

High Fiber Count Trunks Applications Guide

AEN161, Revision 2

This Application Engineering Note will serve as a guide to selecting the best Corning Optical Communications High Fiber Count solution for your structured cabling application. This document will cover the market drivers, structure cabling impact, design considerations and deployment methods for MTP® High Fiber Count connectivity backbone cabling.

Market Drivers

Data center build-outs continue to grow, driven by the increase in bandwidth demands and changes in network architectures. As a result, time-to-market needs for the data center production environment continue to compress.

As seen in Figure 1, 10GbE switching is the current majority of data center switch revenue, with 40GbE and 100GbE switch revenue beginning to show growth. Bandwidth demands will continue to develop as the majority of server port bandwidth currently operates at 10GbE, but is moving to 25GbE and 40GbE. This increase in demand at the server level is driving the need for 100GbE switch connectivity.

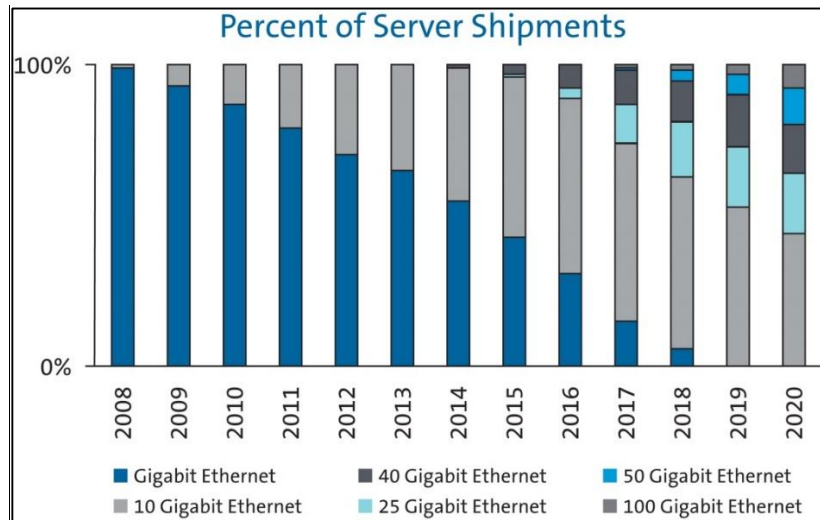


Figure 1: Percent of Server Port Shipments by Speed¹

Adoption of network architectures such as spine-and-leaf is driving not only bandwidth demand, but also the scale of the network, requiring an increase in fiber count for the cabling infrastructure. With spine-and-leaf architectures, each leaf switch in the network is connected via a mesh to every spine switch in the network to provide increased resiliency. As a result, fiber counts can multiply very quickly as compared to the fiber counts required in traditional 3-layer distribution architectures.

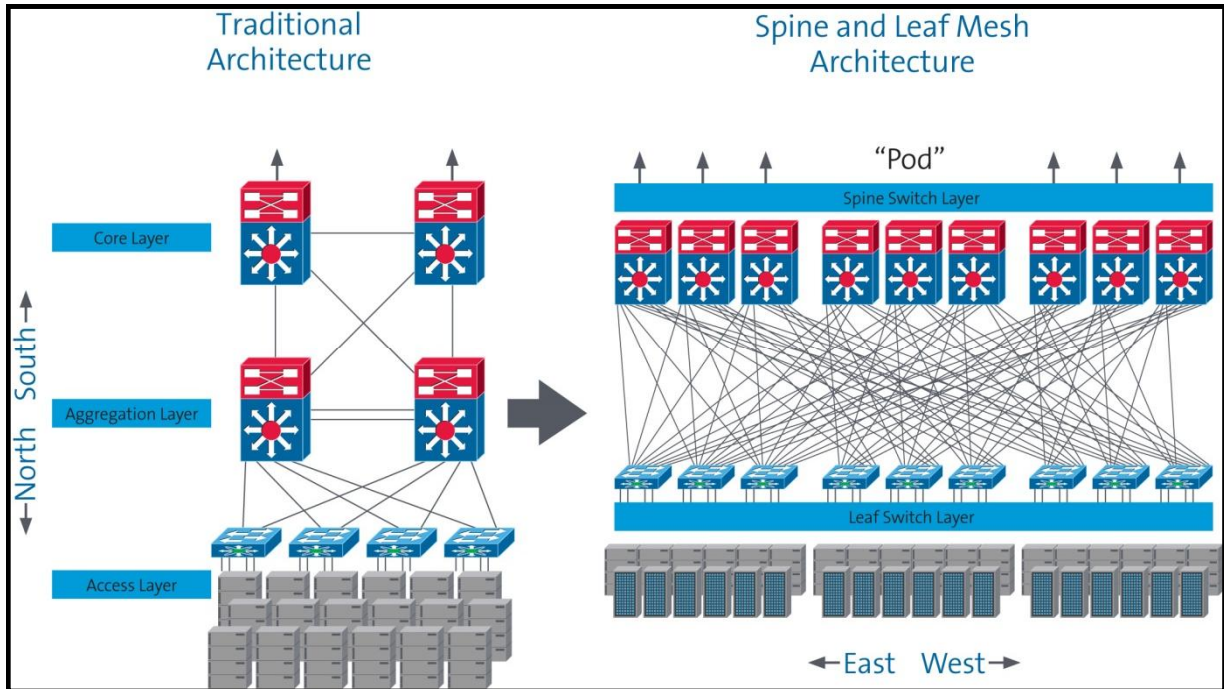


Figure 2: Traditional 3-layer Architecture vs. Spine-and-Leaf Architecture

While the demand may come from different sources, such as support of external clients operating in a cloud-based services data center or internal lines of business for a traditional enterprise data center, the need to offer services quickly and improve time-to-market is critical. To support this, the infrastructure must be able to be deployed in an efficient manner, offering quick movement into production for large networks.

Impact on Structured Cabling

Traditional structured cabling deployments in the data center space are based on infrastructure designs using pre-terminated MTP[®] assemblies ranging in fiber counts from 12 to 144 fibers. To support the growth in bandwidth needs and changing technologies and architectures, fiber count requirements are increasing, with spaces in the data center requiring connectivity to support demands of up to 864 fibers in a single run, and even fiber counts of 1728 fibers in high-density areas.

As these types of deployments become necessary, it is important to continue to consider the impact of the application, environment, and installation methods required to provide this high fiber count connectivity. This document will explore the recommended design options for implementation of high fiber count cabling and connectivity. These solutions enable scalability and maintain the ability to support the speed to market needs of the data center environment.

