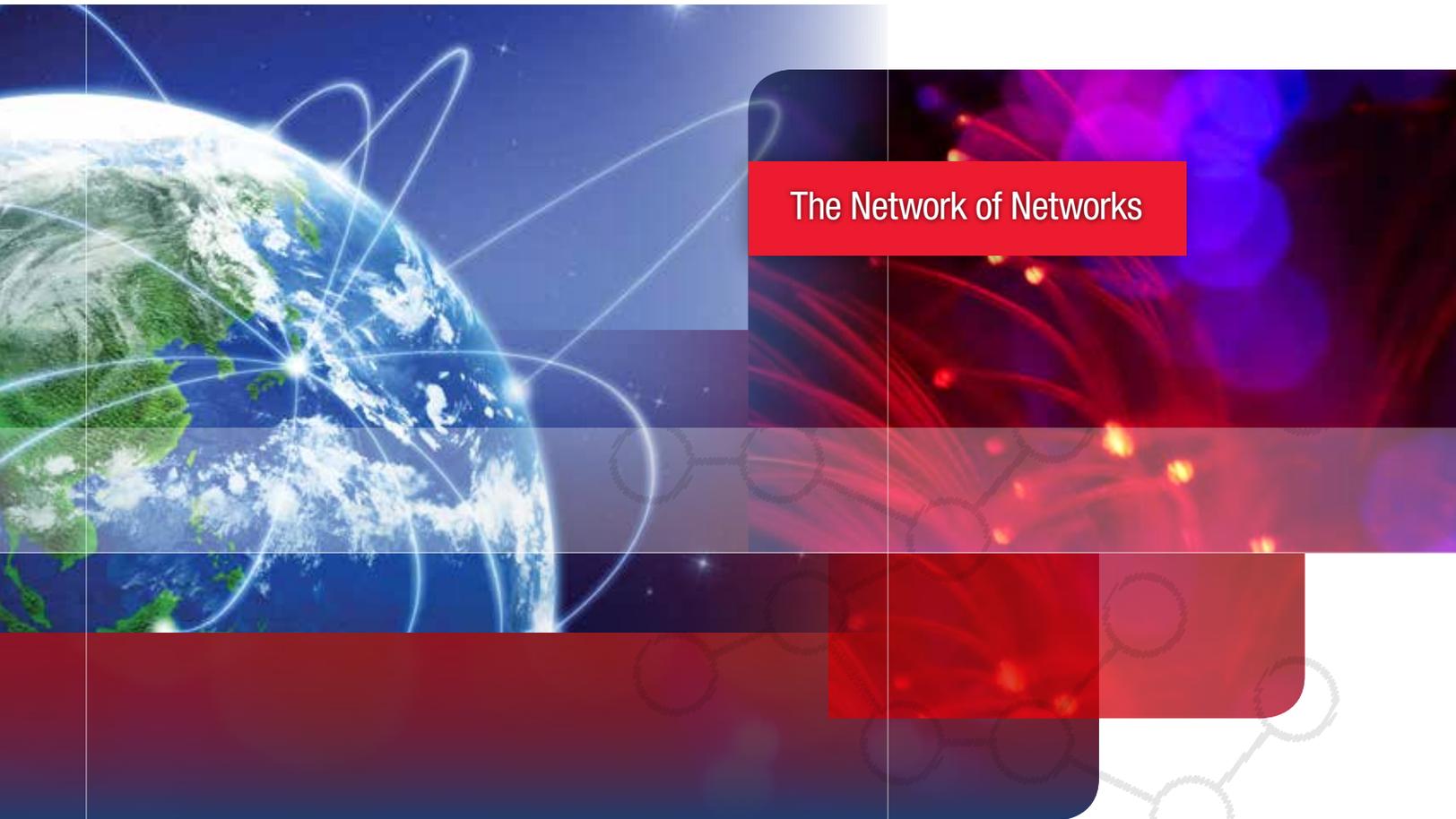


Next Generation Fiber Connectivity

New tools and technologies invented by 3M are transforming old notions about field terminations while delivering great flexibility, cost savings and reliability

Business White Paper



The Network of Networks

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Introduction

As the popularity of bandwidth-intensive applications has increased and the arguable perception that copper cabling is reaching its limits, demand for fiber-optic installations has escalated – especially fiber-to-the-premises (FTTP). But the challenges and limitations of installing singlemode optical connectors in the field have posed financial barriers for many service providers. Training, termination time and equipment costs can be significant.

