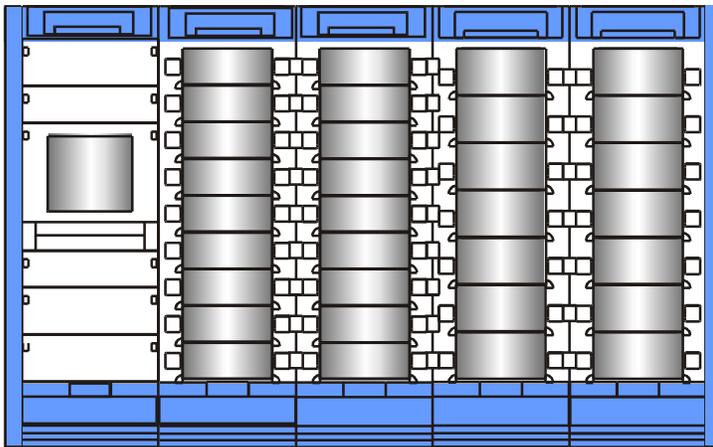




*Leading Optical Innovations*

# **LGX<sup>®</sup> Fiber Distribution System**

## System Reference Guide



636-299-120  
Issue 6  
January 2002

## About This Document

---

### Purpose of This Document

The purpose of this document is to provide users and potential users with a total system approach to implementing a fiber distribution system. In particular, this reference guide provides guidelines for planning, engineering, and installing the LGX® Fiber Distribution Frame. This guide is primarily written for planners and engineers involved with specification of fiber distribution projects. This manual provides useful information on installation and cabling methods. This guide is also useful for operations personnel responsible for connecting and maintaining fiber services.

### Scope of This Document

This document covers planning and engineering guidelines for use of the LGX Fiber Distribution Frame in Central Office, Private Network, and Outside Plant applications. This reference guide describes all of the necessary components for constructing an LGX Fiber Distribution System. The document provides applications guidelines for the LGX Fiber Distribution Frame, the Fiber Distribution Shelves and the apparatus designed for use with these products. Also covered are installation, operation and maintenance guidelines. This reference guide does not cover details on optical connectors, jumpers, splices, cables, tools or test sets. For more information regarding these products, contact your OFS account representative or OFS product management.

### Reason for Reissue

**This reissue converts the previous issue to OFS colors and markings.**

**The previous reissue was in May, 1999, incorporating the latest features available for the LGX product line.**

- Ordering information is now integrated directly into the product description sections 2 through 7. A separate ordering section is no longer provided.
- Improved Termination Shelf Features
- Multi-Access Modular Unit (MAMU) shelves
- New Connector Panels
- Connector Panels equipped with Adapters
- Shelves e/w Couplings
- High Density Connector Panel
- 96-Fiber High Density Shelf
- 144-Fiber High Density Shelf
- 216-Fiber High Density Shelf
- Preterminated Modules

- Preterminated Shelves
- Splitter Modules
- Wavelength Division Multiplexer (WDM) Modules
- New 15-inch deep **LGX** Frame
- Preassembled Frame
- Broadband Fiber Management System Frames
- 15-inch End Guard
- 18-inch End Guard
- 24-in Frames and End Guard
- European Telecommunication Standard (ETSI) Mounting Brackets
- High Density central office application
- Broadband Fiber Management System Application

## **User Feedback**

---

**Any user of this document is invited to comment back to OFS with suggestions for improvement, additions, and/or corrections. All such comments should be directed to [techhelp@ofsoptics.com](mailto:techhelp@ofsoptics.com).**

**Technical Support**

---

**Additional OFS product and application information can be found at [www.ofsoptics.com](http://www.ofsoptics.com). Customers of OFS may find additional help by calling 1-888-342-3743 (US only), or by sending a message to [techhelp@ofsoptics.com](mailto:techhelp@ofsoptics.com).**

# Contents

About this Document	i
1. Introduction	1-1
2. Fiber Optic Shelves	2-1
3. Connector Panels and Modules	3-1
4. Shelf Accessories	4-1
5. FDF Equipment	5-1
6. Related Equipment	6-1
7. FDF Patch Cords	7-1
8. FDF Planning	8-1
9. FDF Engineering	9-1
10. Central Office Applications	10-1
11. CATV Head-End Application	11-1
12. Outside Plant Applications	12-1
13. Premises Applications	13-1
14. Retrofit Applications	14-1
15. Installation and Cabling	15-1
16. Operations and Maintenance	16-1
References	REF-1
Glossary	GL-1
Index	IN-1

The following are trademarks of Fitel USA Corp:

LGX® Fiber Distribution System  
ST® Connector

Copyright ©, 2002, Fitel USA Corp. All rights reserved.

# Introduction

1

## Section Contents

---

This section provides a brief introduction to the LGX® Fiber Distribution System including components, features, applications, and functions.

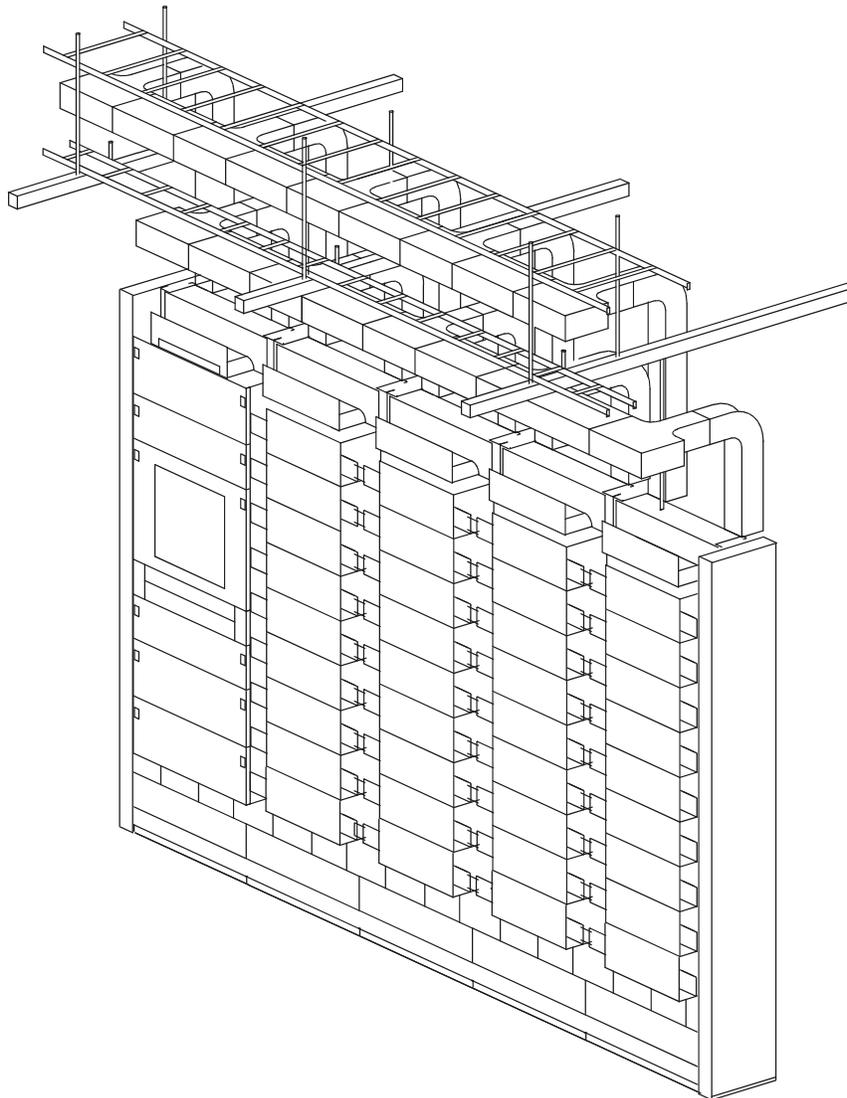
- Overview 1-2
- Features 1-3
- Applications 1-4
- Functions 1-7

## Overview

---

The *LGX* Fiber Distribution System is a set of modular interface products used for terminating fiber cables and connecting optical circuits. The system consists of *LGX* Fiber Distribution Shelves, the *LGX* Fiber Distributing Frame (FDF), and associated fiber connecting apparatus and equipment. The *LGX* Fiber Distribution System is a complete set of modular hardware, with application guidelines, and operating procedures for implementing any size fiber installations.

The *LGX* Fiber Distribution System provides organization and protection for fiber cables. The system provides convenient access to fiber cable terminations allowing rapid connection of fiber services. The *LGX* Fiber Distributing Frame is particularly important in applications requiring organization and access to large numbers of circuits. As shown in the figure below, the FDF comprises a frame used to organize fiber cables and shelves used to house optical connections.



## Features

---

Key features of the *LGX* Fiber Distribution System are listed in the following paragraphs.

### Flexible Architecture

The *LGX* Fiber Distribution System consists of modular frames and shelves that allow growth associated with any fiber application. The modular design allows the user to order only the equipment needed for initial fiber capacities, thereby controlling system cost. The modular design also allows for future expansion of the frame system as more fiber capacity becomes necessary.

### Centralized Fiber Administration

An FDF arrangement allows the fiber cables converging on a site to be centrally located for administration purposes. This results in overall lower operations cost because fiber cables are easily located, identified and can be quickly connected into service.

### Total Jumper Management

To manage the *LGX* Fiber Distribution System on a day-to-day basis, OFS supports the system with total fiber management guidelines for jumper selection, routing, and operations tools to help the craft. Jumper management is made easy through the use of OFS Jumper Administration Guidelines (Cross Connect System), select number 636-299-116 Issue 2 which ships with each of the frame offerings.

### Organized Cabling Environment

Current standard cabling practices call for limiting the length of flammable Outside Plant (OSP) cable entering the building. The *LGX* Fiber Distribution System provides a complete line of products with indoor cables to support a fire-safe environment. Preterminated shelves and modules come equipped with fire resistant building cables, making the fire-safe installation easy. An important piece of related equipment is the Optical Cable Entry Facility (OCEF) cabinet used for splicing OSP cables to fire-resistant building cables.

### Cable Protection

The *LGX* Fiber Distribution System provides complete protection for fiber cable terminations and organizes fibers in a simple, orderly fashion. The Fiber Protection System (FPS) provides a means for distributing fiber throughout the facility, while protecting and organizing fiber in an enclosed duct system. Within the FDF, cables are carefully organized in an enclosed duct and secured directly to the termination and splice shelves.

## Applications

---

The *LGX* Fiber Distribution System can be used in a wide variety of applications. Applications include:

- Central Office (CO)

- Cable Television (CATV) Head-End
- Outside Plant (OSP)
- Premises Distribution Systems (PDS)

In each application, the fibers are organized at central locations. The **LGX Fiber Distribution System** is used to organize the fibers at these locations and provides a common service interface.

### **Central Office**

In CO applications, the FDF serves as the primary interface between OSP fibers entering the building and the Fiber Optic Transmission Systems. In many cases, the FDF will be located in the transmission equipment area of the CO. An alternative is to locate the FDF closer to the cable entrance facility. The OSP cables entering the building are usually spliced to fire retardant building cables and then routed to the FDF. The FDF can be used for terminating either OSP cables or multifiber building cables and forms a convenient facility for maintenance craft to quickly provide fiber service to customers. The **LGX Fiber Distribution System** becomes especially important in applications where multiple bays of fibers are terminated in a continuous lineup. The **LGX FDF** can be configured in standard or high density to serve even the largest fiber terminal application needs. All FDF terminations are identified, allowing them to be easily and quickly located for circuit connection, rearrangement, or restoration.

### **CATV Head-End**

The **LGX Fiber Distribution System** may also be adapted to CATV head-end applications using exactly the same approach as the central office application. Alternatively the head-end fiber distribution system may be configured using the **LGX Broadband Fiber Management System**. The **LGX Broadband Fiber Management System** shares common shelf and connector hardware with the **LGX CO** application but employs a different frame structure that allows for organizing all optical components at the head-end. The **LGX Broadband Distributing Frame** allows fiber terminations, optical splitters, and broadband CATV laser equipment to be located within the same frame lineup. Thus the **LGX Broadband Fiber Management System** provides a total integrated approach for managing fiber circuits in the head-end environment.