Application Spaces

As the data center environment evolves, the cabling and connectivity to support its needs must change and evolve as well. In Figure 3 below, the areas where connectivity is required both within a data center as well as within a data center campus are defined.

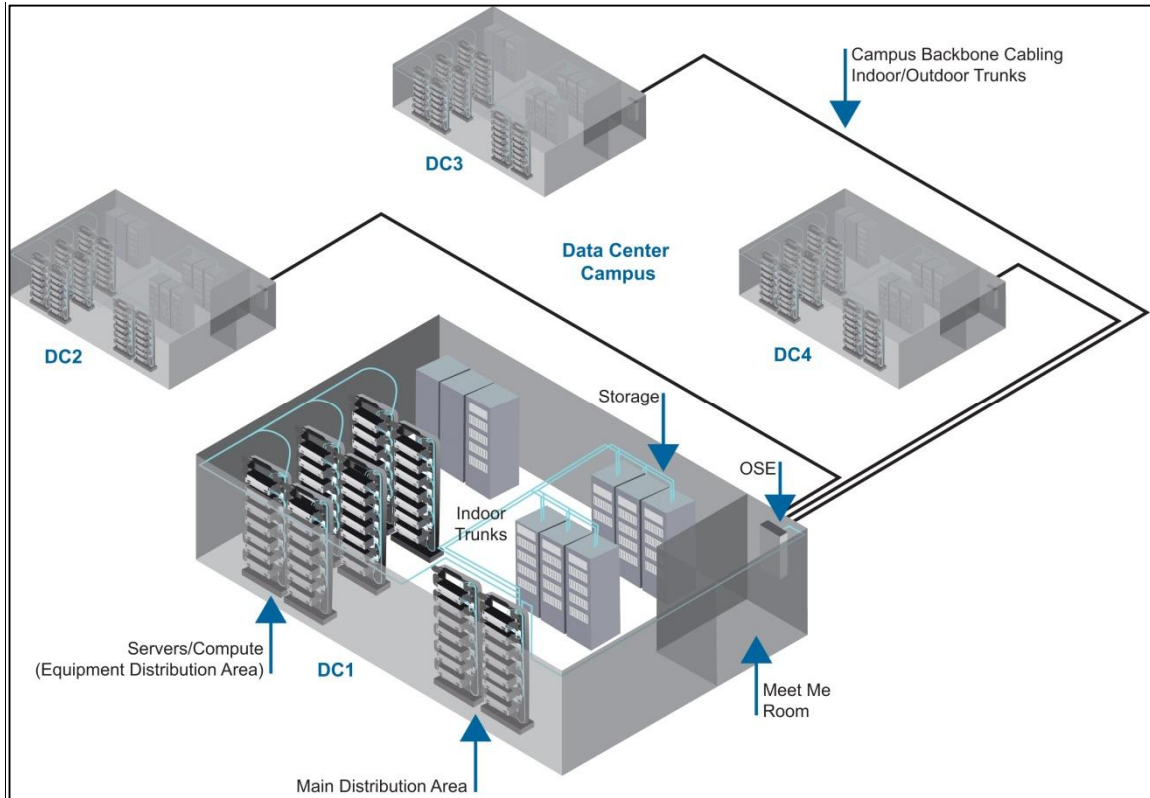


Figure 3: Data Center and Data Center Campus Areas

Design Considerations

When designing the optical cabling infrastructure for a data center many factors have to be considered, including network architecture and physical planning of the white space or data center production area. The optical cabling can be deployed in a manner that mimics the network architecture layout. For example, a common practice in many data center designs is the use of top-of-rack (ToR) switch architectures. One option in cabling for this type of architecture is to install dedicated low fiber count optical cables to each cabinet for the ToR switch in each cabinet. Alternatively, the optical cabling can be deployed in a middle-of-row (MoR), or end-of-row (EoR) topology, utilizing patch cords to support connectivity from the MoR or EoR structured cabling to the end equipment. This approach allows for the consolidation of the optical cabling, making more efficient use of rack space and pathway space.

In many legacy data center designs, links requiring greater than 12 fibers consist of multiple 12-fiber trunks. As fiber needs continue to grow, the fiber count of the cabling deployed in a given pathway has increased. However, utilizing a traditional approach of multiple low fiber count cables to accomplish this is a challenge for both pathway space utilization and cable

management. To address these challenges many data center cabling designs utilize MTP[®] trunks with fiber counts up to 144 fibers. In data centers requiring link deployments of fiber counts greater than 144 fibers multiple runs of a 144-fiber count cable assembly are typically installed to achieve the total desired fiber count. For example, if a link required 288 fibers from the main distribution area of the data center to another location, two 144-fiber trunk cables would be installed. The use of multiple cables can fill the available pathway space quickly, reducing the physical space capacity for future growth. An improved approach would include installation of a single high fiber count trunk (ex. 288 fibers) in place of the multiple lower fiber count trunk cables. The installation of a high fiber count trunk assembly reduces day one space requirements, allowing room to grow in the future, as well as reducing the quantity of trunks that need to be installed, decreasing deployment time of data center construction schedules.

Figure 4 below depicts the space savings across four deployment scenarios:

- 4440 total fibers utilizing 370 x 12 Fiber MTP-MTP EDGE Trunks
- 13680 total fibers utilizing 95 x 144 Fiber MTP-MTP EDGE Trunks
- 16128 total fibers utilizing 56 x 288 Fiber MTP-MTP EDGE Trunks

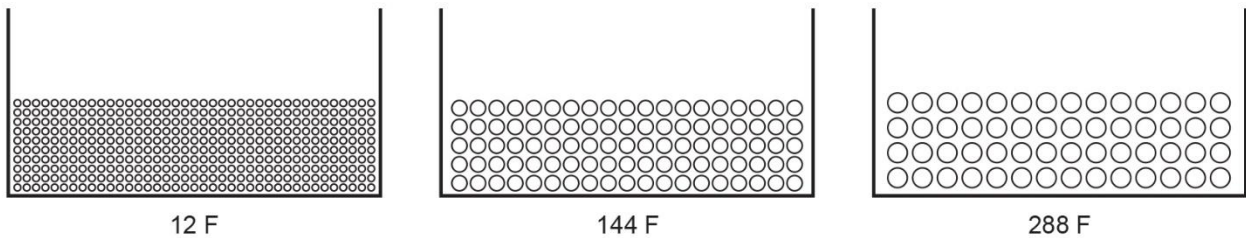


Figure 4: 12” x 6” Basket Tray Fill Comparison with Different Fiber Count Trunks

Deployment Solutions

To meet the need for high fiber count cable and connectivity solutions, various implementation options are available. Depending upon the application space as well as deployment considerations, each solution has a target placement in the data center.

