splicers do not have mirrors



Clamps (2)

Mirrors (2)

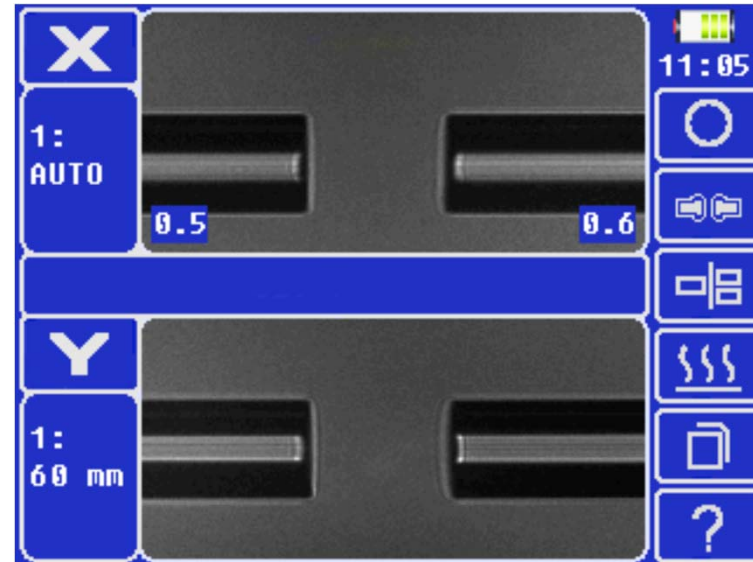
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# Splicing Best Practices

## Maintenance Menu

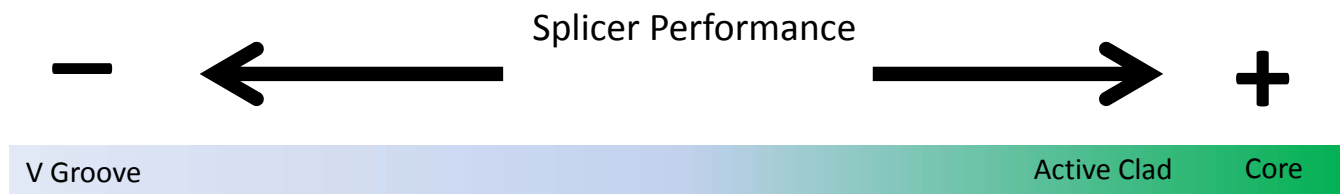
- ARC Calibration
- Motor Calibration
  - Bring the motor travel back to factory setting
- Screen Calibration
  - Bring the camera position back to factory setting



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# Splicing Technologies

- Core Alignment
- Active Clad Alignment
- V – Groove Alignment (cladding)



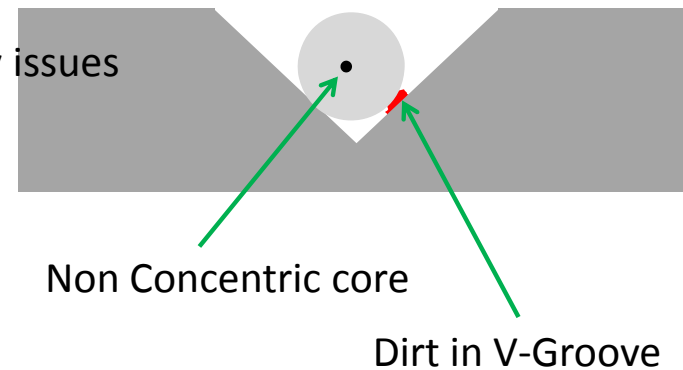
# Core vs Cladding Alignment

## Core alignment

- Provides the lowest splice loss under adverse conditions
- Is more tolerant of contamination
- Virtually eliminates fiber concentricity issues
- Controls in the X, Y & Z domains
- Provides camera focus capability