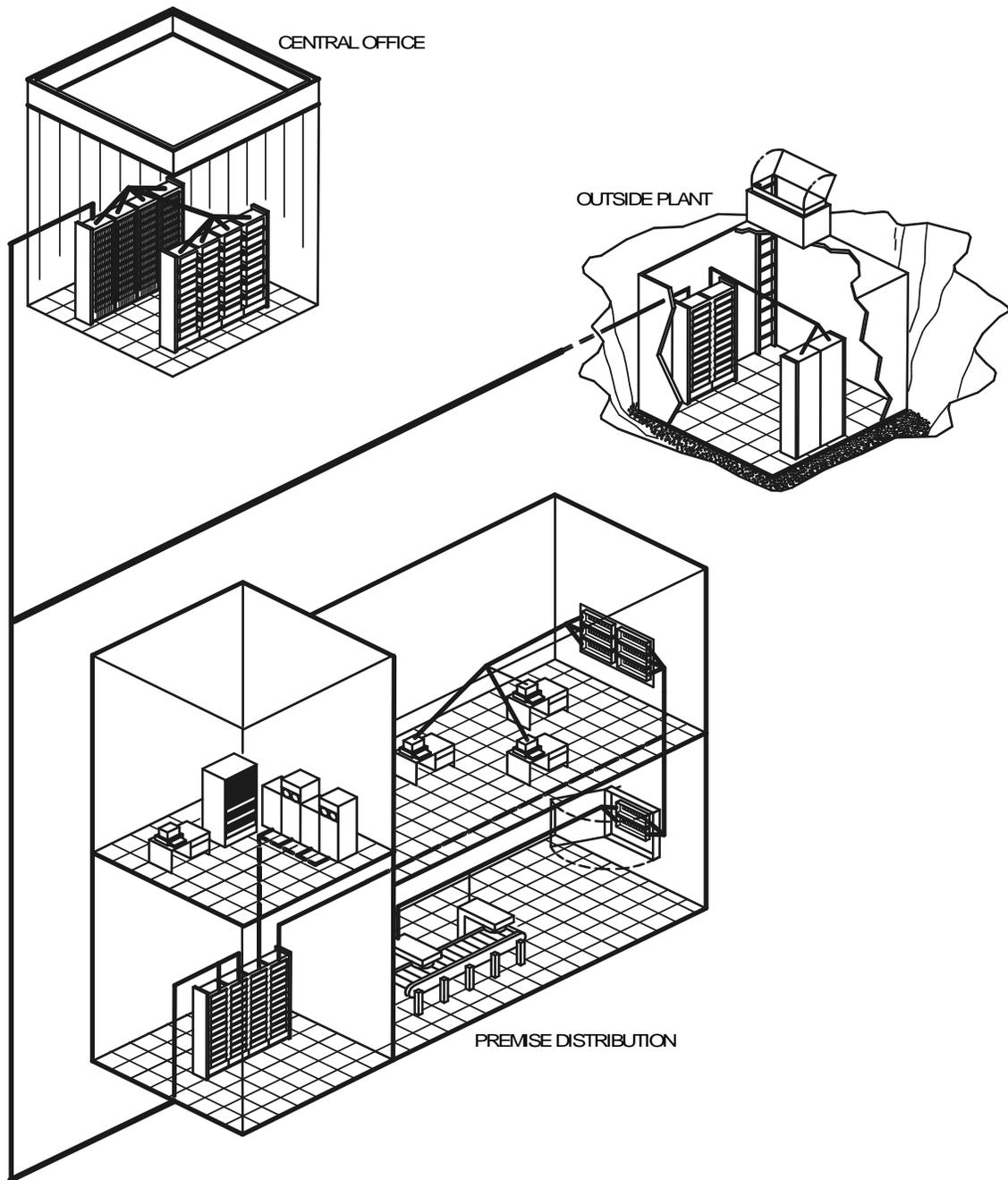
## **Outside Plant**

The *LGX* Fiber Distribution System can also be adapted to OSP applications including remote terminal frame arrangements for interfacing fiber in the loop. As the use of fiber in the loop grows, there is an increasing need to provide flexibility for rearrangements and efficient cable usage. Remote terminals can rapidly become a hub for large numbers of fibers. The *LGX* Fiber Distribution System is an effective way for organizing fibers into an interconnect or cross-connect arrangement. Several high-density options are available for interconnecting fibers at a remote terminal site.

## **Private Network Distribution Systems**

The *LGX* Fiber Distribution System is also well suited for private network structure cabling system applications and other data communication needs at the customer premises. It can be implemented in a variety of building and interbuilding distribution schemes. Regardless of the building distribution scheme, the *LGX* Fiber Distribution System is ideally suited to handle either horizontal or vertical fiber distribution.

The *LGX* Fiber Distribution System is specifically designed to provide extra security and protection often needed in a customer premises environment. Special arrangements allow the equipment to be wall mounted in tightly constrained spaces or cabinet mounted where a high degree of protection or security is desired. Moreover, the *LGX* Fiber Distribution System can easily be used in any of these applications as an interconnect, cross-connect, or through-splice facility. This flexibility is a major benefit when designing a high-performance transmission system.



## Functions of an LGX Fiber Distribution System

---

An *LGX* Fiber Distribution System is a collection of cables and connecting interfaces for organizing fiber optic cables into an efficient network. Depending on the requirements of the application, a fiber distribution system can be used to terminate, splice, interconnect, cross-connect, and test fiber circuits. The following paragraphs briefly describe the functions of the *LGX* Fiber Distribution System.

### **Termination**

A distribution plan usually includes terminating fibers at a central location. Fibers are terminated on optical connectors that are mounted on front facing panels for easy access. In typical applications, OSP fibers and Fiber Optic Transmission Systems (FOTS) equipment fibers are terminated in adjacent fields, allowing connection of circuits by simply connecting the two fiber terminations with a jumper. In addition, a fiber terminated on optical connectors provides a convenient point for test access during initial construction or during maintenance.

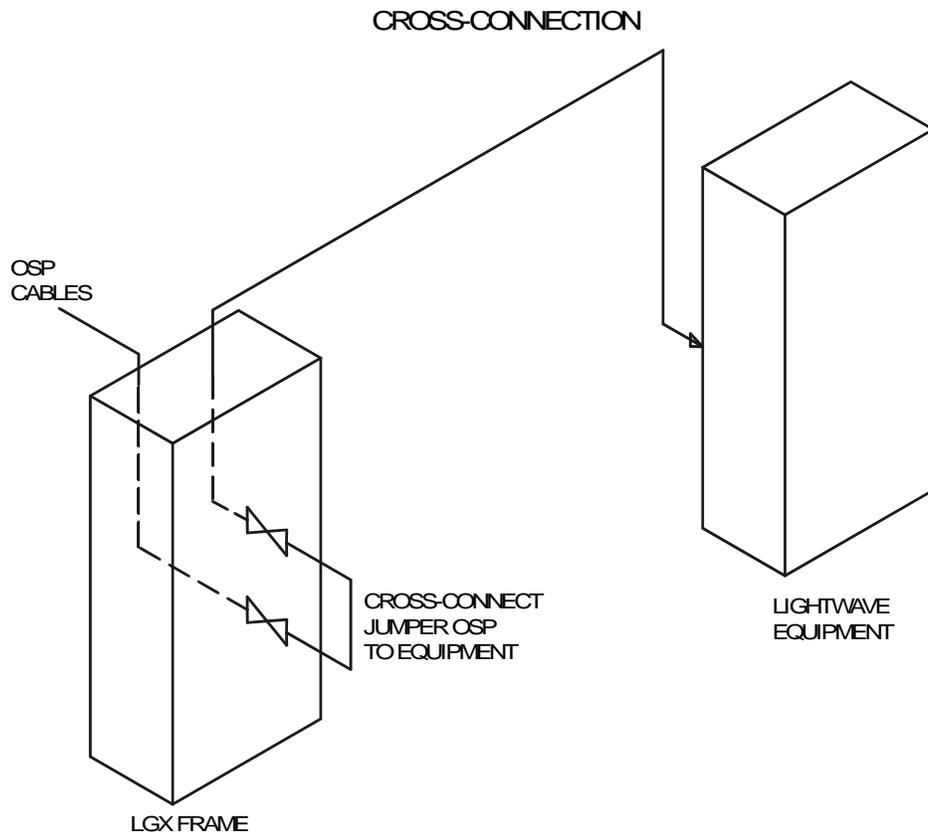
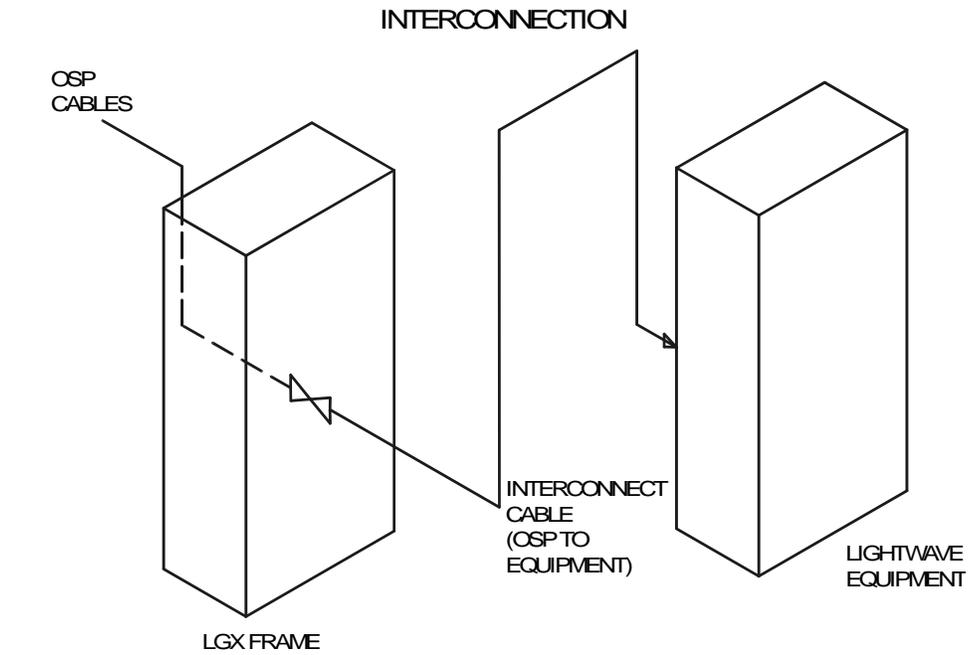
### **Cross-Connection**

A fiber distribution system may be efficiently operated using the cross-connect configuration where all fibers are terminated on fiber distribution shelves within the same Fiber Distributing Frame system. For example, both OSP and equipment cables can be terminated on shelves within the same FDF system. Fiber jumper cables are used to cross-connect the fiber terminations together to complete the optical circuit. The jumper cables are typically routed on the front of the FDF and are easily organized into jumper troughs and raceways. The cross-connect is recommended when flexibility is required for future rearrangement of circuits. The cross-connect function builds two insertion loss points into the circuit and is used for circuits that can accept the loss caused by the two connections at the FDF interface.

### **Interconnection**

---

The interconnection service configuration is used to connect equipment directly to the OSP fiber termination. An interconnection cable is a fiber jumper that is routed from the transmission equipment lineup directly to the outside plant fiber termination shelf on the FDF. The interconnection service configuration builds only one insertion loss into a fiber circuit at the FDF. Interconnection often requires routing the interconnecting cable over other equipment or cable racks to reach the destination. Interconnection is recommended in cases where low loss is required and where limited flexibility is acceptable.



## Splicing

A plan for terminating fibers may involve optical splicing as a means of joining fibers. The LGX Fiber Distribution System will accommodate any kind of mechanical or fusion splice – both individual and mass. Fiber splices and associated slack can then be stored in splice organizers inside the LGX Fiber Distribution Shelves. However, most current applications typically do not require splicing at the FDF. Rather splicing of OSP cables is located at an intermediate position closer to the point where the cable enters the building. OSP cables are typically spliced to fire-retardant building cables, which in turn are routed to the FDF for termination.

## Test Access

The LGX Fiber Distribution System provides a convenient point to access fiber lines for testing. The termination field provides a test access point for all fibers converging on a fiber hub. Testing is usually performed at the initial installation of new fiber cables prior to running fiber jumpers because access to the connector is required. Testing may be done at a later time for line maintenance, monitoring, and surveillance or troubleshooting.

## Passive Optical Components

The LGX Fiber Distribution System provides a convenient means for inserting passive optical components into the network. Passive optical devices such as optical splitters are used for distributing communication signals across multiple paths. In the CATV application, optical splitters are used to split the CATV signal into multiple trunks, thus defraying the cost of the broadband optical laser transmitter. In other transmission applications, passive Wavelength Division Multiplexer (WDM) devices are used to combine two or more wavelengths on a single optical fiber path. Passive optical components are supplied in enclosed modules with optical connectors that allow cross-connect or interconnection using standard jumpers. Modules are fully plug-compatible with LGX Fiber Optic Shelves. Thus the LGX Fiber Distribution System integrates passive optical components to enable many value added functions for the user.

## Fiber Optic Shelves

2

### Section Contents

---

The *LGX*<sup>®</sup> Fiber Optic Shelves provide a flexible and modular means for constructing a high-capacity Fiber Distributing Frame (FDF). This section describes the various types of shelves used in the *LGX* system.

- Fiber Optic Shelf Applications 2-2
- Termination Shelves 2-4
- Splice Shelves 2-9
- Combination Shelves 2-11
- Slack Storage Shelves 2-14
- Preterminated Shelves 2-18
- Shelves equipped with Adapters 2-22
- Shelves equipped with Adapters & Fibers 2-24

## Fiber Optic Shelf Applications

---

The *LGX* Fiber Optic Shelves and associated apparatus are assemblies of modular components used to construct an *LGX* Fiber Distributing Frame (FDF). The shelf is usually selected to meet the desired application. Then apparatus is selected to equip the shelves for a variety of termination, splicing, and interconnection requirements. Connectors, connector panels, optical adapters, cable clamps, splice organizers, and other associated apparatus may be ordered individually as needed. Alternatively, shelves may be ordered completely equipped with optical adapters or completely pre-terminated with connecting apparatus and fiber cables.