For connectivity required in a data center campus to connect between buildings, solutions that incorporate indoor/outdoor cabling, such as FREEDM[®], or outdoor cabling should be considered. Within the data center, however, solutions utilizing indoor rated cable can be utilized just as traditionally deployed with today's indoor EDGE[™] based solutions.

MTP[®] connectivity is a key component of the solutions recommended in high fiber count environments. The MTP footprint enables the lowest total cost of ownership for the implementation of, or future migration to, 40/100/200/400GbE networks with the use of parallel-optic technologies. Additionally, installation of cabling with MTP connectivity allows the deployment of the optical fiber terminations 12 fibers at a time rather than individual termination of single fiber strands. These MTP terminations can then either be broken out into individual ports with the use of MTP-LC modules or used directly for MTP interfaces. With variations in infrastructure design, cabling environments and pathway types, MTP connectivity in the backbone cabling can be achieved with multiple methods:

- 1) Cables that are factory-terminated on both ends with MTP connectors (MTP Trunk Assemblies)
- 2) Cables that are factory terminated on one end with MTP connectors, and then field terminated or spliced at the blunt cable end of a MTP Pigtail Trunk or Pre-stubbed housing.
- 3) Bulk cables that are field terminated on both ends with MTP Splice-On Connectors (SOCs), MTP pigtails or Pre-stubbed housings.

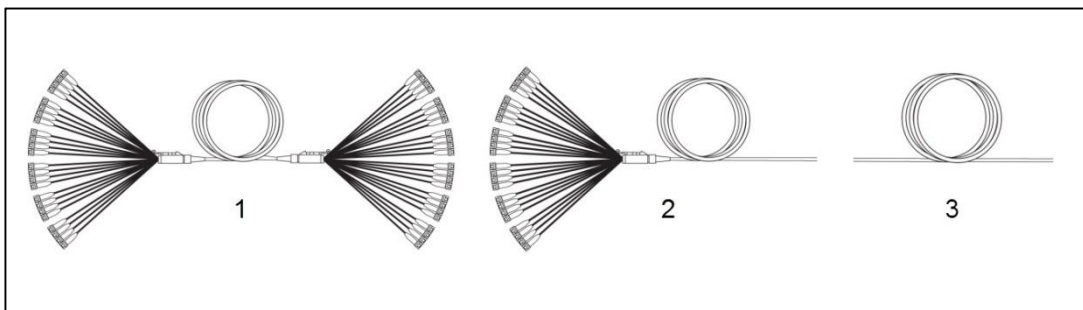


Figure 5: Methods for Achieving MTP Connectivity in the Backbone

MTP®-MTP Trunk Assemblies

MTP Trunk Assemblies are used where the entire fiber count is being landed at a single location at each end of the link. For example, the Main Distribution Area (MDA) to the Horizontal Distribution Area (HDA) or to the Equipment Distribution Area (EDA). This is a typical deployment for indoor cabling within a data center as shown in Figure 6.

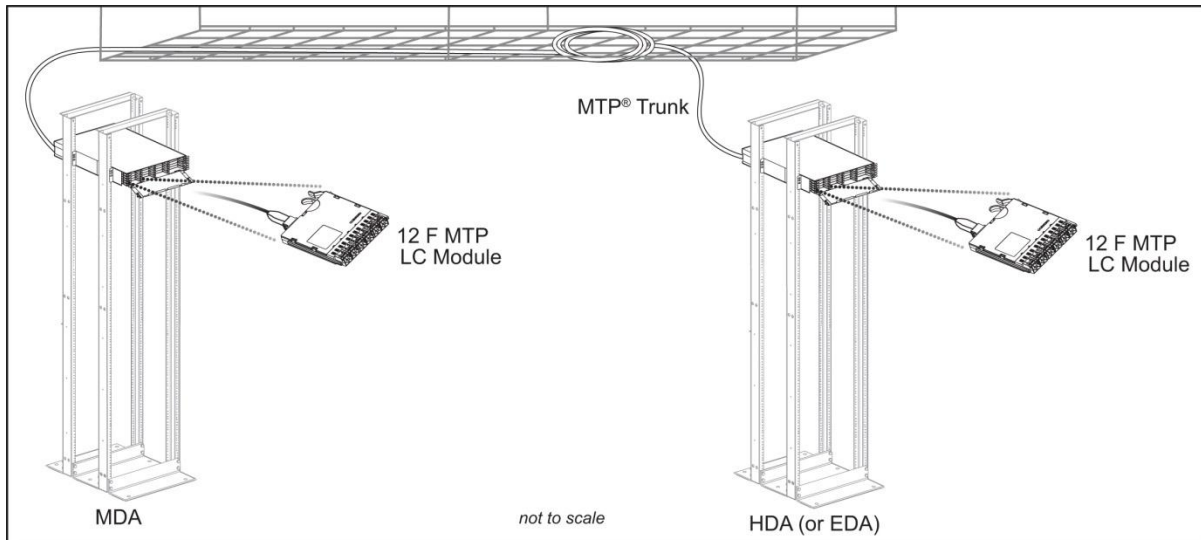


Figure 6: MTP-MTP Trunk Assembly Deployed Indoors

MTP- Pigtail Trunks

The application for MTP Pigtail Trunks has two primary use cases. One application is for environments where the pathway will not allow for a pre-terminated end with a pulling grip to fit through, such as a small conduit space (Figures 7 and 8). Another application is where the high fiber count assembly is deployed to consolidate inter-building fiber connectivity on a campus and is then broken out to multiple lower fiber count assemblies at distribution areas within the building (Figure 9). Additionally, a deployment using pigtail trunks can be useful when the exact pathway or route is not fully known to measure exact lengths prior to ordering of the assembly.

