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Customer Premises Optical Connectivity Solutions

By Technology & Standards Committee

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Table of Contents

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Introduction

The total number of FTTH-FTTB users in Asia increasing every year and the increment is more than the years before. Service providers are in race to bring faster " ready to use" services to the theirs customer and requesting the solution to able them to respond to the customer's request with faster, easier, reliable and low cost solutions as deployment cost continue to drop.

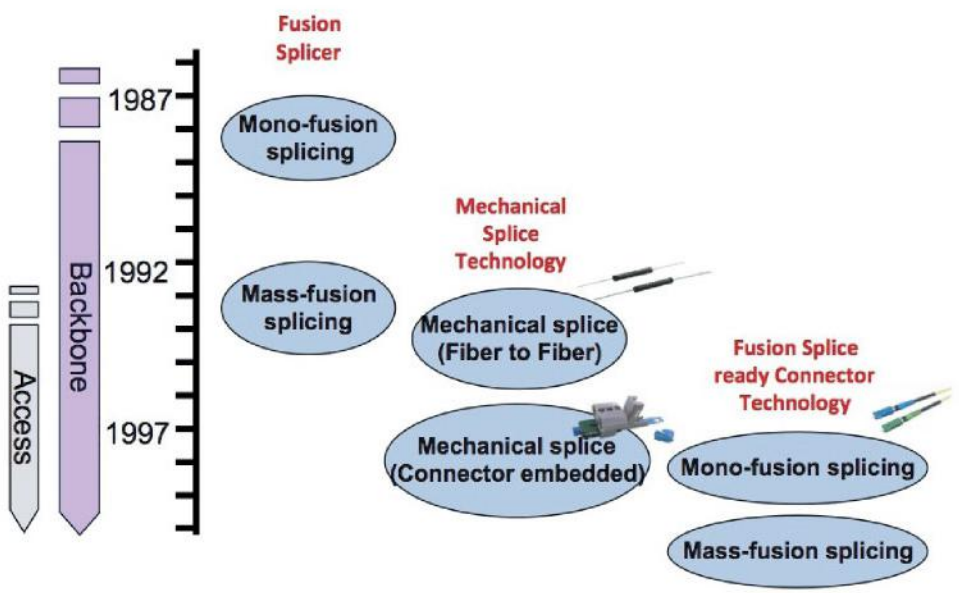
Customer premises connection is most critical and most expensive section of FTTH network. Only a few termination required in customer premises but installer should finish many customer connection in very limited time. For that reason, installer wants fast and easy assemble materials, less dependency of special tools, low loss performance while operator's concern on long reliable solution and less fault rate to reduce operation and maintenance cost.

Various solutions and technology to use for customer premises connection, as;

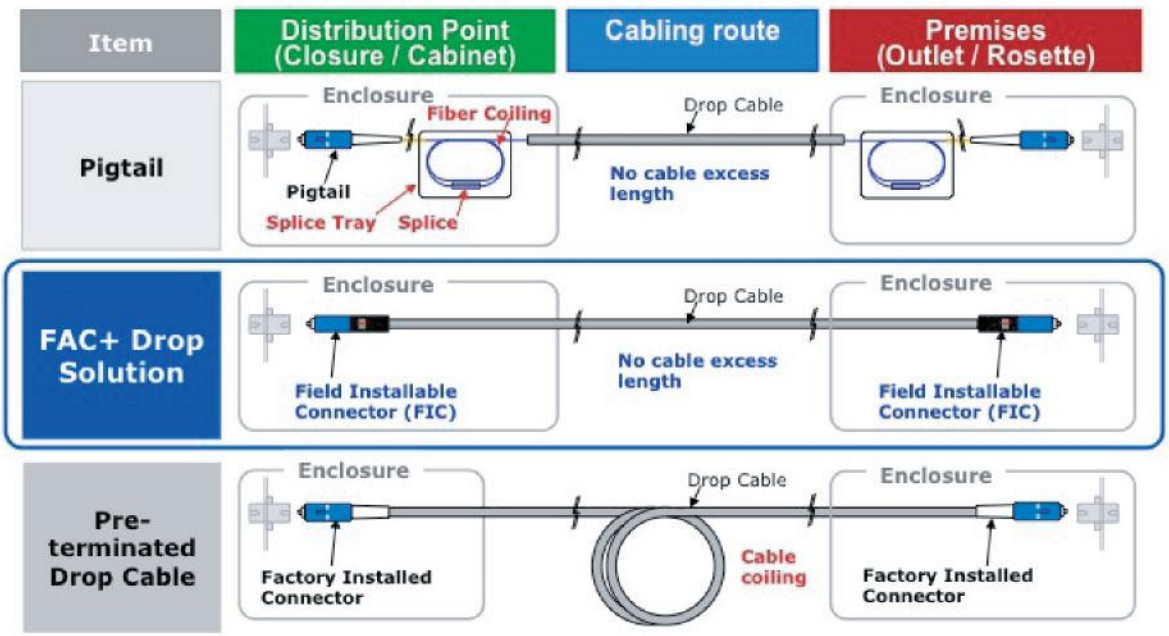
- Mechanical Splice : Field Assemble Connector
- Fusion splice : drop cable with pigtail or drop cable with fusion splice ready connector
- Pre-terminated drop cable (factory termination)