### Modular Shelf Design

The *LGX* system is constructed from a set of one or more modular shelves used for terminating, splicing, and organizing fiber. These modular shelves have a common appearance and when stacked together in frame arrangements form a continuous cross-connect field. Shelf dimensions differ only in the height. *OFS' LGX* Fiber Optic Shelves have many common feature advantages:

- **Universal Mounting** – Mounting on 23 inch (584 mm), 19 inch (483 mm) or directly to a wall with universal mounting bracket supplied with each shelf. Shelves can also mount to European Telecommunication Standard institute (ETSI) racks with adapter brackets.
- **Universal Cable Entry** – Design allows same clamp to be used to secure cables for top or bottom entry and for front or rear entry.
- **Convenient Connector/Adapter Access** – The shelf is designed to allow easy identification and hand access to all optical connectors and adapters.
- **Interchangeable Connector Panels and Bulkheads** – A variety of snap-in panels are interchangeable allowing flexibility in choice of connector type or arrangement allowing shelves to be tailored to user needs.
- **Stackable** – Modular shelves can be stacked in a modular arrangement and portals are provided for fibers routed between shelves.
- **Fiber Bend Radius Control** – Minimum radius is maintained for fiber cables entering the shelf and fibers stored within the shelf.
- **Transparent Doors** – See-through doors on standard termination shelves allow inspection of shelf contents and termination labels without having to open the doors.
- **Labeling** – A variety of labeling options are available to provides ample space to meet user needs, including a hinged shelf labeling system.
- **Removable / Lockable Doors** – Many of the doors allow easy access for service or maintenance. Optional locks may be added for security.
- **Snap-In Cable Placement** – Cables and fibers are easily routed into the shelves through snap-in grommets.

**Shelf Application Summary**

The **LGX Fiber Optic Shelves** are available to provide termination, splicing, or a combination of termination and splicing. Shelves are selected to meet desired functions and capacities needed for a particular application as summarized in the following table and described in detail in the sections that follow.

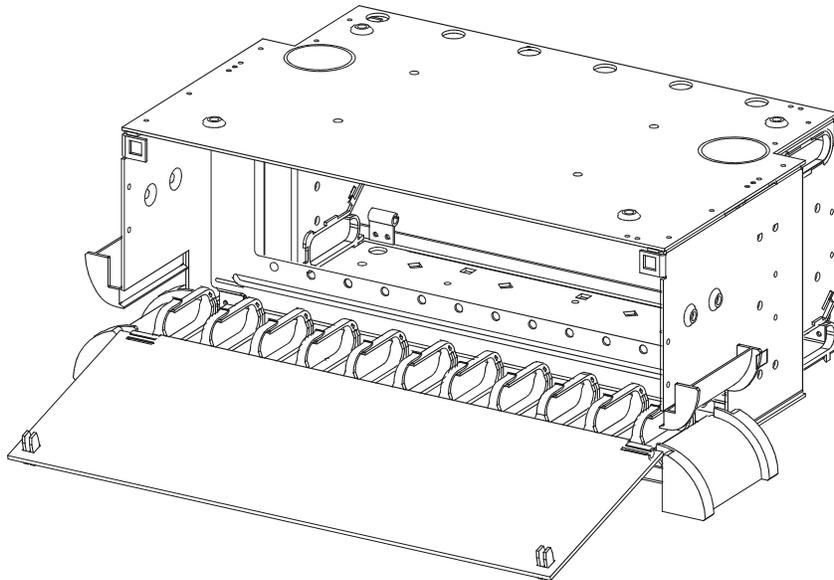
Shelf	Code	Height	Connectors	Splices	Application
Termination Shelves	LST1U-072/7 105 335 871	7 in (178- mm)	72/96 (SC, ST) nominal (144 LC max.)	none	Standard Density – Direct termination of individual fibers
	LST1U-144/9 107 535 569	9 in (228 mm)	144 (SC, ST)nominal (216 LC max.)	none	High Density – Direct termination of fibers
Front Access Termination Shelves	LST1F-072/7 106 191 695	7 in (178 mm)	72/96 (SC, ST) nominal (144 LC max.)	none	Slide-out front access termination shelf
	LST1P-48ST/2.5 106 587 710	2.5 in (64 mm)	48 <b>ST</b> <sup>®</sup>	none	Pivoting shelf for direct termination or pigtail splicing
	LST1P-24SC/5 107 027 427	5 in (127 mm)	24 SC	none	Pivoting termination shelf
	LST1P-12SC/2.5 107 044 323	2.5 in (64 mm)	12-SC	none	Pivoting termination shelf with slack storage
Splice Only Shelves	LSS1U-072/5 105 335 806	5 in (127 mm)	none	72 discrete	Holds three standard LT1A type splice organizers
	LSS1U-144/7 105 335 772	7 in (178 mm)	none	144 discrete	Holds six standard LT1A type splice organizers
Combination Shelves	LSC1U-024/5 106 455 355	5 in (127 mm)	24	24 discrete	Pigtail splice and/or direct termination of individual fibers or ribbon cables
	LSC1U-072/12 105 335 822	12in (305 mm)	72/72/96 (SC, ST) nominal (144 LC max.)	72 discrete	Pigtail splice and termination of individual fibers or ribbon cables
	LSC1U-144/21 105 335 798	21 in (583 mm)	144/144 (SC, ST)nominal (216 LC max.)	144 discrete	Pigtail splice and termination of individual fibers or ribbon cables
	LSJ1U-072/5	5 in			Storage of jumper cable

Jumper Storage Shelves	105 335 780	(127 mm)	none	none	slack
	LSJ1RP-30/7 106 587 694	7 in (178 mm)	none	none	Shelf with six pivoting trays holds a total of 900-ft (274 m) of jumper cable slack
	LSJ1LP-10/2.5 106 795 057	2.5 in (64 mm)	none	none	Shelf with two pivoting trays holds a total of 300-ft (91m) of jumper cable slack

## Termination Shelves

### LST1U-072/7 Standard Density Termination Shelf

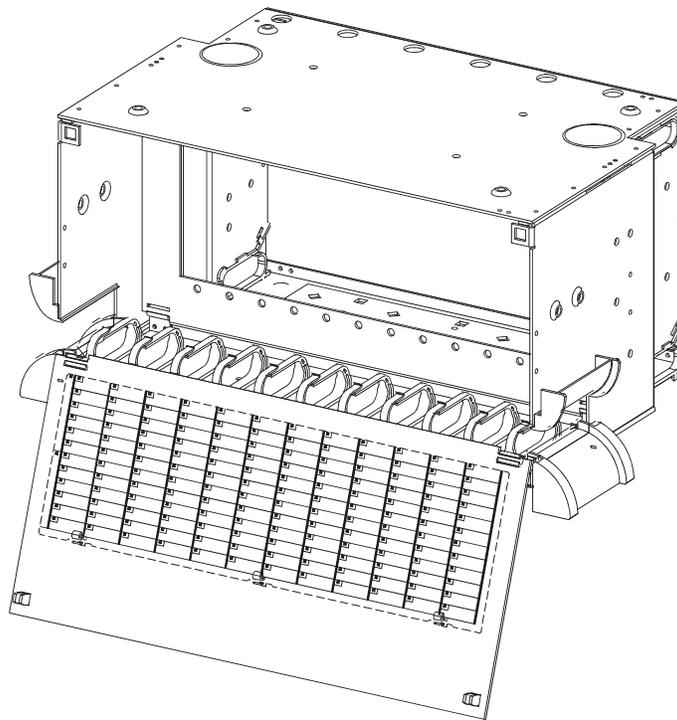
The LST1U-072/7 Termination Shelf is used for direct termination of buffered building cables or Outside Plant (OSP) cables. Building cables or up to four OSP cables (two per side) can be attached to mounting brackets supplied with the shelf using standard cable clamps. Cables enter the shelf through entry ports in the rear. The shelf can also store buffered fiber slack while maintaining a minimum bend radius of 1.5 inches (38 mm). The standard bulkhead supplied with the shelf accommodates up to twelve 1000-type panels. Since each 1000-type panel typically accommodates six adapters, the nominal shelf termination capacity of the shelf is 72 fibers. The shelf can also be equipped with higher density 1000-type panels to achieve a higher density. For instance 8-pack 1000-type panels may be used to achieve a density of 96 fibers per shelf. The shelf may also be equipped with 12-pack 1000-type panels (LC only) to achieve a maximum density of 144 fibers. However, the 144-fiber 7-inch shelf is recommended for use only in special applications (see high-density applications). Connector panels are mounted on the front panel with snap-in fasteners. Preterminated modules, splitter modules, modular fanouts, or mini-fanouts can also easily be installed into the shelf. Fiber jumpers are routed in a trough equipped with fiber rings for strain relief and bend radius guides to protect fibers. The shelf also provides a hinged formatted label for identifying fiber terminations. This shelf may be used as a stand-alone unit or in combination with any of the other shelves.



Shelf	Code	Dimensions	Connectors	Cables	Application
Fiber Optic Termination Shelf	LST1U-072/7 105 335 871	7 in (178 mm) high 17 in (432 mm) wide 11 in (279 mm) deep	72 nominal (144 max)	4	Standard Density – Direct termination of individual fibers

### LST1U-144/9 High Density Termination Shelf

The LST1U-072/9 Termination Shelf is used for direct termination of buffered building cables or Outside Plant (OSP) cables. Building cables or up to four OSP cables (two per side) can be attached to mounting brackets supplied with the shelf using standard cable clamps. Cables enter the shelf through entry ports in the rear. The shelf can also store buffered fiber slack while maintaining a minimum bend radius of 1.5 inches (38 mm). The standard bulkhead supplied with the shelf accommodates up to twelve 1200-type panels. Since each 1200-type panel typically accommodates 12 adapters, the nominal shelf termination capacity of the shelf is 144 fibers. The shelf can also be equipped with 1200-type panels (LC duplex only) to achieve a maximum density of 216-fibers. However, the 216 fiber 9-inch shelf is recommended for use only in special applications (see high-density applications). Connector panels are mounted on the front panel with snap-in fasteners. Fiber jumpers are routed in a trough equipped with fiber rings for strain relief and bend radius guides to protect fibers. The shelf also provides a hinged formatted label for identifying fiber terminations. This shelf may be used as a stand-alone unit or in combination with any of the other shelves.

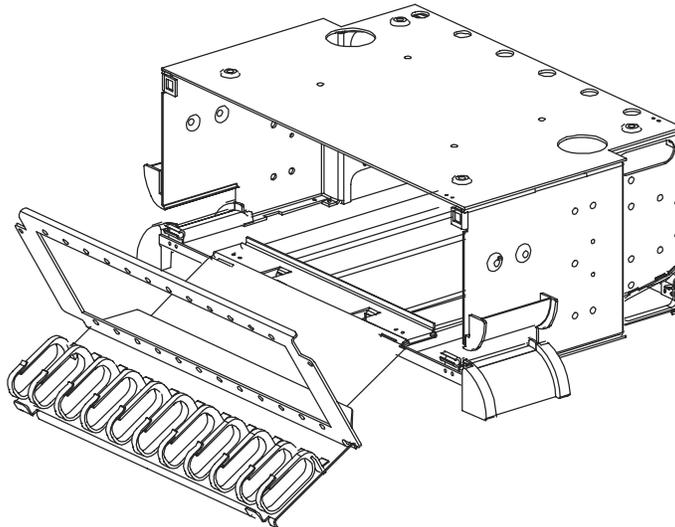


Shelf	Code	Dimensions	Connectors	Cables	Application
Fiber Optic Termination Shelf	LST1U-144/9 107 535 569	9 in (229-mm) high 17 in (432-mm) wide 11 in (279-mm) deep	144 nominal (216 max)	4	High Density – Direct termination of individual fibers

## Front Access Termination Shelves

### LST1F-072/7 (Slide-Out) Front Access Termination Shelf

The LST1F-072/7 front-access termination shelf is recommended for applications requiring front access for cable installation. The shelf is typically only used when the fibers must be terminated against a wall such as remote terminal or wall-mount applications. Frame-mounted arrangements using this shelf require special configurations to accommodate cabling and jumper management. The shelf is the same as the standard termination shelf in appearance and size. The advantage of this shelf is the ability of the connector bulkhead to slide forward and drop 90 degrees bringing the rear connectors into an accessible position from the front. Building cables or up to four OSP cables (two per side) can be attached to the brackets provided with the shelf. Fiber slack is carefully organized in the rear area of the shelf. The shelf nominally accommodates twelve 1000-type panels. Since each 1000-type panel typically holds six adapters, the nominal shelf capacity is 72 fiber terminations. The shelf can be equipped with 8-pack 1000-type panels that may be used to achieve a density of 96 fibers per shelf. The shelf may also be equipped with 12-pack 1000-type panels (LC duplex only) to achieve a maximum density of 144 fibers. However, the 144-fiber 7-inch shelf is recommended only for use in special applications (see high-density applications). The shelf does not accommodate modular fanouts, however; preterminated modules can be used with the shelf. A hinged formatted label is supplied with each shelf for identifying fiber terminations.