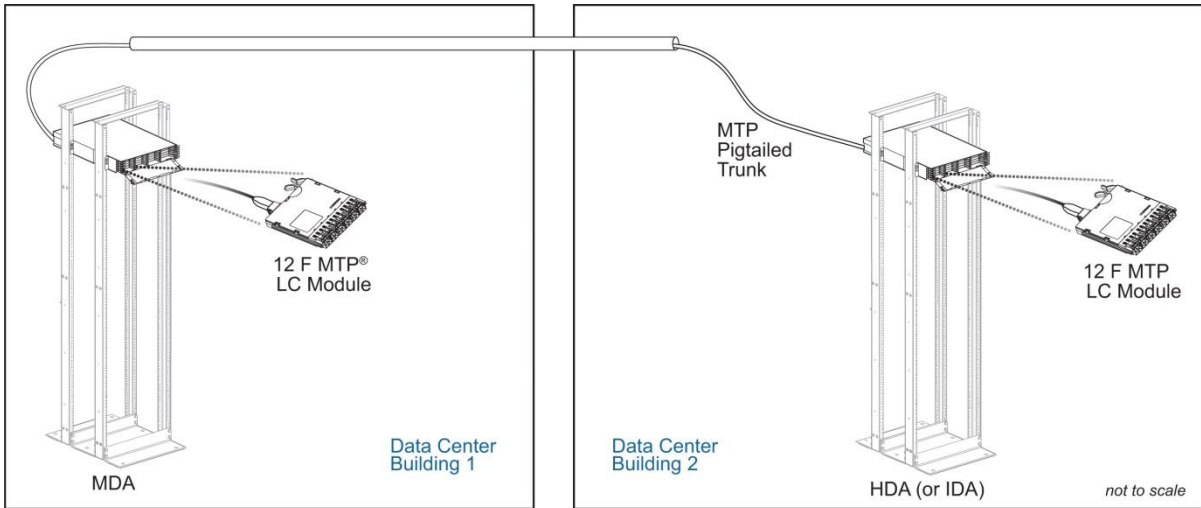


Figure 7: MTP[®] Pigtail Trunk Through a Congested Pathway and Field Terminated at the HDA

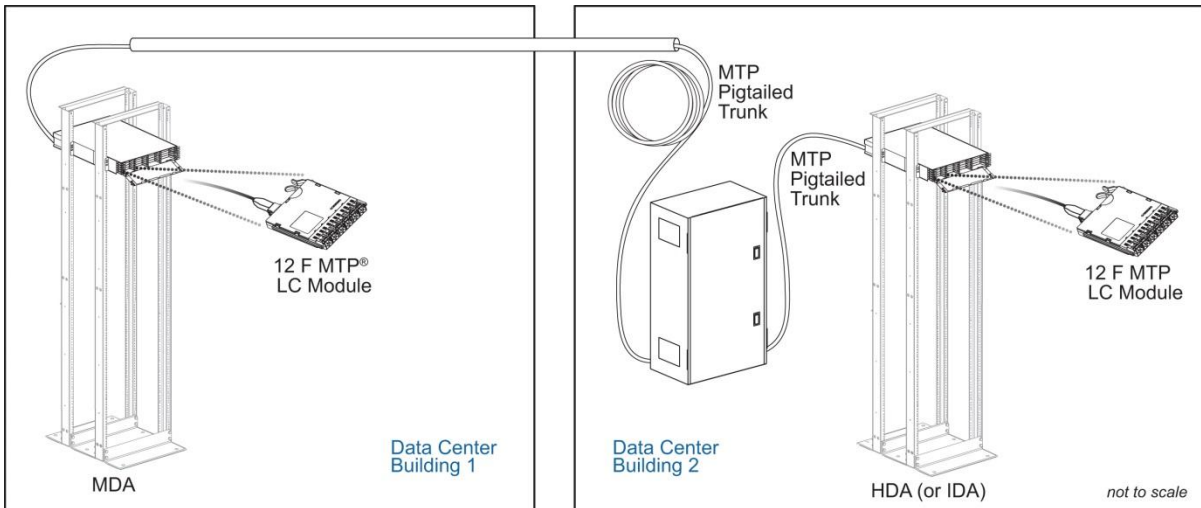


Figure 8: MTP Pigtail Trunk Through a Congested Pathway and Spliced to Another MTP Pigtail Trunk

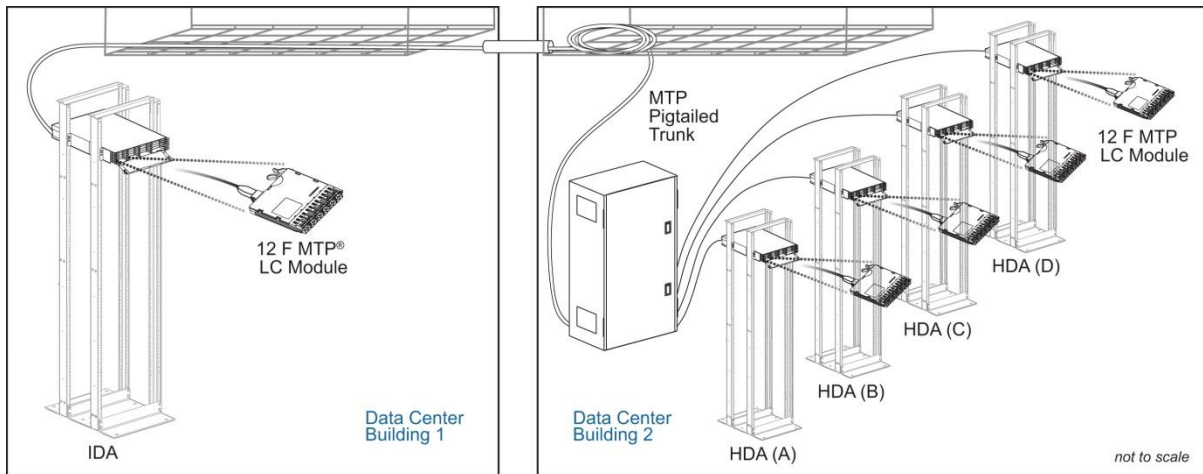


Figure 9: High Fiber Count MTP® Pigtail Trunk Through a Congested Pathway and Spliced to Multiple Lower MTP Pigtail Trunks

MTP Pigtail Trunks can be terminated in multiple ways. The below diagrams depict recommended solution sets based on an application need to maintain MTP connectivity for the full link.

MTP Pigtail Trunks with MTP Splice-On Connectors (SOC)

Field terminating a high fiber count MTP pigtail trunk directly with MTP connectors is recommended when the assembly is landing at a single cabinet or location.