## Cladding alignment

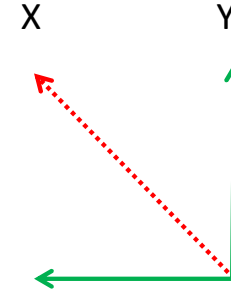
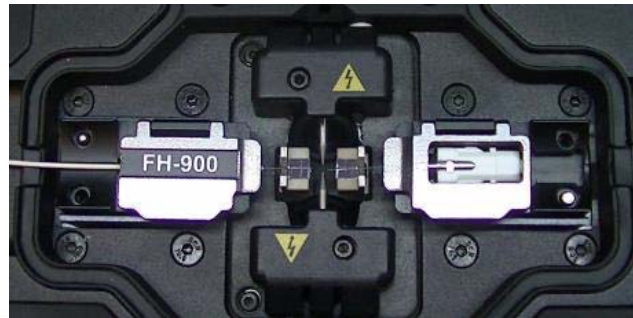
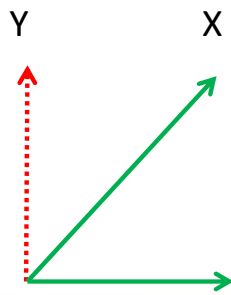
- Z control only
- Susceptible to V-Groove contaminations and damage
- Higher splice losses
- Most economical



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# Active Clad Alignment

- Similar splice loss as Core when splicing similar or new fibers
- Geared towards FTTH – last mile
- Controls the X, Y and Z domains
- Does not have motors that focus on the center of fiber
- The core of new fiber is centric to the clad



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# Splicing Technologies - Recommendations

FTTH – Active Clad

Old fiber to new fiber – Core

Dissimilar Fiber - Core

Newer Fiber – Active Clad

Multimode – Core

Network Backbone – Core



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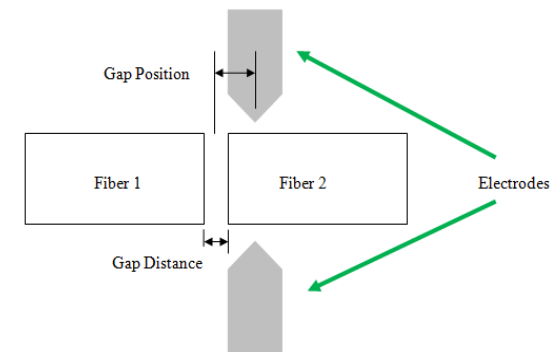
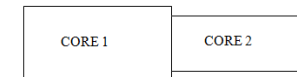
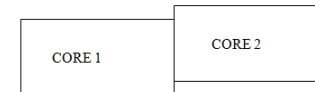
# Dissimilar Splicing Challenges

Fiber geometries can cause problems

- Concentricity
- Fiber diameters

Fiber Composition

- Some fiber is easier to “melt” than others
- Need to adjust the settings of the splicer
  - Arc power & duration
  - Gap settings
  - Consult your instruction manual!



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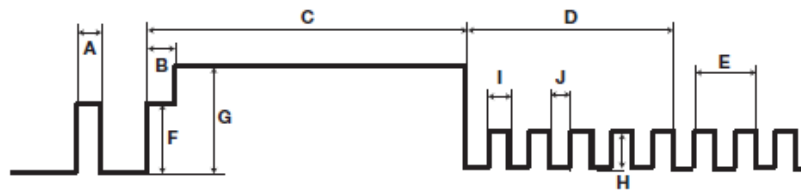


# Dissimilar Splicing Challenges

Non – Auto mode controls

Consult your instruction manual!