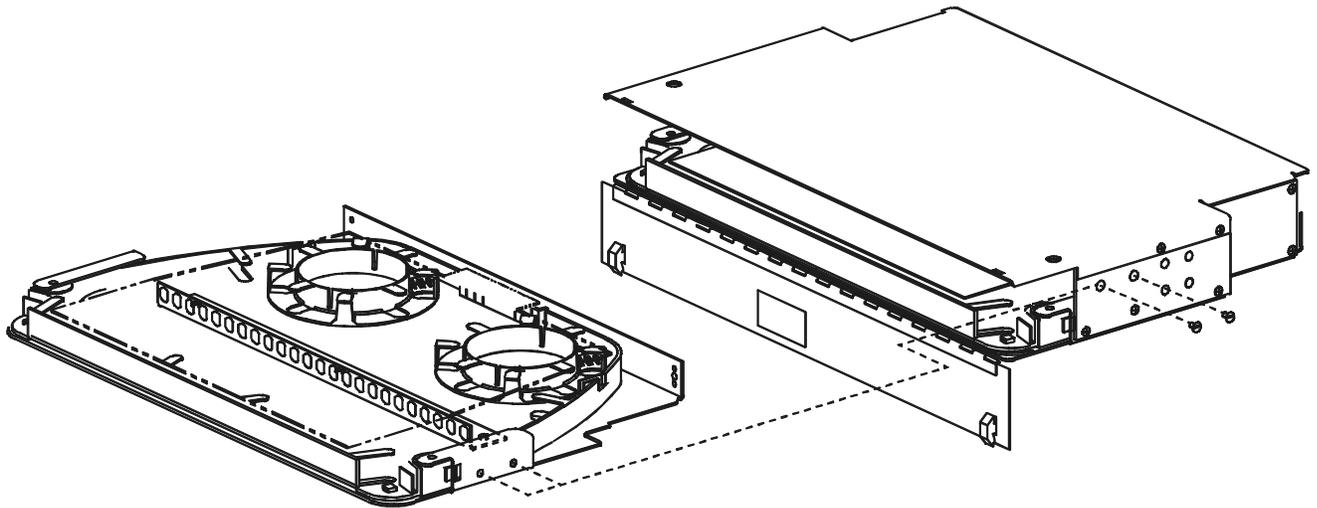


Shelf	Code	Dimensions	Connectors	Cables	Application
Fiber Optic Termination Shelf	LST1F-072/7 106 191 695	7 in (178 mm) high 17 in (432 mm) wide 11 in (279 mm) deep	72 nominal (144 max)	4	Standard Density – Direct termination of individual fibers for front access cabling

**ST® Pivoting Front Access Termination Shelf**

The LST1P-48ST/2.5 Pivoting Front Access Termination Shelf is equipped with two individual pivoting trays that swing out to allow easy front access placement of fibers and connectors. Each pivoting tray will accommodate termination of up to 24 *ST* adapters. Two bend limiting drums are included with each tray to prevent bending fibers less than the minimum allowable radius.

The pivoting front access shelf is specifically designed for use in electronic cabinets. Several mounting brackets are available for mounting the unit and clamping cables in various positions in electronic cabinet applications. These brackets are typically specified and provided with the electronic cabinet.

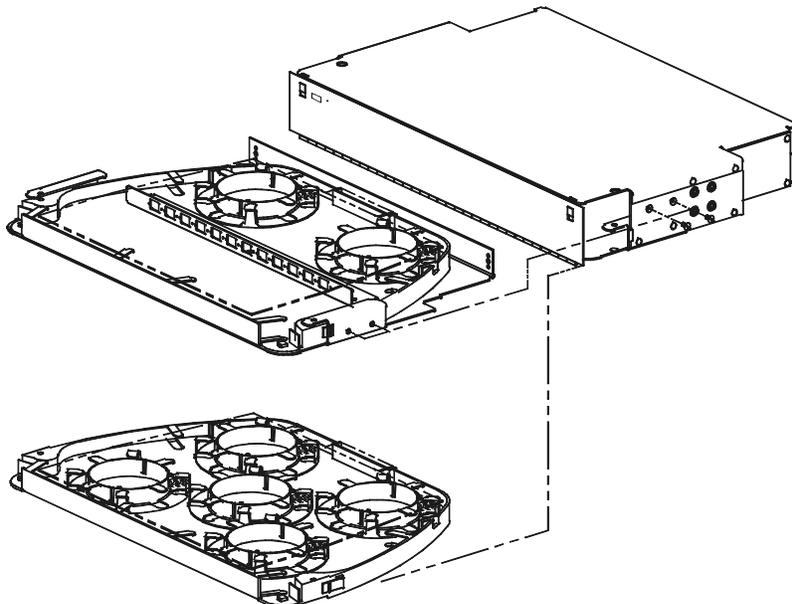


Shelf	Code	Dimensions	Connectors	Cables	Application
Fiber Optic Termination Shelf	LST1P-048ST/2.5 106 587 710	2.5 in (63 mm) high 17 in (432 mm) wide 11 in (279 mm) deep	48 <i>ST</i> ®	2	Pivoting Front Access Termination Shelf accommodates 48 <i>ST</i> adapters

**SC Pivoting Front Access Termination Shelves**

The LSTJ1LP-12SC/2.5 Pivoting Front Access Termination Shelf is equipped with two individual pivoting trays that swing out to allow easy front access placement of fibers and connectors. One of the pivoting trays will accommodate termination of up to 12 SC adapters. Two bend limiting drums are included with each tray to prevent bending fibers less than the minimum allowable radius.

The LST1LP-24SC/5 Pivoting Front Access Termination Shelf is equipped with four individual pivoting trays that swing out to allow easy front access placement of fibers and connectors. Two of the pivoting trays will accommodate termination of up to 12 SC adapters. Two bend limiting drums are included with these termination trays to prevent bending fibers less than the minimum allowable radius. Two additional trays are provided for slack storage. Each slack storage tray is provided with five slack storage drums to take up excess jumper slack. The pivoting front access shelf is specifically designed for use in electronic cabinets. Several mounting brackets are available for mounting the unit and clamping cables in various positions in electronic cabinet applications. These brackets are typically specified and provided with the electronic cabinet.



Shelf	Code	Dimensions	Connectors	Cables	Application
Fiber Optic Termination Shelf	LST1LP-12SC/2.5 107 044 323	2.5 in (63 mm) high 17 in (432 mm) wide 11 in (279 mm) deep	12 SC	2	Pivoting Front Access Termination Shelf with 12 SC adapters on top tray and slack storage on bottom tray
Fiber Optic Termination Shelf	LST1LP-24SC/5 107 027 427	5 in (127 mm) high 17 in (432 mm) wide 11 in (279 mm) deep	24 SC	2	Pivoting front access shelf with two LSTJ1LP-12SC/2.5 shelves combined

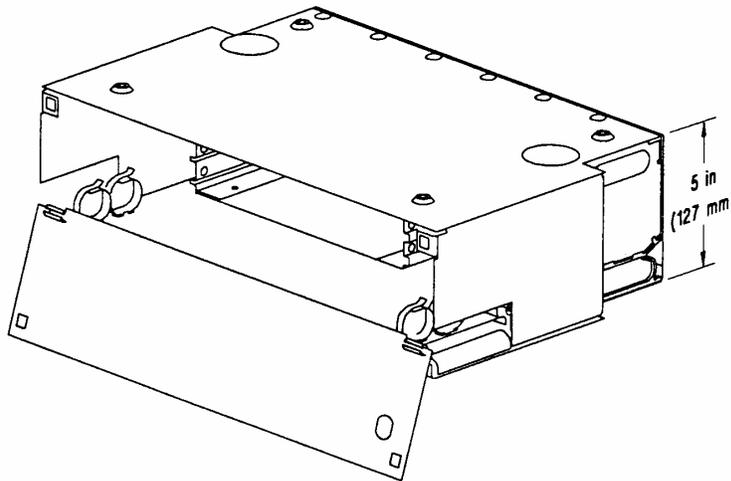
## Splice Shelves

Splice-only shelves are available to store mechanical, fusion, mass fusion, or array splices.

### LSS1U-072/5 Splice Shelf

The LSS1U-072/5 Splice Shelf has positions for three LT1A-type sliding splice organizers. Each LT1A-type organizer can store 24 individual mechanical or fusion splices or can be used to store 12 mass fusion splices. The shelf bottom storage area is used for coiling slack in buffered pigtails or tubes. Up to four OSP cables (two per side) can be secured to the two cable clamp brackets on the splice shelf. This splice shelf has a nominal capacity of 72 individual splices. The shelf is typically used in combination with a single termination shelf (total capacity 72 splices and 72 terminations) when using individual pigtail splices. When using mass fusion splicing, the shelf can be used in combination with multiple termination shelves. In mass splicing applications, each splice tray can accommodate 12 mass splices for a total capacity of 36 mass splices. Alternatively, the shelf may be used alone for splice-only applications.

Shelf	Code	Dimensions	Splices	Cables	Application
-------	------	------------	---------	--------	-------------

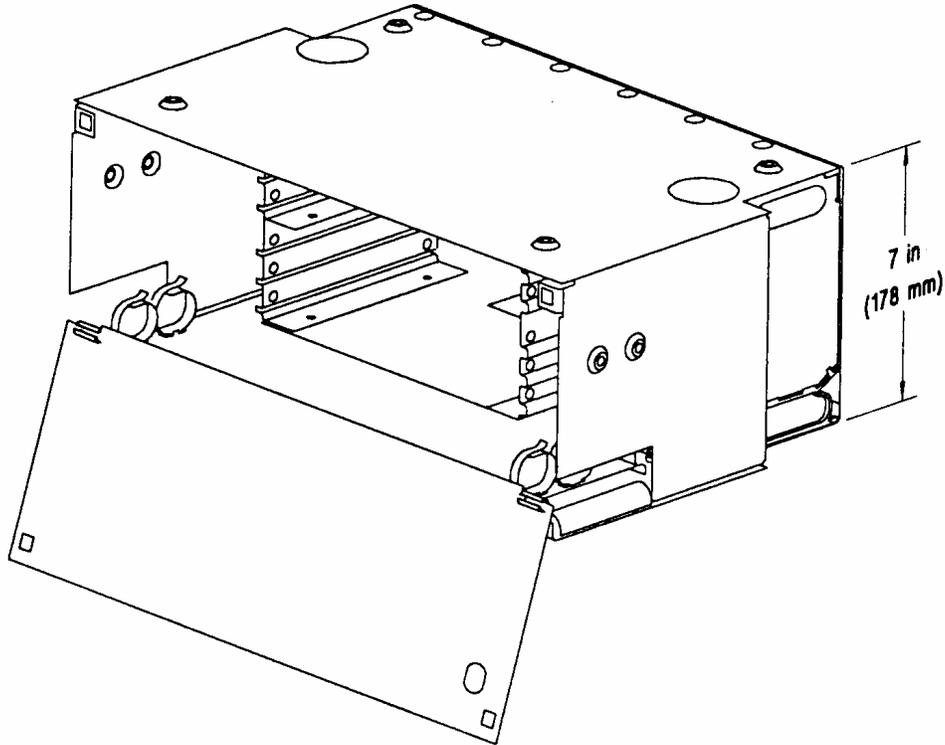


Fiber Optic Splice Shelf	LSS1U-072/5 105 335 806	5 in (127 mm) high 17 in (432 mm) wide 11 in (279 mm) deep	72 nominal	4	Holds three standard LT1A type splice organizers
--------------------------	----------------------------	--	------------	---	--

### LSS1U-144/7 Splice Shelf

The LSS1U-144/7 Splice Shelf has mounting positions for six LT1A-type sliding splice organizers. Each LT1A-type organizer can store 24 individual mechanical or fusion splices or can be used to store 12 mass fusion splices. The shelf is 7 inches (178 mm) high, 17 inches (432 mm) wide, and 11 inches (279mm) deep with a bottom storage area for coiling slack. Up to

four OSP cables (two per side) can be secured to the two-cable clamp brackets on the splice shelf. This shelf has a nominal capacity of storing 144 individual splices. The shelf is typically used in combination with two termination shelves (total capacity 144 splices and 144 terminations) when using individual pigtail splices. When using mass fusion splicing, the shelf can be used in combination with multiple termination shelves. In mass splicing applications, each splice tray can accommodate 12 mass splices for a total capacity of 72 mass splices. Alternatively, the shelf may be used alone for splice-only applications.