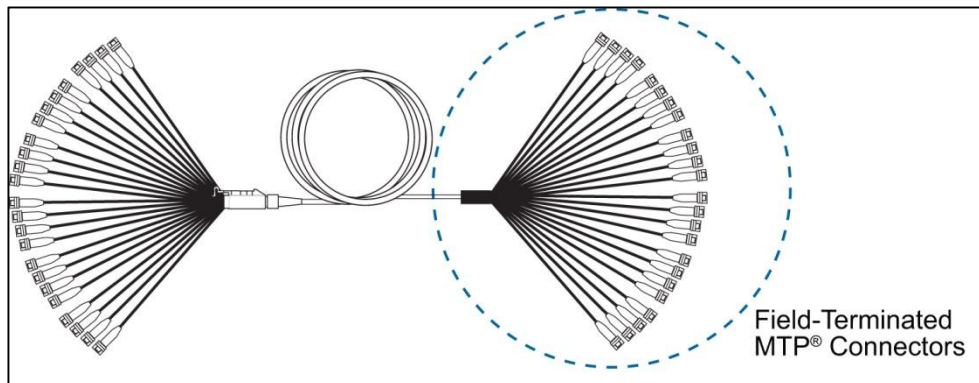


Figure 10: High Fiber Count MTP Pigtail Field Terminated with MTP Splice-On Connectors

An alternate to terminating the MTP pigtail trunk with MTP splice-on connectors is to splice each leg of the MTP pigtail trunk to individual 12F MTP pigtail assemblies. This splicing can be done in splice trays installed in a separate rack-mount splice housing.

MTP® Pigtail Trunks Spliced to Multiple MTP Pigtail Trunks

When the optical fibers in a high fiber count assembly need to be distributed to multiple areas, splicing of the single high fiber count MTP pigtail trunk to multiple lower fiber count MTP pigtail trunks is recommended. For example, as shown in Figure 11 this application is seen when connecting multiple horizontal distribution areas within one building on a data center campus to the main distribution area in another building on a data center campus. The high fiber count pigtail trunk consolidates all of the fibers required between buildings to optimize the space utilization in the conduit pathways. This application could be driven by a campus-wide spine-and-leaf architecture.

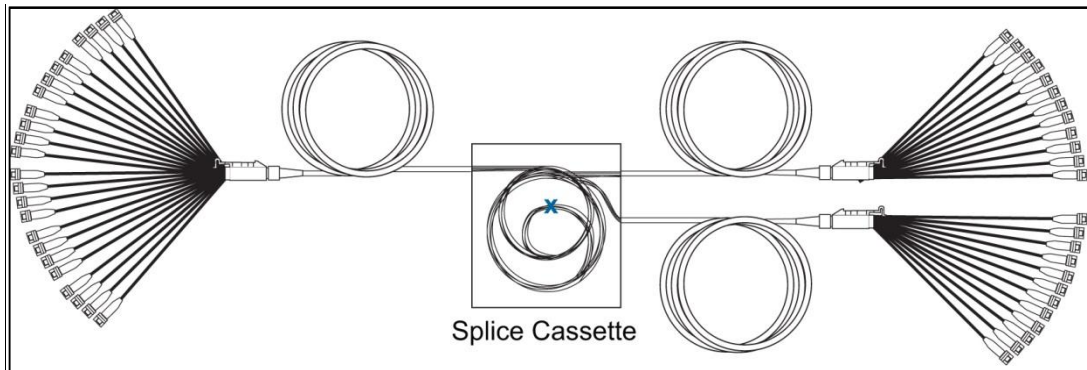


Figure 11: High Fiber Count MTP Pigtail Spliced to Multiple Lower Fiber Count MTP Pigtail Trunks

Alternate High Fiber Count Solutions with Bulk Ribbon Cable

Certain applications and deployment scenarios may have a need for high fiber count solutions utilizing bulk cable and field termination methods. For example, field terminated solutions are common where cable designs require extremely high fiber counts, such as 1728 fibers. Additionally, for deployments where a center-pull cable installation is required, bulk cable may be needed in order to meet pathway installation challenges.

Termination of high fiber count ribbon cable solutions can be accomplished with the MTP field termination or splicing options discussed above. In addition to the recommended MTP-based design solutions, alternate duplex termination methods that can be utilized include:

- Splicing to pre-stubbed housings (central splice location)
- Splicing to EDGE™ splice cassettes (splice at each housing)

Each solution offers advantages depending upon the application environment, design requirements, and installation needs. Key needs of the data center environment to consider when evaluating these solutions include:

- Speed of Deployment
- Product Quality and Performance
- Migration Path & Future Technology Support (ex: Parallel Optics)

Additional considerations include fiber count, pathway type and ability to plan for or measure cable routes. These areas are typically a factor in data center campus environments where cabling is required to connect multiple data center buildings.

When deploying a solution requiring field termination and/or splicing of ribbon cables refer to Applications Engineering Note “AEN160: Fiber Optic Cable Furcation Guide”, for selection guidance of the correct cable furcation kit(s) and references to appropriate Standard Recommended Procedures.

The remaining information in this document will provide example Bills of Materials for the different cable types and applications for High Fiber Count Trunk deployments.

For additional questions, contact Corning Optical Communications’ Technical Support Line at 1-800-743-2671 or dutyeng@corning.com.

References:

1. Weckel, A. (2014) Speeds in Data Centers, Ethernet Alliance Technology Exploration Forum 2014 “The Rate Debate”. Retrieved from: <http://www.ethernetalliance.org/wp-content/uploads/2014/10/Ethernet-Alliance-Rate-Debate-Speeds-in-Data-Centers-Weckel.pdf>

BOM Examples for High Fiber Count Pre-terminated MTP® Trunks

Table 1: Indoor EDGE8™ High Fiber Count MTP Trunks

192F	QTY	Plenum	
		OM4	SM
192F EDGE8 High Fiber Count MTP-MTP Trunk	1	GE5E5K2QPNDUxxxF	GE7E7K2GPNDUxxxF
8F EDGE8 MTP/LC Module	48	ECM8-UM08-05-E6Q-ULL	ECM8-UM08-04-E8G-ULL
2U EDGE8 Housing	2	EDGE8-02U	EDGE8-02U

288F	QTY	Plenum	
		OM4	SM
288F EDGE8 High Fiber Count MTP-MTP Trunk	1	GE5E5U8QPNDUxxxF	GE7E7U8GPNDUxxxF
8F EDGE8 MTP/LC Module	72	ECM8-UM08-05-E6Q-ULL	ECM8-UM08-04-E8G-ULL
2U EDGE8 Housing	2	EDGE-02U	EDGE-02U

