Application Note
Reducing Losses in Fusion Splicing

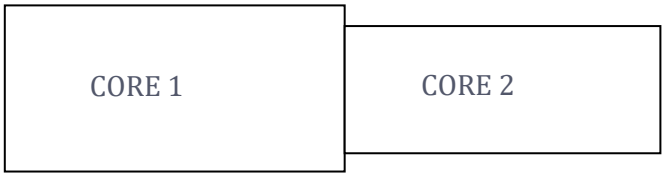
Core vs Cladding
Core alignment fusion splicer's will have much better splice losses than cladding alignment splicer's because of the active alignment of the two fiber cores. This is accomplished in the Tempo Communications FSP200 with two cameras and the ability of the splicer to align the center of the core of the fibers in the X, Y and Z domains. A full analysis is given in the application note Core vs Cladding Alignment Fusion Splicer.

Fusion Splicing Losses
The splice loss displayed on the FSP200 screen after splicing is only an approximation and should be validated with an optical time domain reflectometer (OTDR) or optical loss test set (OLTS). The determining factors for the displayed loss are cleave quality, cleave axis and an analysis of the shape of the finished splice.
Fusion splicer's quote the typical loss of singlemode splice to be 0.02dB. This is always a cut and then re-splice of the same fiber. In the real world the technician will have to splice different types of singlemode fibers together. Sometimes the fibers are old and have different geometries when compared to newer fibers. Different manufacturer's fibers can also have different geometries. Usually a core alignment splicer can accommodate these differences for single mode fibers but multimode fibers may require some of the splicer settings to be fine tuned from the standard splicing profiles.
Older fibers have poor concentricity, varying core diameters and are made of different formulations of glass with different dopants. Graded index multimode fibers are prone to differences in geometries and are especially problematic. The typical multimode splicing problems are due to core diameter, numerical aperture and index of refraction mismatches. Fiber concentricity variations between the core and the cladding will compound splicing difficulty.
If the FSP200 has trouble splicing due to fiber mismatch and concentricity issues, the manual modes of splicing must be used. The manual modes allow the technician to change the arc power, arc duration and splice position with respect to the electrodes.

- If one fiber is harder to melt than the other fiber the gap position can be changed so that more energy is applied to the harder to melt fiber and less energy to the softer fiber. The gap setting can also be increased or decreased so that the splice can be made faster by adjusting the arc power and or arc duration.
- Arc power and duration allow the technician to apply varying amounts of power to the splice point. This may be necessary if the fibers are harder to melt and require more heat to melt the fibers. The arc power and duration can also be reduced to better control fiber melting.

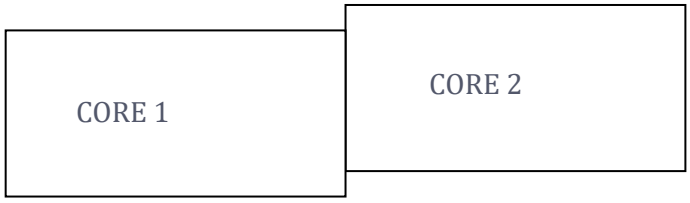
This is very much a trial and error process and requires careful experimentation by the technician. Consulting data sheets of the two fibers will simplify the process.