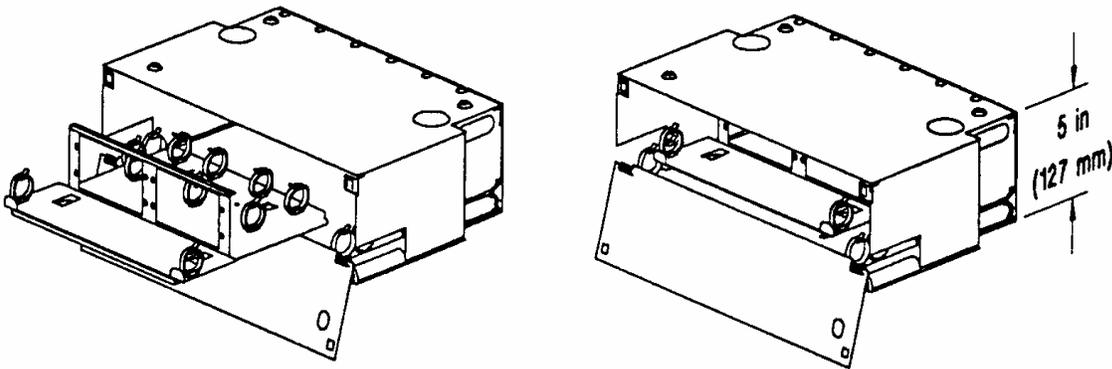


Shelf	Code	Dimensions	Splices	Cables	Application
Fiber Optic Splice Shelf	LSS1U-144/7 105 335 772	7 in (17.8 mm) high 17 in (432 mm) wide 11 in (279 mm) deep	144 nominal	4	Holds six standard LT1A type splice organizers

## Combination Shelves

### LSC2U-024/5 Combination Shelf

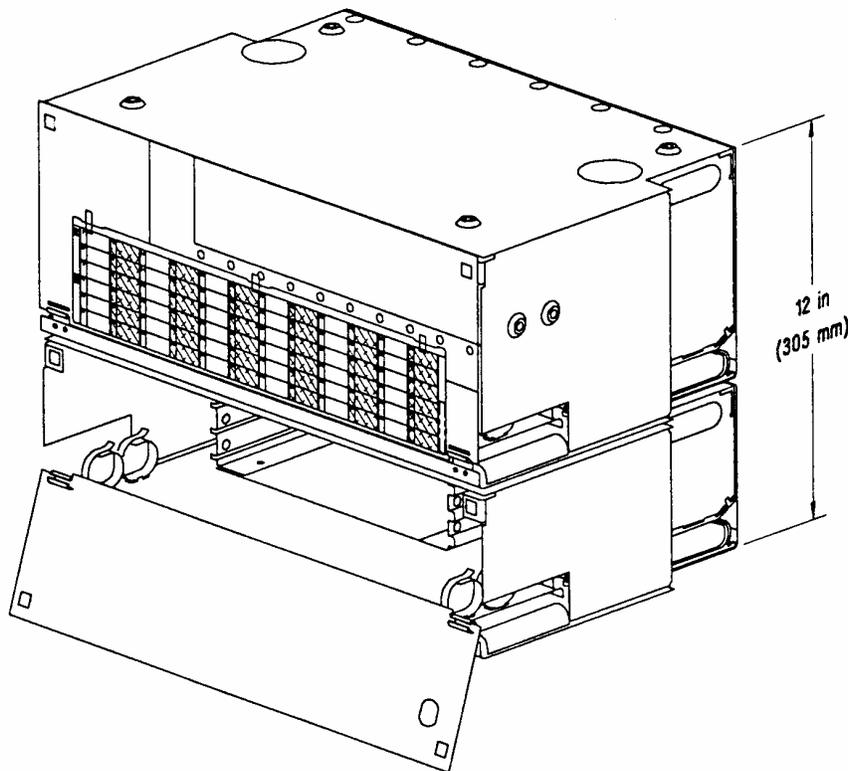
The LSC2U-024/5 Combination Splice/Termination Shelf is used for pigtail splicing and fiber termination. Building cables or up to four OSP cables (two per side) can be attached to brackets provided with the shelf. The shelf can accept one standard LT1A-type splice organizer. The LT1A-type organizer can store up to 24 individual mechanical or fusion splices or 12 mass fusion splices. Up to four 1000-type panels may be mounted in the shelf for a total of 24 fiber terminations. Higher termination capacity can be achieved with 8-pack or 12-pack 1000-type connector panels. The bulkhead for connector panel mounting slides out of the shelf from the front or the rear for easy access during pigtail installation. Fiber rings are used to organize and strain relieve fiber pigtails.



Shelf	Code	Dimensions	Connectors & Splices	Cables	Application
Fiber Optic Combination Shelf	LSC2U-024/5 106 455 355	5 in (127 mm) high 17 in (432 mm) wide 11 in (279 mm) deep	24 nominal	4	Pigtail splice and/or direct termination of individual fibers or ribbon cables

### LSC1U-072/12 Combination Shelf

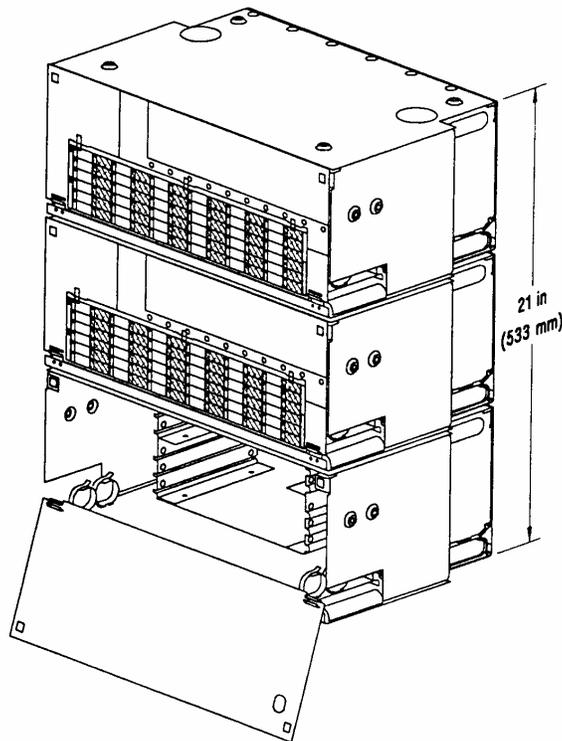
The LSC1U-072/12 Combination Splice and Termination Shelf (see figure below) is used for splicing and terminating up to 72 fibers. The shelf has a 5 inch (127 mm) high splice shelf attached beneath a 7 inch (178 mm) high termination shelf with an overall height of 12 inches (305 mm). The shelf is equipped with brackets for securing up to eight OSP (four per side) cables; OSP fibers are spliced and stored in LT1A-type splice organizers mounted in the splice shelf. The splice shelf has a housing that accommodates up to three LT1A-type organizers. Each LT1A-type organizer can store up to 24 mechanical or fusion splices or 12 mass fusion splices. Pigtails are routed from the splice shelf to the termination shelf through grommeted portals. The shelf accommodates up to twelve 1000-type connector panels. Jumpers are routed in the front trough while fiber slack is coiled in the rear.



Shelf	Code	Dimensions	Connectors & Splices	Cables	Application
Fiber Optic Combination Shelf	LSC1U-072/12 105 335 822	12 in (305 mm) high 17 in (432 mm) wide 11 in (279 mm) deep	72 nominal	8	Pigtail splice and/or direct termination of individual fibers or ribbon cables

### LSC1U-144/21 Combination Shelf

The LSC1U-144/21 Combination Splice and Termination Shelf (see figure below) is used for splicing and terminating up to 144 fibers. The shelf has a 7 inch (178 mm) high splice shelf attached beneath two 7 inch (178 mm) high termination shelves for an overall height of 21 inches (533 mm) high. The shelf is supplied with cable brackets for securing up to 12 OSP cables (six per side). Outside plant fibers are typically spliced and stored in LT1A-type splice organizers that mount inside the shelf. The splice shelf houses up to six LT1A-type organizers. Each LT1A-type organizer can store 24 mechanical or fusion splices or 12 mass fusion splices. Pigtailed are routed from the splice shelf to the termination shelf through grommeted portals. Each termination shelf can accommodate up to twelve 1000-type connector panels for a total of 24 connector panels. The nominal density is 144 fiber terminations. Jumpers are routed in the front trough while fiber slack is coiled in the bottom rear of the shelf.



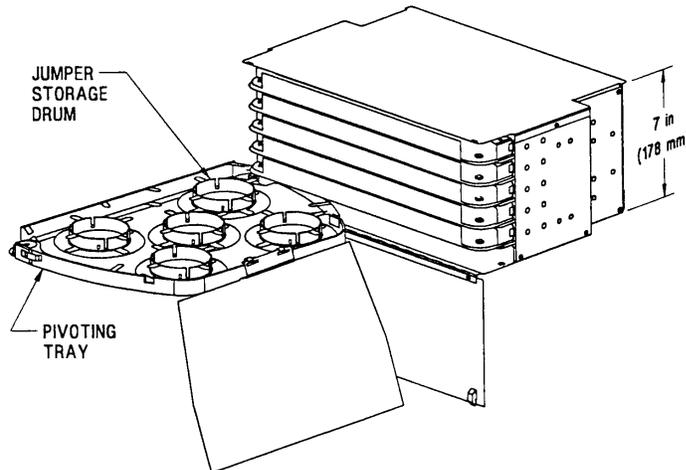
Shelf	Code	Dimensions	Connectors & Splices	Cables	Application
Fiber Optic Combination Shelf	LSC1U-144/21 105 335 798	21 in (305 mm) high 17 in (432 mm) wide 11 in (279 mm) deep	144 nominal	12	Pigtail splice and/or direct termination of individual fibers or ribbon cables

## Slack Storage Shelves

OFS Fiber Management Guidelines (see operations section) generally do not require slack storage shelves. However, there may be special cases where taking up excess interconnect or cross-connect jumper slack is required. For these cases, OFS offers a high density slack storage shelf with swing-out trays and a general-purpose utility slack storage shelf.

### LSJ1RP-30/7 Shelf

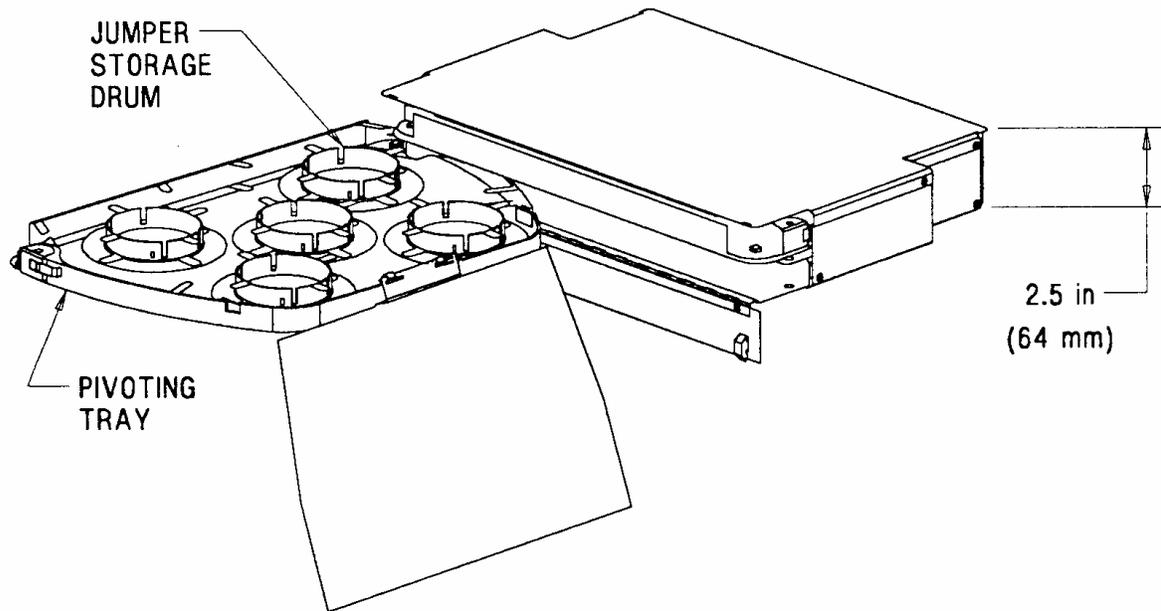
The LSJ1RP-30/7 Storage Shelf (see figure below) is equipped with six individual pivoting trays that swing out to allow easy placement and retrieval of fiber slack. The shelf has the identical dimensions as the standard Fiber Optic Termination Shelf and will fit into any FDF position with a 7-inch (178 mm) vacant position. Each pivoting tray has provisions for mounting up to five removable 3-inch (76 mm) diameter spools for storing cable or jumper slack. Jumper slack is coiled around storage spools in the pivoting trays, maintaining proper bend radius. Each tray's pivoting direction can be reversed as required. Each drum has a maximum capacity for 30 feet (9.1m) of slack jumper. With five drums per tray, each tray has a storage capacity of 150-feet of slack jumper. With five drums per tray, each tray has a storage capacity of 150-feet of slack jumper. The total shelf slack storage capacity is 900 feet (274 m) of jacketed jumper cable. Alternatively each tray may be used to store 30 feet (9.1m) of building cable resulting in a shelf building cable storage capacity of 180 feet (55 m).