Table 2: Indoor EDGE™ High Fiber Count MTP® Trunks

192F	QTY	Plenum	
		OM4	SM
192F EDGE High Fiber Count MTP-MTP Trunk	1	G7575K2QPNDUxxxF	G9090K2GPNDUxxxF
12F EDGE MTP/LC Module	32	ECM-UM12-05-93Q	ECM-UM12-04-89G
2U EDGE Housing	2	EDGE-02U	EDGE-02U

216F	QTY	Plenum	
		OM4	SM
216F EDGE High Fiber Count MTP-MTP Trunk	1	G7575M6QPNDUxxxF	G9090M6GPNDUxxxF
12F EDGE MTP/LC Module	36	ECM-UM12-05-93Q	ECM-UM12-04-89G
2U EDGE Housing	2	EDGE-02U	EDGE-02U

288F	QTY	Plenum	
		OM4	SM
288F EDGE High Fiber Count MTP-MTP Trunk	1	G7575U8QPNDUxxxF	G9090U8GPNDUxxxF
12F EDGE MTP/LC Module	48	ECM-UM12-05-93Q	ECM-UM12-04-89G
2U EDGE Housing	2	EDGE-02U	EDGE-02U

432F	QTY	Plenum	
		OM4	SM
432F EDGE High Fiber Count MTP-MTP Trunk	1	G7575AKQPNDUxxxF	G9090AKGPNDUxxxF
12F EDGE MTP/LC Module	72	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	2	EDGE-04U	EDGE-04U

576F	QTY	Plenum	
		OM4	SM
576F EDGE High Fiber Count MTP-MTP Trunk	1	G7575AZQPNDUxxxF	G9090AZGPNDUxxxF
12F EDGE MTP/LC Module	96	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	2	EDGE-04U	EDGE-04U

Table 3: FREEDM® Riser High Fiber Count MTP Trunks

288F	QTY	Indoor/Outdoor Riser	
		OM4	SM
288F Indoor/Outdoor High Fiber Count MTP-MTP Trunk	1	A7575U8QUFBBUxxxF	A9090U8GUFBBUxxxF
12F EDGE MTP/LC Module	48	ECM-UM12-05-93Q	ECM-UM12-04-89G
2U EDGE Housing	2	EDGE-02U	EDGE-02U

432F	QTY	Indoor/Outdoor Riser	
		OM4	SM
432F Indoor/Outdoor High Fiber Count MTP®-MTP Trunk	1	A7575AKQUFBBUxxxF	A9090AKGUFBBUxxxF
12F EDGE™ MTP/LC Module	72	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	2	EDGE-04U	EDGE-04U

576F	QTY	Indoor/Outdoor Riser	
		OM4	SM
576F Indoor/Outdoor High Fiber Count MTP-MTP Trunk	1	A7575AZQUFBBUxxxF	A9090AZGUFBBUxxxF
12F EDGE MTP/LC Module	96	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	2	EDGE-04U	EDGE-04U

864F	QTY	Indoor/Outdoor Riser	
		OM4	SM
864F Indoor/Outdoor High Fiber Count MTP-MTP Trunk	1	A7575CEQUFBBUxxxF	A9090CEGUFBBUxxxF
12F EDGE MTP/LC Module	144	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	4	EDGE-04U	EDGE-04U

BOM Examples for High Fiber Count MTP Pigtail Trunks Field Terminated with MTP Splice-On Connectors

Table 4: Indoor EDGE8™ High Fiber Count Pigtail MTP Trunks with MTP Splice-On Connectors

192F	QTY	Plenum	
		OM4	SM
192F EDGE8 High Fiber Count MTP Pigtail Trunk	1	G00E5K2QPN0DPxxxF	G00E7K2GPN0DPxxxF
8F MTP Splice-On Connector	24	SOC-Q8MTP-3P-OM4	SOC-Q8MTPA-3P-SMP
8F EDGE8 MTP/LC Module	48	ECM8-UM08-05-E6Q-ULL	ECM8-UM08-04-E8G-ULL
2U EDGE8 Housing	2	EDGE8-02U	EDGE8-02U

288F	QTY	Plenum	
		OM4	SM
288F EDGE8 High Fiber Count MTP Pigtail Trunk	1	G00E5U8QPN0DPxxxF	G00E7U8GPN0DPxxxF
8F MTP Splice-On Connector	36	SOC-Q8MTP-3P-OM4	SOC-Q8MTPA-3P-SMP
8F EDGE8 MTP/LC Module	72	ECM8-UM08-05-E6Q-ULL	ECM8-UM08-04-E8G-ULL
2U EDGE8 Housing	2	EDGE8-02U	EDGE8-02U

Table 5: Indoor EDGE™ High Fiber Count Pigtail
MTP® Trunks with MTP Splice-On Connectors

192F	QTY	Plenum	
		OM4	SM
192F EDGE High Fiber Count MTP Pigtail Trunk	1	G0075K2QPN0DPxxxF	G0090K2GPN0DPxxxF
12F MTP Splice-On Connector	16	SOC-MTP-3N-OM4	SOC-MTPA-3N-SM
12F EDGE MTP/LC Module	32	ECM-UM12-05-93Q	ECM-UM12-04-89G
2U EDGE Housing	2	EDGE-02U	EDGE-02U

216F	QTY	Plenum	
		OM4	SM
216F EDGE High Fiber Count MTP Pigtail Trunk	1	G0075M6QPN0DPxxxF	G0090M6GPN0DPxxxF
12F MTP Splice-On Connector	18	SOC-MTP-3N-OM4	SOC-MTPA-3N-SM
12F EDGE MTP/LC Module	36	ECM-UM12-05-93Q	ECM-UM12-04-89G
2U EDGE Housing	2	EDGE-02U	EDGE-02U

288F	QTY	Plenum	
		OM4	SM
288F EDGE High Fiber Count MTP Pigtail Trunk	1	G0075U8QPN0DPxxxF	G0090U8GPN0DPxxxF
12F MTP Splice-On Connector	24	SOC-MTP-3N-OM4	SOC-MTPA-3N-SM
12F EDGE MTP/LC Module	48	ECM-UM12-05-93Q	ECM-UM12-04-89G
2U EDGE Housing	2	EDGE-02U	EDGE-02U

432F	QTY	Plenum	
		OM4	SM
432F EDGE High Fiber Count MTP Pigtail Trunk	1	G0075AKQPN0DPxxxF	G0090AKGPN0DPxxxF
12F MTP Splice-On Connector	36	SOC-MTP-3N-OM4	SOC-MTPA-3N-SM
12F EDGE MTP/LC Module	72	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	2	EDGE-04U	EDGE-04U