Each solution has advantages and disadvantages. The aim of this White Paper is to provide a guideline on use of any solutions with considering cost, advantages, disadvantages, limitations, benefits and risks

HISTORY OF CONNECTIVITY SOLUTIONS

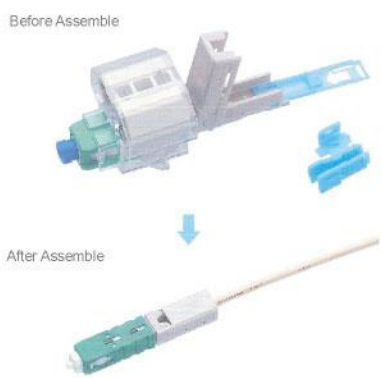


Customer Connections



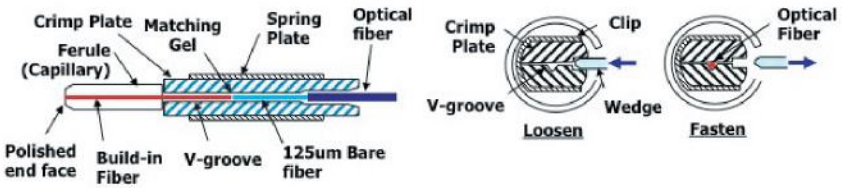
Products Overview

FIELD ASSEMBLE CONNECTOR



There are a lot fiber jointing and termination for Mass deployment of FTTH. High labor cost, expensive equipment to use and long time spending for fiber jointing forced the industry players to simplify the process with easy use products, less dependency for heavy and expensive tools and free from power source necessity.

Field Assemble Connector (FAC) or Field Installable Connector (FIC) requires no polishing in the field, do not require heavy tools and power. Fabricated in controlled environment with built-in fiber polished in one end and cleaved on other hand. Stripped fiber from various type and size drop, indoor cables or cords aligned until it touches the built in fiber where the connection is done via mechanical splice method. Index matching gel at the tips of built-in fiber placed to reduce signal reflection.



Basic Structure of Field Assemble Connector

Advantages:

- Suitable to use at customer premises for drop & indoor cable termination
- Fast set-up, Fast installation. Installer can complete termination in 2-3 minutes
- No epoxy , adhesive and curing required in the field
- No power supply required
- Narrow working space required
- Simple training required
- Simple low cost tools (Fiber cleaver, Jacket remover, Nipper)
- Economical. In-expensive and no cable excess length, splice tray required
- Wide range of Field Assemble Connectors avalibility for flat, round drop cable, indoor cable, cords and coated fiber

Disadvantages:

- Temperature dependency of Return Loss (RL). Reliability of index matching gel can change due to heat
- Possiblity fault cleaving of fiber