Shelf	Code	Dimensions	Slack	Trays	Application
Fiber Optic Jumper Storage Shelf	LSJ1RP-30/7 106 587 694	7 in (178 mm) high 17 in (432 mm) wide 11 in (279 mm) deep	30 ft (9.1m) per tray	6	Pivoting Front Access Jumper Slack Storage

### LSJ1RP-10/2.5 Slack Storage Shelf

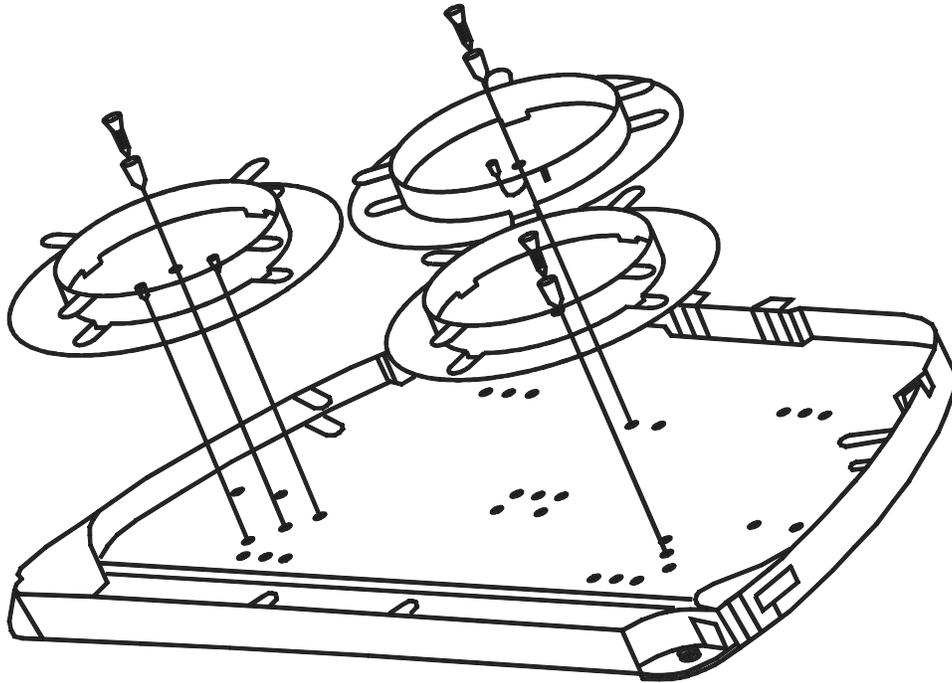
The LSJ1RP-10/2.5 Storage Shelf (see figure below) is equipped with two individual pivoting trays that swing out to allow easy placement and retrieval of fiber slack. The shelf is 2.5 inches (64 mm) high. Each pivoting tray has provisions for mounting up to five removable 3-inch diameter spools for storing jumper cordage, or up to three 4-inch diameter spools for storing building cable. Jumper slack is coiled around storage spools in the pivoting trays, maintaining proper bend radius. Each trays' pivoting direction can be reversed as required. Each drum has a maximum capacity for 30-feet (9.1m) of slack jumper cable. With five drums per tray, each tray has a storage capacity of 150 feet and the total shelf slack storage capacity is 300 feet (91.4 m) of jacketed cable. Alternatively, the shelf can accommodate 60 feet (18.3 m) of LGBC cable.



Shelf	Code	Dimensions	Slack	Trays	Application
Fiber Optic Jumper Storage Shelf	LST1LP-10/25 106 795 057	2.5 in (63 mm) high 17 in (432 mm) wide 11 in (279 mm) deep	30-ft (9.1m) per tray	2	Pivoting Front Access Jumper Slack Storage

### LP-LGBC4A Fiber Optic Organizer

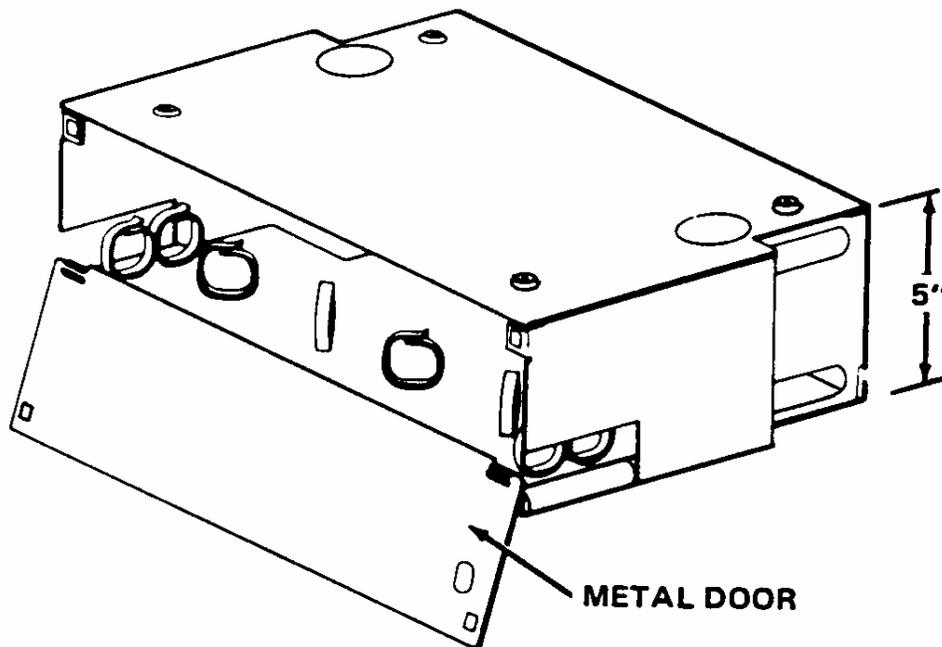
The LP-LGBC4A Fiber Optic Organizer is a package of three 4-inch (102 mm) diameter drums. These drums are ordered to replace the five 3-inch (76 mm) drums supplied with each pivoting tray in the LSJ1RP-30/7 and the LST1LP-10/25 pivoting shelves. Each 4-in (102 mm) drum is designed to store up to 10 feet (3 m) of LGBC-4 or LGBC-6 Fiber Optic Building Cable. The drums are fastened to the individual pivoting trays with simple snap-in fasteners when the shelves are used to store larger cable diameters.



Shelf	Code	Dimensions	Slack	Drums	Application
Fiber Optic Storage Drum	LP-LGBC4A 106 650 989	4 in (102 mm) diameter	10 ft (3 m) drum	3 per package	Replace five standard 3-in (76 mm) drums supplied with each pivoting tray with three larger 4-in (102 mm) storage drums

### LSJ1U-072/5 Storage Shelf

The LSJ1U-072/5 Jumper Storage Shelf (see figure below) is a general-purpose utility slack storage shelf. This shelf stores slack of preassembled cross-connect jumpers or buffered cables in an open shelf arrangement. The shelf may be used to store slack in cross-connect jumpers, interconnect jumpers, or to take up slack in buffered cables routed between equipment racks. Jumper slack is coiled and stored either inside the shelf fiber rings or above the rings provided the proper bend radius is maintained.



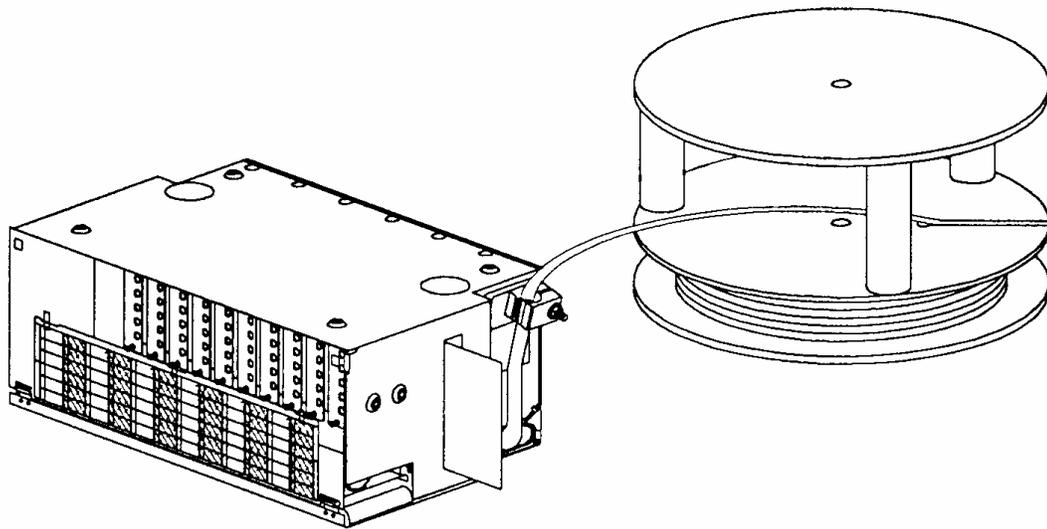
Shelf	Code	Dimensions	Slack	Trays	Application
Fiber Optic Jumper Storage Shelf	LSJ1U-072/5 105 335 780	5 in (127 mm) high 17 in (432 mm) wide 11 in (279 mm) deep	Flexible depending on cable type	none	Jumper Slack Storage

### Preterminated Shelves

LGX shelves are provided with pre-terminated cables and fibers. Shelves are available with fire retardant Lightguide Building Cable (LGBC) stubs or fire-retardant ribbon riser cables in any specified lengths. This allows the user to easily install a shelf and route a fire-retardant cable to a splice location close to the cable entrance facility. Because the connectors are terminated in the controlled environment of the factory, overall quality of

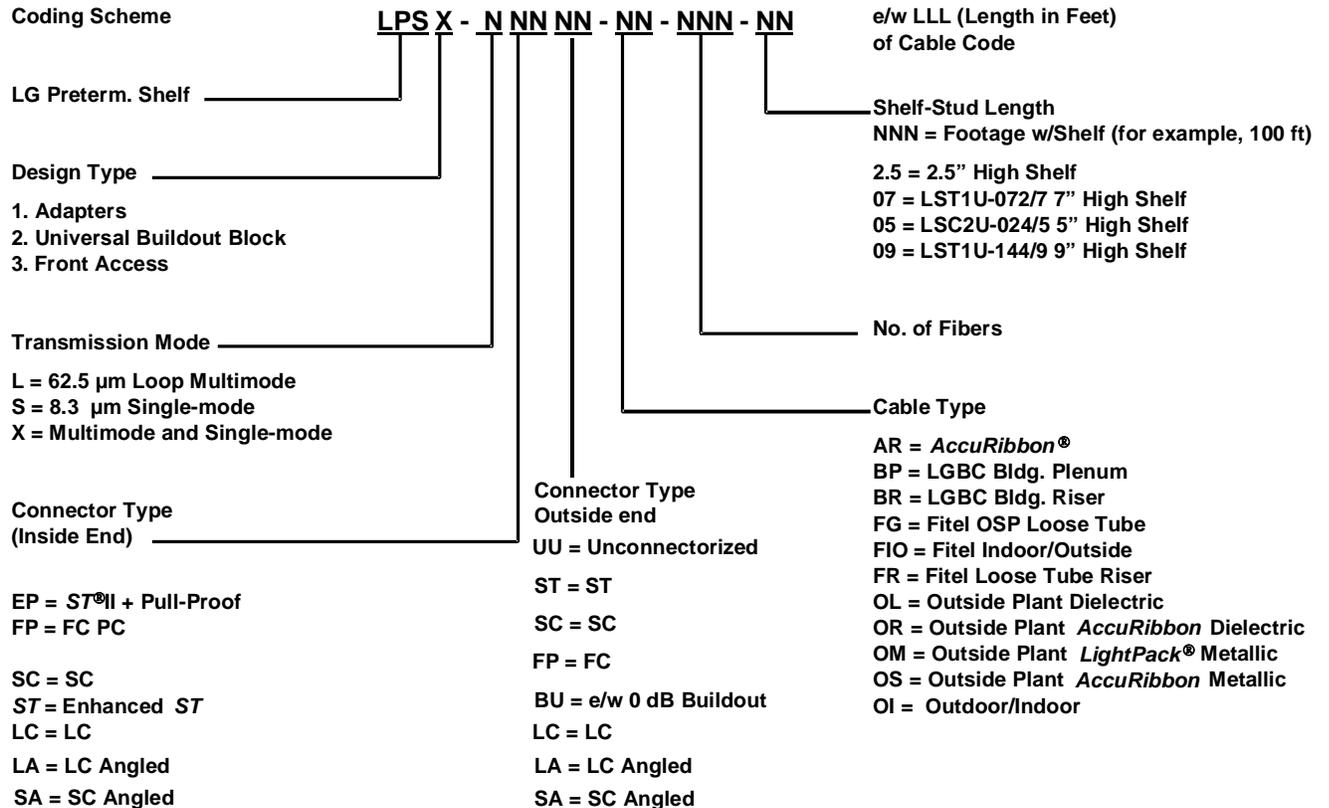
fiber connections is improved and the overall installation is better organized.