576F	QTY	Plenum	
		OM4	SM
576F EDGE High Fiber Count MTP Pigtail Trunk	1	G0075AZQPN0DPxxxF	G0090AZGPN0DPxxxF
12F MTP Splice-On Connector	48	SOC-MTP-3N-OM4	SOC-MTPA-3N-SM
12F EDGE MTP/LC Module	96	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	2	EDGE-04U	EDGE-04U

Table 6: Ribbon Plenum High Fiber Count MTP Pigtail Trunks with MTP Splice-On Connectors

576F	QTY	Plenum	
		OM4	SM
576F Plenum Ribbon MTP Pigtail Trunk	1	A0075AZQC80BPxxxF	A0090AZGC80BPxxxF
Furcation for Gel-Filled/ Gel-Free UltraRibbon™ Cables 288-864F (1 kit per cable end)	1	HFC-FURC-KIT-A	HFC-FURC-KIT-A
Supplemental for Field Installed MTP Splice-On Connectors Applications on Ribbon Cable (1 kit per 24 connector terminations)	2	HFC-FURC-KIT-SUP-1	HFC-FURC-KIT-SUP-1
12F MTP Splice-On Connector	48	SOC-MTP-RN-OM4	SOC-MTPA-RN-SM
12F EDGE MTP/LC Module	96	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	2	EDGE-04U	EDGE-04U

Table 7: Ribbon FREEDM® Riser High Fiber Count MTP Pigtail Trunks with MTP Splice-On Connectors

288F	QTY	Indoor/Outdoor Riser	
		OM4	SM
288F Indoor/Outdoor High Fiber Count MTP Pigtail Trunk	1	A0075U8QUF0BPxxxF	A0090U8GUF0BPxxxF
Furcation for Gel-Free UltraRibbon Cables 288-432F (1 kit per cable end)	1	HFC-FURC-KIT-B	HFC-FURC-KIT-B
Supplemental for Field Installed MTP Splice-On Connectors Applications on Ribbon Cable (1 kit per 24 connector terminations)	1	HFC-FURC-KIT-SUP-1	HFC-FURC-KIT-SUP-1
MTP Splice-On Connector	24	SOC-MTP-RN-OM4	SOC-MTPA-RN-SM
12F EDGE MTP/LC Module	48	ECM-UM12-05-93Q	ECM-UM12-04-89G
2U EDGE Housing	2	EDGE-02U	EDGE-02U

432F	QTY	Indoor/Outdoor Riser	
		OM4	SM
432F Indoor/Outdoor High Fiber Count MTP Pigtail Trunk	1	A0075AKQUF0BPxxxF	A0090AKGUF0BPxxxF
Furcation for Gel-Filled/ Gel-Free UltraRibbon Cables 288-864F (1 kit per cable end)	1	HFC-FURC-KIT-B	HFC-FURC-KIT-B
Supplemental for Field Installed MTP Splice-On Connectors Applications on Ribbon Cable (1 kit per 24 connector terminations)	2	HFC-FURC-KIT-SUP-1	HFC-FURC-KIT-SUP-1
MTP Splice-On Connector	36	SOC-MTP-RN-OM4	SOC-MTPA-RN-SM
12F EDGE MTP/LC Module	72	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	2	EDGE-04U	EDGE-04U

576F	QTY	Indoor/Outdoor Riser	
		OM4	SM
576F Indoor/Outdoor High Fiber Count MTP® Pigtail Trunk	1	A0075AZQUF0BPxxxF	A0090AZGUF0BPxxxF
Furcation for Gel-Filled/ Gel-Free UltraRibbon™ Cables 288-864F (1 kit per cable end)	1	HFC-FURC-KIT-A	HFC-FURC-KIT-A
Supplemental for Field Installed MTP Splice-On Connectors Applications on Ribbon Cable (1 kit per 24 connector terminations)	2	HFC-FURC-KIT-SUP-1	HFC-FURC-KIT-SUP-1
MTP Splice-On Connector	48	SOC-MTP-RN-OM4	SOC-MTPA-RN-SM
12F EDGE™ MTP/LC Module	96	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	2	EDGE-04U	EDGE-04U

864F	QTY	Indoor/Outdoor Riser	
		OM4	SM
864F Indoor/Outdoor High Fiber Count MTP Pigtail Trunk	1	A0075CEQUF0BPxxxF	A0090CEGUF0BPxxxF
Furcation for Gel-Filled/ Gel-Free UltraRibbon Cables 288-864F (1 kit per cable end)	1	HFC-FURC-KIT-A	HFC-FURC-KIT-A
Supplemental for Field Installed MTP Splice-On Connectors Applications on Ribbon Cable (1 kit per 24 connector terminations)	3	HFC-FURC-KIT-SUP-1	HFC-FURC-KIT-SUP-1
MTP Splice-On Connector	72	SOC-MTP-RN-OM4	SOC-MTPA-RN-SM
12F EDGE MTP/LC Module	144	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	4	EDGE-04U	EDGE-04U

BOM Examples for High Fiber Count MTP Pigtail Trunks Field Spliced to MTP Pigtails

Table 8: Indoor EDGE™ High Fiber Count MTP Trunks to MTP Pigtails

192F	QTY	Plenum	
		OM4	SM
192F EDGE High Fiber Count MTP Pigtail Trunk	1	G0075K2QPN0DPxxxF	G0090K2GPN0DPxxxF
12F EDGE MTP Pigtail	16	J007512QE8-NP010F	J009012GE8-NP010F
5U Rack Mount Splice Housing	1	CSH-05U-F	CSH-05U-F
Fusion Splice Tray (48 single fiber splices or 6 mass fusion splices/tray)	3	SCF-ST-077	SCF-ST-077
Mass Fusion Splice Protectors (package of 25)	1	2806031-012	2806031-012
12F EDGE MTP/LC Module	32	ECM-UM12-05-93Q	ECM-UM12-04-89G
2U EDGE Housing	2	EDGE-02U	EDGE-02U

216F	QTY	Plenum	
		OM4	SM
216F EDGE™ High Fiber Count MTP® Pigtail Trunk	1	G0075M6QPN0DPxxxF	G0090M6GPN0DPxxxF
12F EDGE MTP Pigtail	18	J007512QE8-NP010F	J009012GE8-N010F
5U Rack Mount Splice Housing	1	CSH-05U-F	CSH-05U-F
Fusion Splice Tray (48 single fiber splices or 6 mass fusion splices/tray)	3	SCF-ST-077	SCF-ST-077
Mass Fusion Splice Protectors (package of 25)	1	2806031-012	2806031-012
12F EDGE MTP/LC Module	36	ECM-UM12-05-93Q	ECM-UM12-04-89G
2U EDGE Housing	2	EDGE-02U	EDGE-02U