Core Mismatch Losses



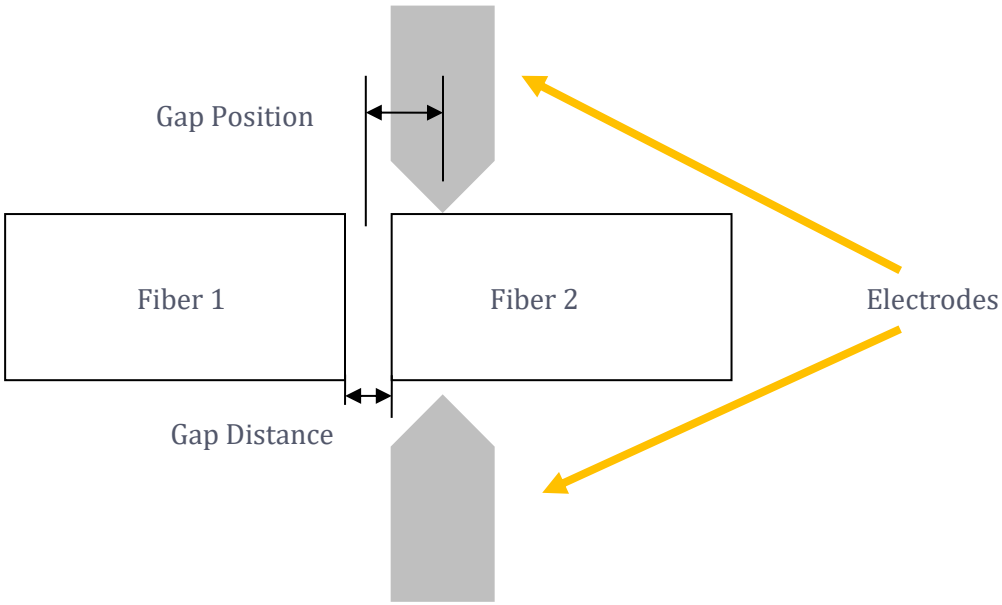
Insertion loss will be higher for signals travelling left to right.
Return loss will be high for signals travelling left to right.

Concentricity Losses

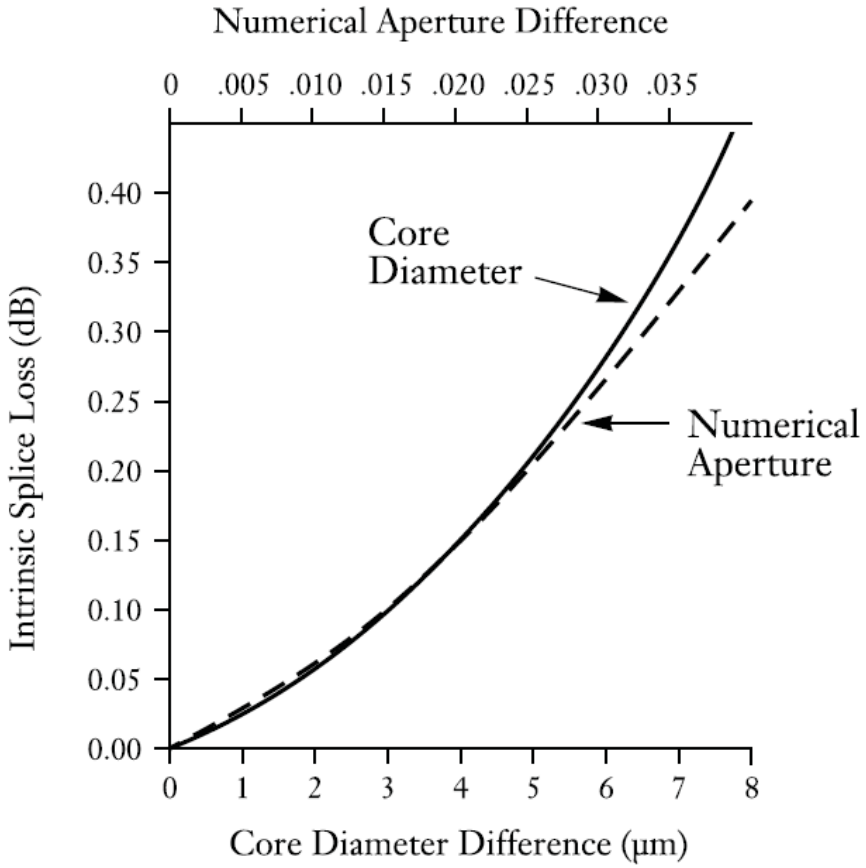


Especially problematic with cladding splicer's.
Return loss & insertion loss will be higher.

Adjust Gap Setting and Position



Fiber #1 melts easier so more energy is applied to Fiber #2.



A core diameter mismatch of 5 microns can cause a 0.2dB loss.

Notes

- Always clean the fiber with 99% isopropyl alcohol and a clean lint free wipe prior to cleaving.
- If the cleaver does not cleave the fiber make sure that the acrylic coating was removed.
- Make sure that the technician performs an ARC calibration at the beginning of a splicing session or when the ambient splicing conditions have changed.
- Always inspect and clean the fusion splicer as per Tempo Communications recommendations.
- Do not touch the electrodes with your hand.
- Stabilizing the electrodes may be necessary if the technician is experiencing poor splicing performance.