Preterminated LGX shelves are available in many varieties including any specified connector such as the ST<sup>®</sup>, SC or LC. Preterminated shelves are usually constructed out of the standard LST1U-072/7 Termination Shelf or the LSC2U-024/5 Combination Shelf. These shelves will typically be equipped with up to 72 or 24 preterminated connectors respectively in one shelf. Applications requiring higher fiber capacity are supplied with termination shelves stacked with up to 216 connectors; 72 connectors terminated in each of three shelves. These shelves are offered with *AccuRibbon*<sup>®</sup> or *AccuMax*<sup>®</sup> cables already coiled in a packaging arrangement that allows easy routing of cables.



### Preterminated Shelf Ordering Description

The following ordering description provides general guidelines for specifying a preterminated shelf. All possible combinations of the listed preterminated shelf codes may not be available. Please contact your local Lucent sales representative for availability and ordering information.



**Multi-Access Modular Unit (MAMU)**

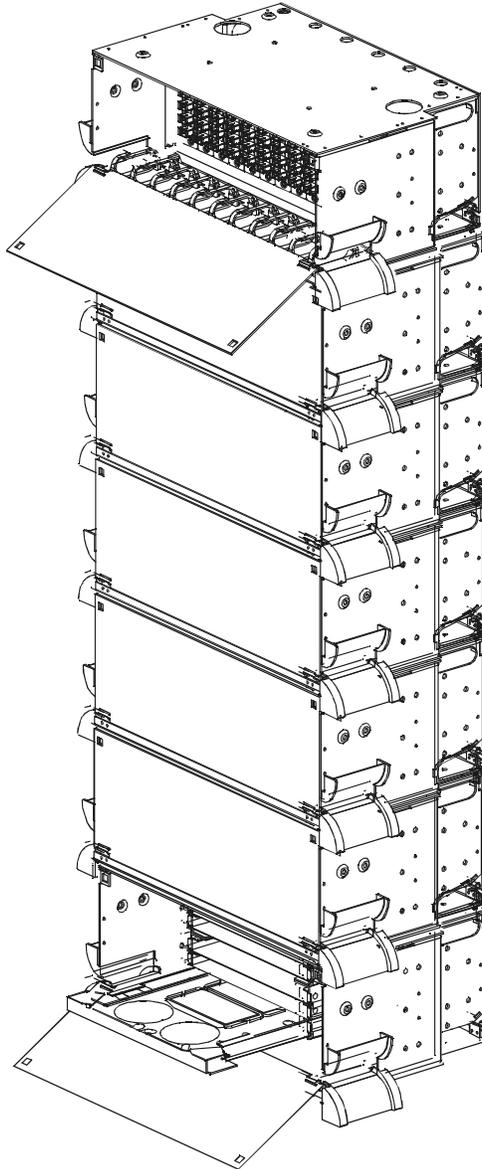
The Multi-Access Modular Unit (MAMU) provides a convenient means for quickly splicing and terminating high fiber count cables. The unit consists of a stack of multiple termination shelves (LST1U-072/7) and one splice shelf (LSS1U-144/7). Each Fiber Termination Shelf is equipped with connector panels, fiber termination and fanouts. Each Splice Shelf is equipped with LT1A-MF/MF type mass-fusion splice organizers. All of the shelves are secured together in the factory to form an assembly that is shipped and installed as one unit.

The assembly is supplied preterminated with a complement of 12-fiber ribbon fanouts. The fanouts supplied in each shelf have individual on one end and are unconnectorized on the other end. Fanouts are stored in the rear of the termination shelves. The unconnectorized end of each fanout is routed from the rear of the termination shelf position to the splice shelf and into the splice organizers. The unconnectorized end is positioned in the organizer ready for mass fusion splicing only. The unconnectorized end of each fanout is clearly identified to correspond to the termination shelf and connector positions within that shelf. The splice shelf and organizers are typically located at the bottom of the assembly in the position most convenient for splicing.

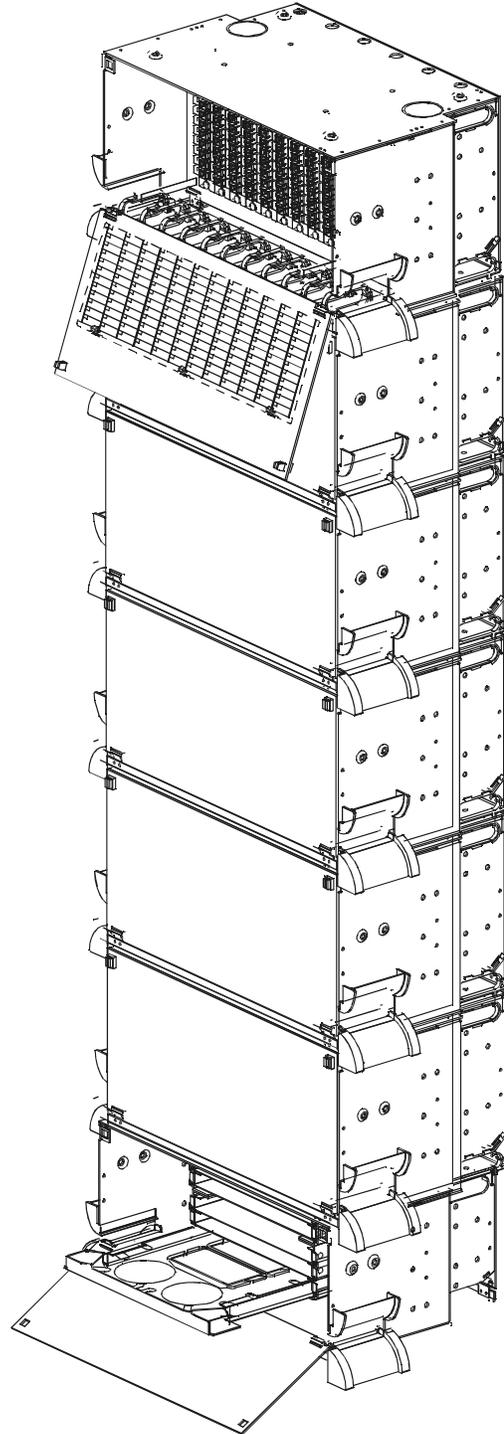
The MAMU unit is available for 432 fiber termination. This unit consists of a stack of six LST1U-072/7 Fiber Termination Shelves and one LSS1U-144/7 Splice Shelf for a total height of 49 inches (1244 mm).

A high density MAMU unit is also available for terminating 864 fibers. This unit consists of six LST1U-144/9 Fiber Termination Shelves and one LSS1U-144/9 Splice Shelf for a total height of 63-inches (1550 mm).

Product Code	Height	Description
LPST-S-SCUU-AR-432-49 108 298 829	49in (1244-mm)	<b>Multi-Access Modular Unit</b> – The unit consists of a stack of six pre-terminated LST1U-072/7 Fiber Termination Shelves and one LSS1U-144/7 Splice Shelf with 6 LT1A-MF/MF mass fusion splice trays with 36 twelve fiber ribbons ready for mass splicing.
LPST-S-SCUU-AR-864-63 108 617 481	63in (1600-mm)	<b>Multi-Access Modular Unit</b> – The unit consists of a stack of six pre-terminated LST1U-144/9 High Density Fiber Termination Shelves and one LSS1U-144/9 Splice Shelf with 6 LT1A-MF/MF mass fusion splice trays and 72 twelve fiber ribbons ready for mass splicing.



**MAMU-432**

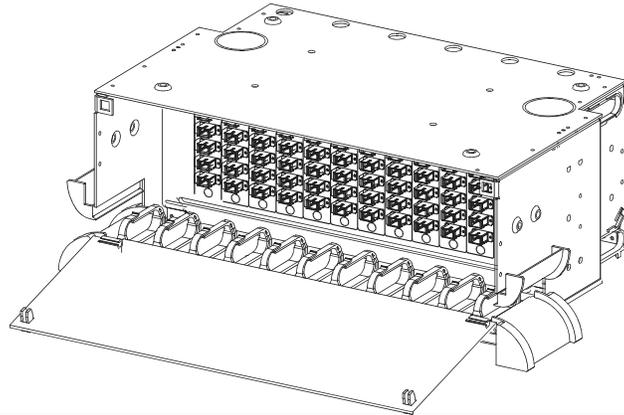


**MAMU-864**

## Shelves e/w Adapters

### LST1U-072/7 7-Inch Termination Shelves e/w Adapters

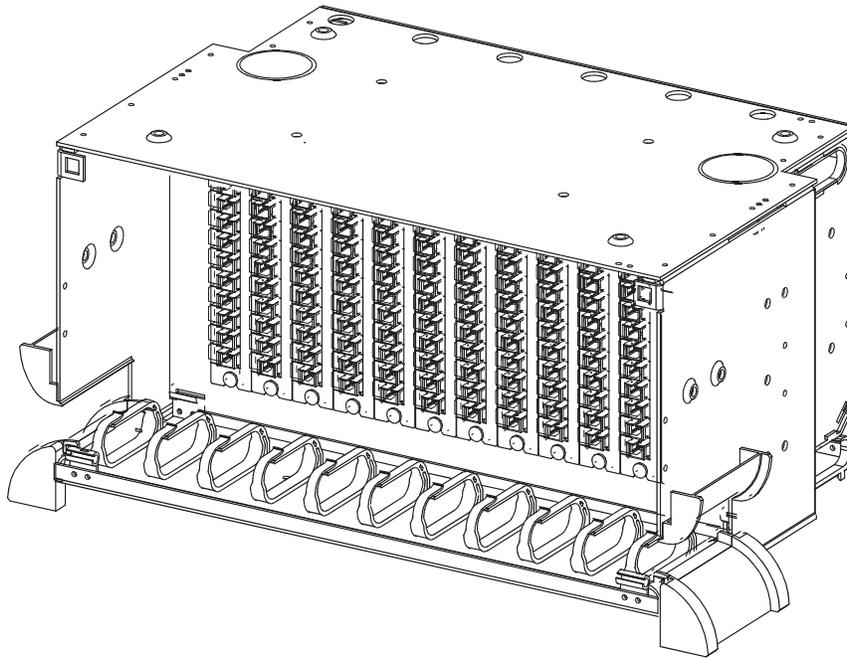
The 7-Inch *LGX* Termination Shelves are available equipped with connector panels and optical adapters in a variety of configurations.



Product Code	Description
106 500 614	LST1U-072/7 Termination Shelf e/w twelve 1000SC1 Connector Panels and 72 SC Adapters
107 075 160	LST1U-072/7 Termination Shelf e/w twelve 1000ST1 Connector Panels (optical adapters not included)
107 525 115	LST1U-072/7 Termination Shelf e/w twelve 1000ST1 Connector Panels and (72) A3001 <i>ST</i> <sup>®</sup> Blocks (buildouts ordered separately)
107 525 123	LST1U-072/7 Termination Shelf e/w twelve 1000ST1 Connector Panels, (72) A3001 <i>ST</i> Blocks and (72) 0-dB <i>ST</i> Buildouts
107 640 131	LST1U-072/7 Termination Shelf e/w twelve 1000ST1 Connector Panels and (72) C3000A2 single-mode <i>ST</i> Adapters
107 640 609	LST1U-072/7 Termination Shelf e/w twelve 1000ST1 Connector Panels and (72) C2000A-2 single-mode <i>ST</i> Adapters
107 933 251	LST1U-072/7 Termination Shelf e/w twelve 1000ST-8 Connector Panels and 96 A2000 multimode <i>ST</i> Adapters
109 136 119	LST1U-072/7 Termination Shelf e/w twelve 1000SC-8 Connector Panels and 96 C6000A-4 single mode <i>SC</i> Adapters
109 062 059	LST1U-072/7 Termination Shelf e/w twelve 1000LC1 Simplex Connector Panels and 72 <i>LC</i> Simplex Adapters
108 632 019	LST1U-072/7 Termination Shelf e/w twelve 1000ST1 Connector Panels and 72 A3002 <i>ST</i> blocks (buildouts ordered separately)
108 464 686	LST1U-072/7 Termination Shelf e/w 72 multimode duplex LC adapters

### 9-Inch Shelves e/w Adapters

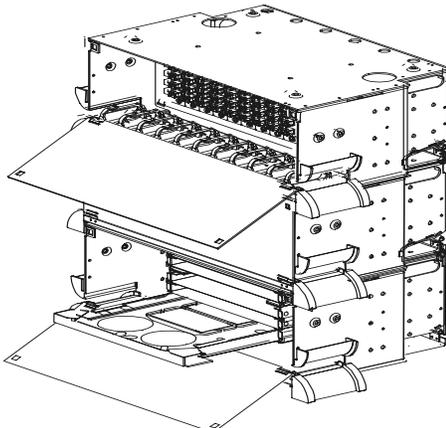
The 9-Inch *LGX* Termination Shelves are available equipped with optical adapters in a variety of configurations.