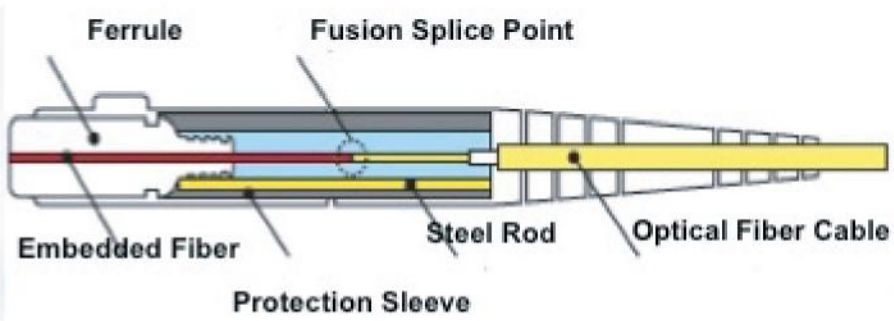
Fusion Splice Ready Connector

Before Assemble

Splice

After Assemble

It is very similar to Field Assemble Connector, Fusion Splice Ready Connector designed with pre-polish ferrule to eliminate polishing, adhesives and crimping in the field. Instead of mechanical splice method, fusion splice on two fiber can provide greater higher return loss performance. Installer error is lower compare to mechnical splice methods.



Basic Structure of Fusion Splice Ready Connector

Advantages:

- Suitable to use at central office connection, MDU customer premises connection, data center
- No splice tray required
- No pigtail required
- Suitable for mass splicing
- Long term operation
- Fusion splice and splice protection sleeve in the body
- Able to see estimated insertion loss of splice point
- Fabricated in controlled environment

Disadvantages:

- Expensive tool (Fusion splicing machine)
- Takes several minutes to set-up
- May require power (if battery out)

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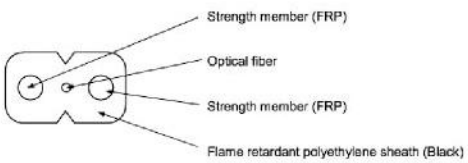
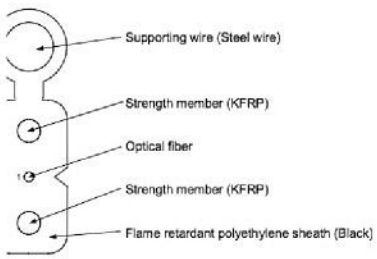
Pre-terminated Drop Cable





Underground Drop Cable

Aerial Drop Cable

Suitable for Single Dwelling Unit (SDU) and Multi Dwelling Unit (MDU) wiring inside ducts or aerial application. Aerial drop cable with supporting wire is UV resist type and suitable for outdoor wiring. Single core and multi core type cable can use as drop cable or branch cable for FTTH networks.

Pre-terminated drop cable is alternate solution to avoid field termination and potential installer's error. It can be good solution where the installer skill insufficiant or skilled installer shortage. However installation of pre-terminated cable can give some problem also. Many service provider requires cable pulling through existing conduit or requires microduct protection at customer premises. Cable pulling through conduit and microduct can damage the connectors. For that reason, installer prefer only one side pre-connectorized cables especially underground wiring

Advantages:

- Easy plug&play connections without high skill
- Cable and connectors tested in the factory
- Greater IL and RL performance
- Faster customer premises connection
- Factory assemble connector cheaper than Field Assemble Connector
- No expensive tools required (no cleaver or splicing machine)

Disadvantages:

- Longer restoration time
- Potential connector damage during cable pulling
- Excess cable length coiling in the field (may require storage box)
- High wastage due to standard length cable
- Inventory and logistic difficulty for varieties of cable length (if no pre-survey required for each customer premises)
- Field survey in advance (depends on service providers)