Summary of electrode activation:

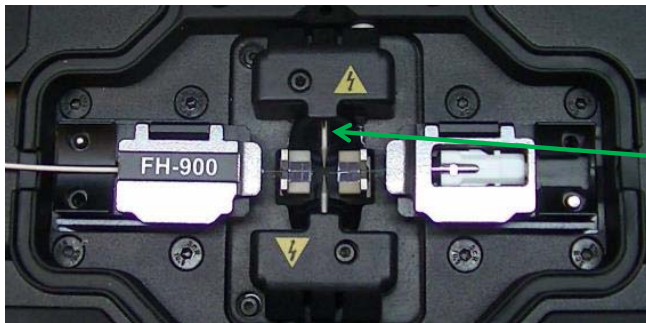


- A: Cleaning Arc
- B: Prefuse Time
- C: Arc1 Time
- D: Arc2 Time
- E: Rearc Time
- F: Prefuse Power
- G: Arc1 Power
- H: Arc2 Power
- I: Arc2 ON Time
- J: Arc2 OFF Time

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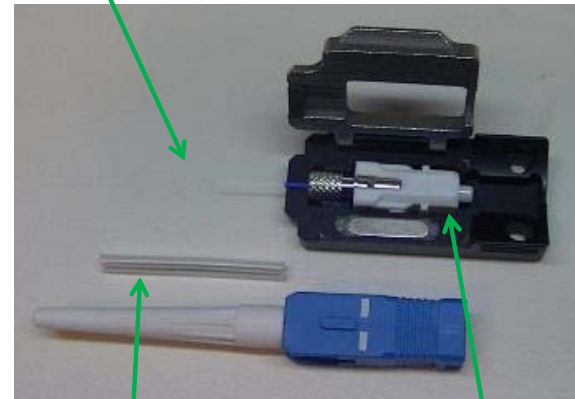
## Splice on Connectors – Reduce the RL

- SC, LC, FC, ST terminations (>60dB RL for APC)
- Inserted into the fusion splicer using fiber adapters
- Protection sleeve is located in the strain relief
- No splice tray is required
- No crimping, epoxies, matching gels
- Easier cable management
- GR326 compliant



Electrodes

Pre-cleaved fiber ready for splicing



Pre-polished fiber termini

Splice protector located in strain relief

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# Evaluating the Fusion Splice - OTDR

- The loss displayed on the screen is only an estimate!
- Need an OTDR to validate

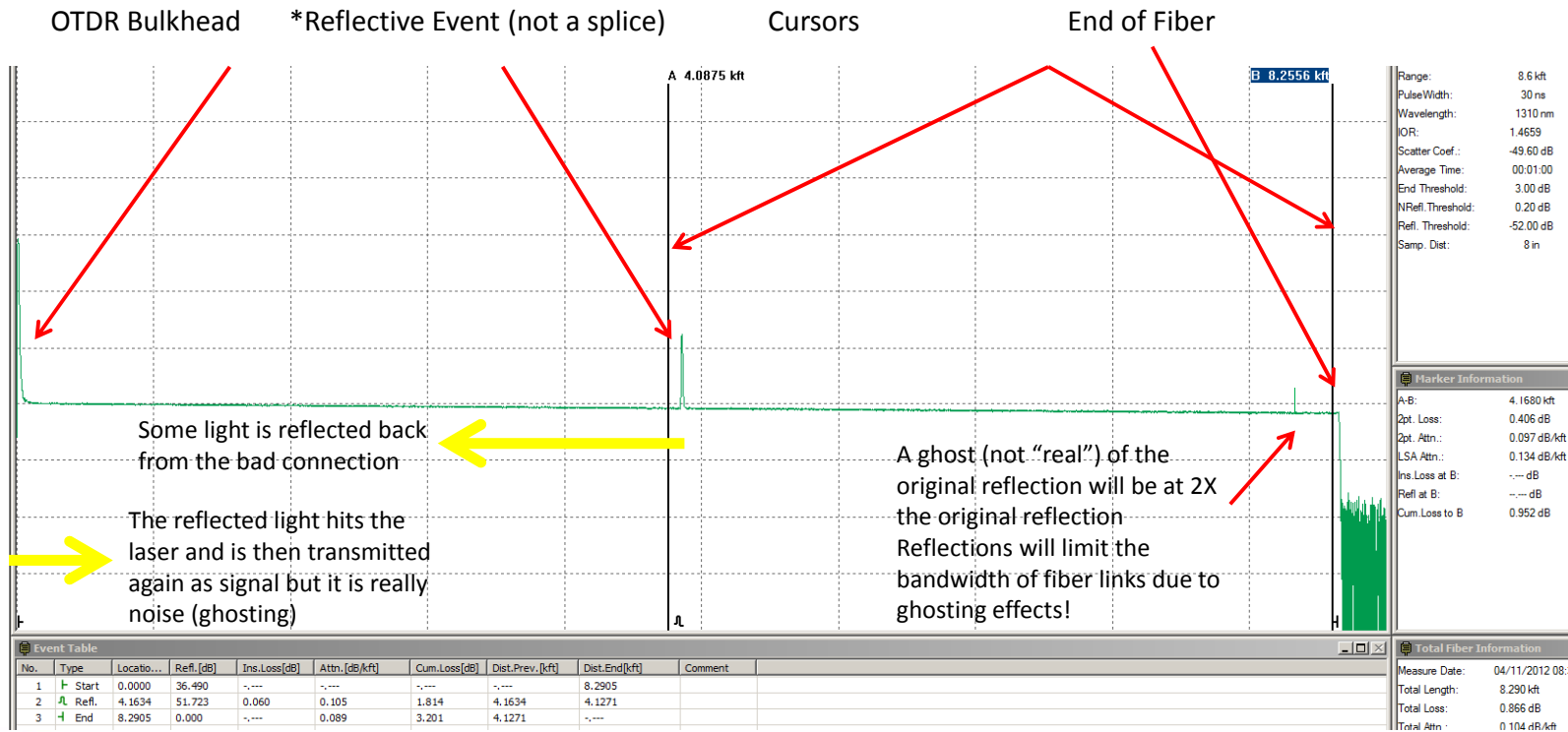
Optical Time Domain Reflectometer (OTDR)