Fiber-optic cable termination styles and tools have evolved over time in an attempt to address the industry-wide need for easier, faster and less expensive termination methods. Each termination type presents advantages and pitfalls that can ultimately impact service providers' capital expenditure budgets, subscriber satisfaction and the speed with which the return on investment can be realized.

Fiber end-face finishing has rarely been easy outside the factory. That is, until now.

This paper reviews the pros and cons of some available singlemode termination methods and presents an exciting and field-proven alternative: 3M™ Crimplok™+ Connectors, the first-known, commercially available, field-mounted fiber optic connectors that meet indoor and outdoor performance requirements without a splice, gel or adhesive.

Eight Reasons Why the 3M™ Crimplok™+ Connector is a Game-Changing Solution

- No splice, no gel, no adhesive
- Temperature-tolerant; connection can be installed in indoor or outdoor conditions
- Installed with simple, low-cost tools that require no power source
- No elaborate set-up or special training needed
- Can reduce equipment costs by up to 75%
- Can reduce labor costs by up to 20% to 50%
- Achieves signal strength comparable to fusion splicing

Traditional Fiber-Optic Termination Methods

Several different approaches have been predominantly used for making fiber-optic terminations.

The original termination for fiber optics, heat-cured epoxy and multi-step polishing, is still in use today, and is popular for factory assembly or in high volume installations. This method is dependable, relatively stable, low cost and high yield. The downsides of this method are that it requires a high level of skill and training to accomplish, and a significant investment in equipment. Unless undertaken in a controlled environment, heat curing epoxy and polishing is generally not considered to be well suited for field use.

Another common method involving adhesives utilizes either hot melt or anaerobic resins. This style overcomes some of the issues that essentially barred the original termination style from field use. Stable in most environments, this method is not suitable for use at high temperatures. And it still requires multi-step field polishing, which has typically been an expensive and somewhat dicey prospect for installers.

No polish connectors, which include pre-polished connectors with integral mechanical splices and pre-installed fiber stubs, are considered by many to be fast and easy to install. Although dependable and easily field installable, the added optical interface and index matching gel can be an issue to some.

Fusion splice-on connectors can be as reliable as factory pre-terminated connectors because they exhibit very low additional back reflection. This style of field termination requires an expensive fusion splicer that costs several thousand dollars, and requires a power source – an important consideration in field installations. In addition, a high degree of training and experience is required to successfully complete the work – even when the installation is accomplished with factory pre-terminated pigtails. Labor costs and time to complete the installation can be significant.

Another option for termination is the use of factory pre-terminated cable assemblies. This type of solution is relatively easy to accomplish in the field as it requires little training or start-up costs. But the potential for waste can be a significant budget factor. Careful and precise measurements must be taken to ensure adequate cabling is ordered in advance of the installation. Measurement errors that can dramatically increase costs – when too much or not enough cable is ordered – are usually not discovered until installation begins. Order lead time must be factored into the installation schedule, which may negatively impact speed to market. Finally, storage of excess cable lengths consumes valuable space and can be problematic in terms of housekeeping.

In summary, the key challenges and limitations of traditional termination methods include:

- Complex installation processes
- Inconsistent performance
- Environmental stability
- Training requirements
- Potential for costly cable waste
- Potentially high labor costs due to skill required
- Potentially high labor costs due to termination time and re-dos
- High equipment costs – whether purchased or rented
- Potential subscriber impacts during and after installation

As many in the industry have long agreed, the ideal termination solution is one that can be cost-effectively and efficiently accomplished in the field. But that ideal has been elusive up until now. The 3M™ Crimplok™+ Connector is a technologically advanced solution that is designed to help overcome the major drawbacks of traditional field termination methods and revolutionizes two key termination components through the invention of:

1. A fiber connector that provides environmental stability in virtually all conditions, whether indoor or outdoor, and is suitable for both ultra polished connectors (UPC) and angled physical contact (APC) applications, and
2. Affordable equipment and tools needed to reliably accomplish field installation in the most cost-efficient manner.