288F	QTY	Plenum	
		OM4	SM
288F EDGE High Fiber Count MTP Pigtail Trunk	1	G0075U8QPN0DPxxxF	G0090U8GPN0DPxxxF
12F EDGE MTP Pigtail	24	J007512QE8-NP010F	J009012GE8-NP010F
5U Rack Mount Splice Housing	1	CSH-05U-F	CSH-05U-F
Fusion Splice Tray (48 single fiber splices or 6 mass fusion splices/tray)	4	SCF-ST-077	SCF-ST-077
Mass Fusion Splice Protectors (package of 25)	1	2806031-012	2806031-012
12F EDGE MTP/LC Module	48	ECM-UM12-05-93Q	ECM-UM12-04-89G
2U EDGE Housing	2	EDGE-02U	EDGE-02U

432F	QTY	Plenum	
		OM4	SM
432F EDGE High Fiber Count MTP Pigtail Trunk	1	G0075AKQPN0DPxxxF	G0090AKGPN0DPxxxF
12F EDGE MTP Pigtail	36	J007512QE8-NP010F	J009012GE8-NP010F
5U Rack Mount Splice Housing	1	CSH-05U-F	CSH-05U-F
Fusion Splice Tray (48 single fiber splices or 6 mass fusion splices/tray)	6	SCF-ST-077	SCF-ST-077
Mass Fusion Splice Protectors (package of 25)	2	2806031-012	2806031-012
12F EDGE MTP/LC Module	72	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	2	EDGE-04U	EDGE-04U

576F	QTY	Plenum	
		OM4	SM
576F EDGE High Fiber Count MTP Pigtail Trunk	1	G0075AZQPN0DPxxxF	G0090AZGPN0DPxxxF
12F EDGE MTP Pigtail	48	J007512QE8-NP010F	J009012GE8-NP010F
5U Rack Mount Splice Housing	1	CSH-05U-F	CSH-05U-F
Fusion Splice Tray (48 single fiber splices or 6 mass fusion splices/tray)	8	SCF-ST-077	SCF-ST-077
Mass Fusion Splice Protectors (package of 25)	2	2806031-012	2806031-012
12F EDGE MTP/LC Module	96	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	2	EDGE-04U	EDGE-04U

BOM Examples for High Fiber Count MTP® Pigtail Trunks Field Spliced to Low Fiber Count MTP Trunks

Table 9: Ribbon FREEDM® Riser High Fiber Count MTP Trunks to Ribbon FREEDM Riser Low Fiber Count MTP Trunks

864F	QTY	Indoor/Outdoor Riser	
		OM4	SM
864F Indoor/Outdoor High Fiber Count Pigtail Trunk	1	A0075CEQUF0BPxxxF	A0090CEGUF0BPxxxF
288F Indoor/Outdoor High Fiber Count Pigtail Trunk	3	A0075U8QUF0BPxxxF	A0090U8GUF0BPxxxF
Low Density Optical Splice Enclosure (OSE)	1	OSE-LD0-W0-1-L	OSE-LD0-W0-1-L
OSE Mass Fusion Splice Tray	12	OSE-ST-3	OSE-ST-3
Mass Fusion Splice Protectors (package of 25)	3	2806031-12	2806031-12
Cable Entry Kit, 0.875-1.00" cable OD	3	OSE-CBL-38	OSE-CBL-38
Cable Entry Kit, 1.00-1.125" cable OD	1	OSE-CBL-39	OSE-CBL-39
Furcation for Gel-Filled/ Gel-Free UltraRibbon™ Cables 288-864F (1 kit per cable end)	1	HFC-FURC-KIT-A	HFC-FURC-KIT-A
Furcation for Gel-Free UltraRibbon Cables 288-432F (1 kit per cable end)	3	HFC-FURC-KIT-B	HFC-FURC-KIT-B
12F EDGE™ MTP®/LC Module	144	ECM-UM12-05-93Q	ECM-UM12-04-89G
4U EDGE Housing	4	EDGE-04U	EDGE-04U

BOM Examples Bulk Cable Field Terminated with MTP Splice-On Connectors

Table 10: ALTOS® Ribbon Cable with MTP Splice-On Connectors

1728F	QTY	OSP
		SM
1728F ALTOS Ribbon Cable	xxx ft.	H28EQ4-14101-53
Furcation for Gel-Filled/Gel-Free Corning Central Tube Ribbon Cables 12-216F (1 kit per cable end) Furcation for Gel-Filled/Gel-Free ALTOS Ribbon Cables 288-1728F (1 kit per buffer tube end)	12	HFC-FURC-KIT-C
Supplemental for Field Installed MTP Splice-On Connectors Applications on Ribbon Cable (1 kit per 24 MTP connector terminations)	12	HFC-FURC-KIT-SUP-1
MTP Splice-On Connector	288	SOC-MTPA-RN-SM
12F EDGE MTP/LC Module	288	ECM-UM12-04-89G
4U EDGE Housing	6	EDGE-04U

BOM Examples Bulk Cable Field Spliced to Pre-stubbed Hardware

Table 11: ALTOS® Ribbon Cable to Pre-stubbed Hardware on both sides

1728F	QTY	OSP
		SM
1728F ALTOS Ribbon Cable	xxx ft.	H28EQ4-14101-53
High Density Optical Splice Enclosure (OSE)	2	OSE-HD0-W0-1-L
OSE Mass Fusion Splice Tray	48	OSE-ST-3
Mass Fusion Splice Protectors (package of 25)	12	2806031-12
Cable Entry Kit, 0.75-0.875" cable OD	12	OSE-CBL-37
Cable Entry Kit, 1.25-1.375" cable OD	2	OSE-CBL-40
Furcation for Gel-Filled/Gel-Free Corning Central Tube Ribbon Cables 12-216F (1 kit per cable end) Furcation for Gel-Filled/Gel-Free ALTOS Ribbon Cables 288-1728F (1 kit per buffer tube end)	12	HFC-FURC-KIT-C
Furcation for Gel-Free UltraRibbon™ Cables 288-576F (1 kit needed per cable end)	12	HFC-FURC-KIT-B
288F 2U Pre-Stubbed EDGE™ Housing	12	EG2U8A012AE-V7001B