- Single ended measurement
- Typically used to locate faults
- Also used to validate installations
- Locates & quantifies individual IL & RL events
- Full reporting can be used to record fiber links for qualification, later troubleshooting and analysis



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# If You Do Have Reflections

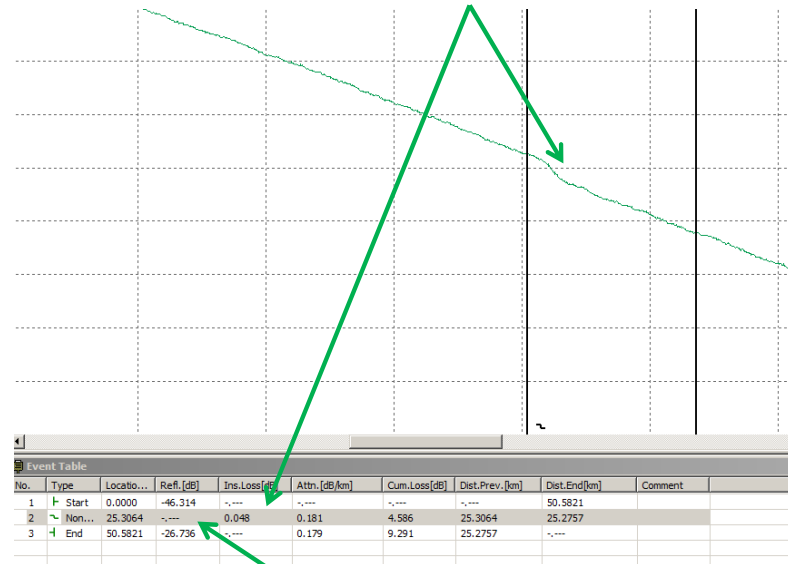


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# Typical Fusion Splice Loss

Fusion Splice Measured to be = 0.048dB



The return loss was not measureable!

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# Summary

- Handle the fusion splicer with care
- ARC calibration is a must
- Clean, Clean and Clean
- Core alignment compensates for fiber geometries
- Active clad provides near core performance
- An OTDR should be used to validate the insertion loss and return loss of the splice
- Splice on connectors should be used – not mechanical connectors
- Non auto controls determine who really is a splicing technician

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