

Factory Produced Fiber Optic Connector Terminations vs. Field Installed Connector Ends



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Broadcast engineers who cut their technical teeth on attaching connectors to coax cable might be surprised to learn that when working with fiber, relying on factory-terminated cables offers several advantages over field termination, including performance and savings in labor, material costs and installation time.

Unlike field terminated fiber, pre-connectorized cable assemblies are guaranteed to work to the highest performance specification out of the box. Under the best circumstances, field terminated cables offer 0.25 dB signal loss, while factory-terminated fiber delivers typical loss of 0.2 dB or better.

TV engineers who have worked hard over the past several years to implement video production workflow solutions that improve productivity, have personal knowledge of the stations ongoing efforts to work as efficiently as possible and to use labor wisely. Against this backdrop, using factory-terminated fiber in stations makes a lot of sense.

The labor savings associated with using factory-terminated cables in most instances make it a more economical solution than field termination of fiber cables. Not only do factory-terminated cables eliminate the labor costs associated with installing connectors in the field, but they also eliminate the need to spend time and money on re-doing work that has failed and the cost of additional connectors.

For further illustration, a cost analysis concerning the material and labor savings of factory termination over field termination was conducted. The cost factors provided are at a common discount structure for both methods. Labor and material costs used are a compilation from various industry sources, including ADC Professional Services and ADC Customer Services.

ADC's Next Generation Fiber Termination Block (FTB) was used as the example for all comparisons. In the factory termination example the FTB has a 100-meter plenum-rated IFC (Intra-Facility Cable) with 144 factory terminated multi-mode SC connectors at one end with a stub at the other end.

For the field termination examples the IFC cable was connectorized using two different methods, field polished terminations and pre-polished field crimp terminations.



Preterminated Fiber Termination Blocks arrive from the factory with either IFC or OSP Cables



Fiber cable easily uncoils during installation



Fiber Termination Block ships inside the drum

Preterminated Fiber Terminal Blocks (FTBs) With IFC or OSP Cable

Preterminated Fiber Terminal Blocks (FTBs) with IFC cable are available with connectors on the FTB end and a stub at the far end for splicing in an off-frame splicing application or with connectors on both ends of the cable for tie panel applications. Preterminated FTBs are available with either indoor or outdoor rated cable in ribbon or stranded configurations in fiber counts ranging from 12 to 216 per cable. The IFC cable was cut to the length needed and connectorized. All connector terminations are 100% tested for insertion loss and return loss in the factory before they are loaded into the FTBs.

Factory Termination

Factory-terminated cable comes from the manufacturer where it is prepared under the supervision of fiber optic experts in a clean environment free of pollutants found in a common field environment. All completed assemblies are tested through each connector to the stub end of the fiber with documentation being provided as a deliverable item with each assembly.

The first picture above shows the completed Next Generation Frame Fiber Termination Block Assembly in a shipping configuration. The second picture shows how the FTB/IFC cabled assembly is removed from the shipping configuration, and the third picture shows how the FTB with IFC fiber cable is deployed for installation from the shipping assembly.

At the station, this fiber is pulled into place and the factory-terminated connectors are attached to patch panel frames. Taking advantage of factory-terminated cable requires some forethought and planning. Knowing where panels must be located and the length of runs from the panel to various pieces of equipment is necessary. It is also important to know how best to bring panel, fiber and equipment together.

One approach is using multifiber cable with factory connectors attached to one end for the equipment side of the run. At the patch panel, a factory-connectorized pigtail plugs into the back of the panel leaving a factory-prepared stub end ready for fusing. Station technicians then fuse individual strands of the multifiber cable equipment run to single strands of fiber making up the pigtail. Another approach is to use factory terminated connectors on both ends. In some instances a multifiber connector may be utilized for further plug-and-play benefits.

For the cost analysis we only examine the factory preterminated cable in a panel with stub end on the far end. The cost of the completed 144 termination FTB assembly with 100 meters of IFC cable was \$8,422 per block. This cost includes the FTB, connectors, a 100-meter IFC cable, labor and associated expendable termination materials.

Field Termination Analysis Field Polished Termination

When fiber is terminated in the field, bulk cable arrives at the television station on optical cable reels with packages of connectors. That cable must be pulled between points and attached to patch panels at both ends of each run. Before it can be attached to the panel, technicians must attach connectors to each strand of fiber. Those connectors, which get plugged into the back of patch panels, can fail or perform below acceptable signal loss tolerances.

In the field polished termination method there are numerous costs and labor efforts that must be considered. An example of a project where field polished termination was employed is detailed in the following table.

The labor to accomplish termination of 144 field polished connectors was 42 hours at \$40 per hour. This included a 30% factor for unproductive time in delays and security restrictions.

Labor	\$ 1680
Connectors	\$ 500
Tools and consumables	\$ 100
FTB with adapters	\$ 1100
144 strand cable, 100 meter length	\$ 7800
Connector waste	\$ 56
Total costs	\$ 11,236

Field Termination Analysis - Pre-polished Crimp Field Termination

Using the pre-polished field crimp method there are also costs and labor efforts that must be considered. These costs are listed in the table below. The labor to accomplish termination of 144 field polished connectors was 31 hours at \$40 per hour. This included a 30% factor for unproductive time in delays and security restrictions.

Labor	\$ 1240
Connectors	\$ 1870
Tools and consumables	\$ 100
FTB with adapters	\$ 1100
144 strand cable, 100 meter length	\$ 7800
Connector waste	\$ 56
Total costs	\$ 12,166

Additional advantages of factory termination over field termination that must be noted in addition to the cost savings are:

- Accomplished in a controlled and clean environment
- All connectors are polished at the factory and inspected under a quality check and quality control program
- All IFC and connectors are tested through each connector to the stub end of the IFC. These test results are documented and provided with each assembly

- All expendables, labor and “do again” costs are bore by ADC
- Combined with splice of the stub end, injection of the lowest possible loss into a system. A typical loss through a fusion splice is .01db with a factory pigtail end less than .2dB versus a field term typically in the .3dB to .7dB range.
- Combined with splice of the stub end to factory pigtails, splice machine estimations provide an immediate read out of the splice loss upon completion of the splice. ADC provided documentation contribute to the reduction in test and acceptance time.

Conclusion

ADC emphasizes the advantages and benefits of factory termination assemblies over field termination e.g. finished assemblies are tested and losses documented, there is no waste or “do again” costs, enhanced performance, etc. Pre-connectorized assemblies are available with connectors on the assembly end and a stub at the other for splicing purposes or with connectors at both ends for tie panel applications.

In reviewing the costs indicated for each method the following is determined:

The factory termination provides a cost savings of \$2814.00 over the field polish method.

The factory termination provides a cost savings of \$3744.00 over the pre-polished field crimp method.

For TV engineers who have grown up in the business cutting coax to length and attaching connectors, these approaches might seem a little foreign. However, the clear advantages of lower labor costs, higher performance and the elimination of wasted material and time offered by using factory-terminated fiber optic cable make a little re-orientation in engineering mindset and practice more than worthwhile.



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