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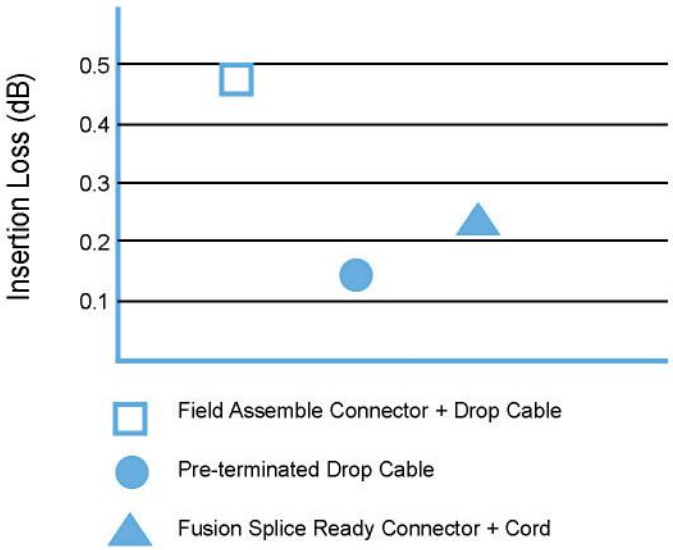
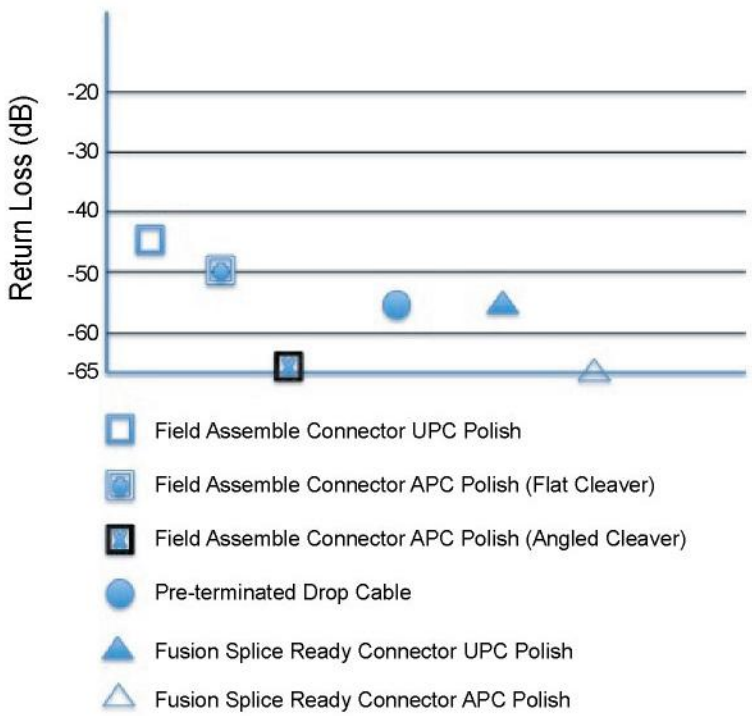
Insertion Loss (Il) Comparison



Return Loss (RI) Comparison



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Connectivity Solution Summary

	Field Assemble Connector + Drop Cable	Pre-terminated Drop Cable	Splice (Pigtail + Drop Cable)	Splice (Fusion splice ready connector + Drop Cable)
Material Cost (Low/Medium/High)	Medium	High	Low	Medium
Tooling Cost (Low/Medium/High)	Medium	None	High	High
Training Cost (Low/Medium/High)	Medium	Low	High	Medium
IL/RL Performance (Low/Medium/High)	Medium	High	High	High
Reliability (Low/Medium/High)	Medium	High	High	High
Skill Requirement (Low/Medium/High)	Medium	Low	High	High
Flexibility (Low/Medium/High)	High	Low	Medium	Medium
Installation Time (Short/Medium/Long)	Short	Short	Medium	Medium
Restoration Time (Short/Medium/Long)	Short	Long	Short	Short

Conclusion:

Several solution and technology developed by manufacturer and all products and techniques are giving solutions to installer's, customer's and financer's needs. All existing technology shown in this paper can be used by industry players to bring their services to the customers. However each players should make their selection with knowing the cost, advantages, disadvantages, limitation, benefits and risks.

FTTH Council Asia-Pacific Technology and Standards Committee thanks to all contributors for their great and valuable support for this white paper