3M™ Crimplok™ + Connector

Like many service providers, a large U.S. company wanted to cut fiber connectivity costs in a fiber-to-the-home (FTTH) deployment to greenfield multi-dwelling units (MDUs). The provider had previously relied on fusion splice-on connectors inside the living unit at the optical network terminal (ONT). Although the provider was aware that mechanical splicing offered a potentially less expensive alternative, concern about the performance of the index matching gel in the splice prevented the company from adopting the method.

The 3M Communications Markets Division offered a different solution: the 3M™ Crimplok™ + Connector, the first-known, commercially available, fiber optic field-mounted connector that meets indoor and outdoor performance requirements without a splice, gel, or adhesive. The Crimplok+ connector combines the speed of mechanical splice connectors with the high performance of fusion splice-on connectors.

UPC- and APC-compatible, Crimplok+ connectors can be installed in indoor or outdoor locations while maintaining excellent optical reflections (less than -40 dB for UPC and less than -60 dB for APC). Best of all, the Crimplok+ connector provides fast, easy field installation of 900 μm singlemode fiber without a splice, gel or adhesive.



The connectors are SC-compatible and contain a metallic element which mechanically locks the fiber in place. Crimplok+ connectors have a thermally-balanced design that has been tested for premises and FTTP applications and for indoor and outdoor conditions ranging from -40° F to 167° F (-40° C to 75° C).

Additionally, the connectors have a streamlined boot attached to the body, which minimizes the risk of losing or forgetting to install the boot during the termination process. After installation is complete, the boot helps keep the fiber from kinking, even during side pull.

3M™ Crimplok™+ Connectors provide high levels of optical performance and offer many benefits:

- Installation is quick and easy, typically taking five minutes or less
- Saves time and significantly reduces costs
- Eliminates a splice interface
- Field installation reduces cable waste – always the right cable length with no cable slack to store
- Connectors are installed with simple, low-cost tools that do not require a power source
- Does not require batch installation of multiple connectors at a time
- Angled connectors without an expensive angle cleaver

A U.S. service provider conducted a field trial of the Crimplok+ SC/APC connector in a 240-unit new construction apartment complex in Texas. In each apartment, the connector was terminated on the drop cable's 900 µm fiber in a wall outlet box set into a closet. Technicians were trained in one morning, and began installations that afternoon.

On average, the technicians installed each connector in less than five minutes. Total installation took only about 15 minutes per unit on average, and involved set up of the Crimplok+ connector kit, uncoiling the cable in the closet, preparing the cable jacket, terminating the connector, coiling the cable back in the outlet box, packing up the kit and moving on to the next apartment.

The Crimplok+ connector was specifically designed for easy, fast and nearly foolproof installation. This reduces costs significantly. Providers replacing fusion splices with the Crimplok+ connector may realize cost savings of up to 75 percent or more on equipment and 20 to 50 percent on labor while achieving comparable signal strength.

Connections are Easy as 1-2-3 with 3M™ Crimplok™ + Connectors

Step 1 – Cleave fiber



Step 2 – Insert cleaved fiber through Crimplok+ connector and lock into place, using the 3M™ Crimplok™ + Protrusion Setting Tool



Step 3 – Polish fiber tip with one turn of a handle, using the 3M Crimplok+ Nano Finishing Tool.

Elapsed time: Typically five minutes or less.



Summary

The 3M™ Crimplok™+ Connector provides high levels of optical performance and environmental stability. Tests have demonstrated this connector is suitable for use in outdoor environments such as FTTH. As many service providers have found, its impact on the ease and success of field-mount connectivity and the ability to dramatically reduce installation costs are groundbreaking.

Learn more about 3M Mechanical Connectors. Visit www.3M.com/Connectivity.

The Network of Networks

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