Product Code	Description
107 871 337	LST1U-144/9 Termination Shelf e/w twelve 1200SC1-12 Connector Panels and 144 <i>SC</i> Adapters
108 363 722	LST1U-144/9 Termination Shelf e/w twelve 1200ST1-12 Connector Panels and 144 C3000A2 SM <i>ST</i> <sup>®</sup> Adapters
109 086 090	LST1U-144/9 Termination Shelf e/w twelve 1200LC-12 Connector Panels and 144 <i>LC</i> Simplex Adapters
108 363 813	LST1U-144/9 Termination Shelf e/w twelve 1200ST1-12 Connector Panels and 144 C2000 MM <i>ST</i> Adapters

### Combination Shelves e/w Adapters and Splice Organizers

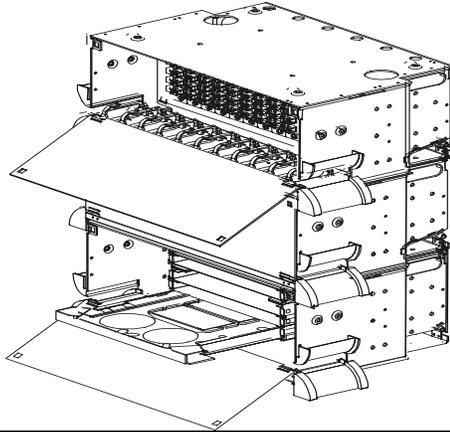
**LGX Combination Shelves** are available equipped with optical adapters and splice organizers in a variety of configurations.



<b>Product Code</b>	<b>Description</b>
108 248 287	LSC2U-024/5 Combination Shelf e/w four 1000SC Connector Panels, 24 SC Adapters, one LT1A-F/F Splice Organizers and one 12A1 Cable Clamp
108 248 295	LSC1U-072/12 Combination Shelf e/w twelve 1000SC Connector Panels, 72 SC Adapters, three LT1A-F/F Splice Organizers and one 12A1 Cable Clamp
109 136 135	LSC2U-096/12 Combination Shelf e/w twelve 1000SC-8 Connector Panels, 96 SC Adapters, three LT1A-MF/MF Splice Organizers and one 12A1 Cable Clamp
108 248 303	LSC1U-144/21 Combination Shelf e/w twenty-four 1000SC Connector Panels, 144 SC Adapters, six LT1A-F/F Splice Organizers and one 12A1 Cable Clamp

**Combination Shelves e/w Adapters and Splice Organizers and Fanouts**

**LGX Combination Shelves** are available equipped with optical adapters and splice organizers as well as Mini Fanouts in a variety of configurations.



<b>Product Code</b>	<b>Description</b>
108 844 382	LSC2U-024/5 Combination Shelf e/w four 1000SC Connector Panels, 24 SC Adapters, one LT1A-MF/MF Splice Organizer and four Mini Fanouts
109 083 451	LSC2U-048/5 Combination Shelf e/w four 1000LC Duplex Adapter Panels, one LT2A-MF/MF Splice Organizer and four Mini Fanouts
108 851 965	LSC2U-072/12 Combination Shelf e/w twelve 1000SC Connector Panels, 72 SC Adapters, three LT1A-MF/MF Splice Organizers and six Mini Fanouts
109 080 887	LSC2U-144/14 Combination Shelf e/w twelve 1200LC1 Simplex Adapter Panels, 144 Single Mode LC Simplex adapters, Three LT2A-MF/MF Splice Organizer and 12 Mini Fanouts.
108 949 322	LSC2U-144/14 Combination Shelf e/w twelve 1200SC1 Adapter Panels, 144 SC Adapters, Three LT2A-MF/MF Splice Organizer and 12 Single Mode Mini Fanouts

## Connector Panels and Modules

3

### Section Contents

---

The LGX® Fiber Optic Shelves may be equipped with a wide variety of connector panels, fanouts, and passive optic component modules. This section describes the more common connector options specified for use in the shelf.

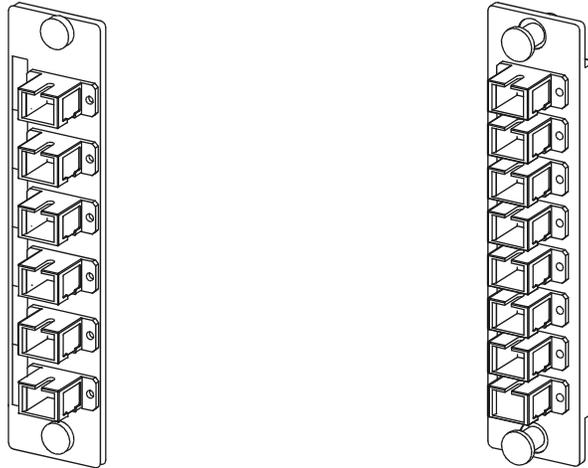
- 1000-Type Connector Panels 3-2
- 1200-Type Connector Panels 3-7
- Connectorized Modules 3-11
- Fanouts 3-15
- Optical Splitter Modules 3-16
- Wavelength Division Multiplexer (WDM) Modules 3-21

## 1000-Type Connector Panels

The 1000-SC Connector panels are used in 7-inch standard termination shelves or in 5-inch combination shelves. Connector panels provide a rigid means for mounting fiber optic adapters.

### 1000SC Connector Panels

The 1000SC connector panels are used to mount SC-Type adapters and SC Universal Buildout Blocks in 7-inch standard termination shelves or 5-inch combination shelves. The SC connector panels accommodate SC simplex C6000A-4 Adapters, SC simplex C6000A-5 Adapters and A30003 SC Universal Buildout Blocks. A panel is also available for mounting SC duplex adapters including the C6060A-4 Adapter or the C6061A-4 Adapter. All adapters and buildout blocks simply snap into the openings in the panel. Alternatively adapters can be secured to the panel with screws supplied with the panel. A stick-on label is supplied with each panel for identifying terminations.

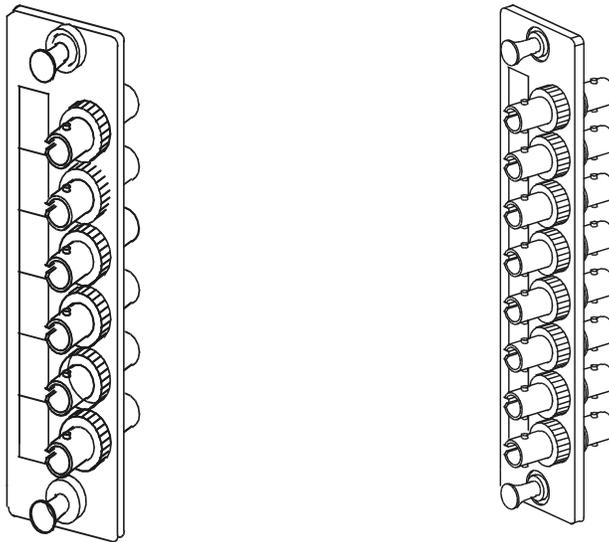


Connector Panel Code	Adapter Positions	Application
1000SC1* 106 372 121	6	Mounting for six SC simplex adapters or Universal Buildout Blocks
1000SC1 Bulk Pack* 108 190 398	6 each	Package of twelve 1000SC1 Panels
1000SC1 e/w SC 106 500 630	6	Panel equipped with six SC simplex adapters
1000SC1-8* 106 970 981	8	Mounting for eight SC simplex adapters or Universal Buildout Blocks
1000SC1-8 e/w SC 107 187 650	8	Panel equipped with eight SC simplex adapters
1000SC1-DPLX* 107 153 462	3 (duplex)	Mounting for three SC duplex adapters

Φ SC Adapters, SC Universal Buildout Blocks, and Universal Buildouts ordered separately with panels marked with asterisk.

### 1000ST Connector Panels

The 1000ST connector panels are used to mount *ST*<sup>®</sup>-Type couplings in standard 7-inch termination shelves or 5-inch combination shelves. The panels accommodate A2000-Series *ST* adapters, A3000-series *ST* Adapters, A3001 *ST* buildout blocks, or A3002 *ST* buildout blocks. All adapters and buildout blocks are secured to the panel with a threaded nut supplied with adapter or buildout. A stick-on label is supplied with each panel for fiber identification.

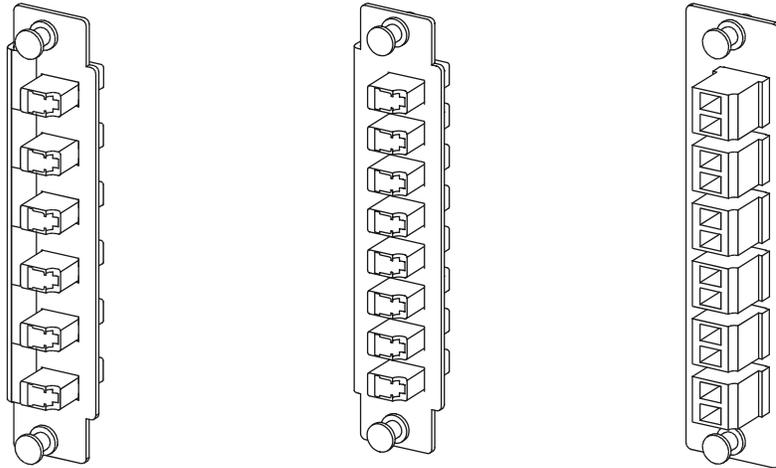


Connector Panel Code	Adapter Positions	Application
1000ST1* 105 392 005	6	Mounting for six <i>ST</i> <sup>®</sup> adapters or <i>ST</i> buildout blocks
1000ST1 Bulk Pack* 105 428 486	6 each	Package of twelve 1000ST1 Panels
1000ST1 e/w (SM) <i>ST</i> 106 500 622	6	Panel equipped with six simplex A3000 <i>ST</i> Single-Mode (SM) Adapters
1000ST1 e/w (MM) <i>ST</i> 107 802 498	6	Panel equipped with six simplex A2000 <i>ST</i> Multi-Mode (MM) Adapters
1000ST1 e/w (SM) UBO 108632001	6	Panel equipped with six simplex A3002 <i>ST</i> universal buildout blocks
1000ST1-8* 107 026 130	8	Mounting for eight <i>ST</i> adapters or <i>ST</i> buildout blocks (Must use circular nut adapter – A3000 or A2000)
1000ST1-8 e/w (SM) <i>ST</i> 107 187 643	8	Panel equipped with eight simplex A3000 <i>ST</i> Single-Mode Adapters

Φ *ST* Adapters, *ST* Buildout Blocks, and *ST* Buildouts ordered separately with panels marked with asterisk.

### 1000LC Connector Panels

The 1000LC connector panels are used to mount LC simplex or duplex adapters in 7-inch standard termination shelves or 5-inch combination shelves. The simplex panel accommodates C1000 Single Mode LC Adapters or C1000 Multimode LC Adapters. The duplex panel accommodates C1000A-Z Couplings that snap into the openings in the panel. A stick-on label is supplied with each panel for fiber identification.

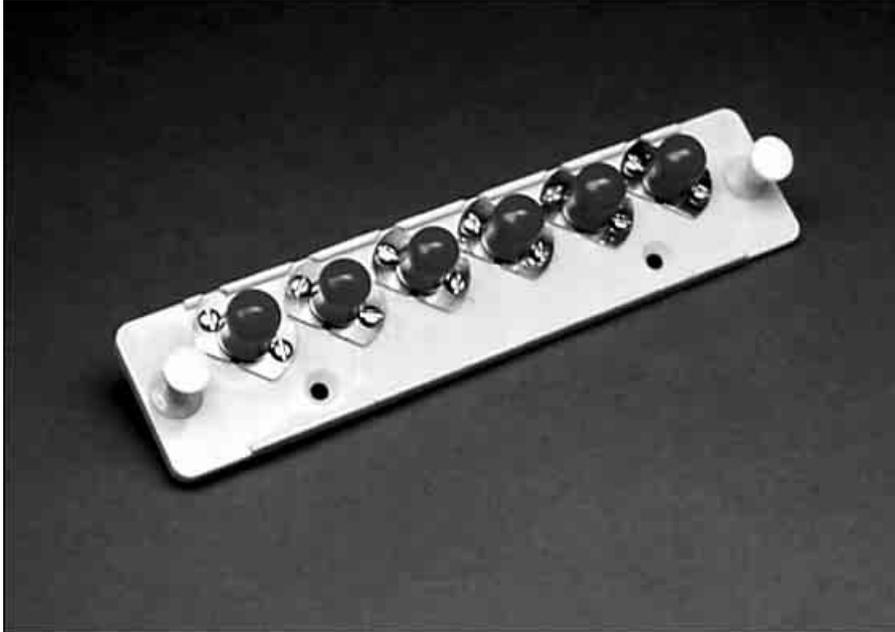


Connector Panel Code	Adapter Positions	Application
1000LC1 SMPLX-6 108 365 685	6	Mounting for six LC simplex adapters. Adapters separate.
1000LC1 SMPLX-8 108 365 693	8	Mounting for eight LC simplex adapters. Adapters separate.
1000LC1-DPLX* 107 783 763	12	Mounting for six LC duplex couplings in standard shelves. Adapters separate.

Φ This panel results in a shelf/panel density that may reduce craft efficiency.

### 1000FC Connector Panel

The 1000FC panel mounts six FC Type adapters. Threaded FC adapters are secured to the panel with locking nuts. Labels are supplied with the panel for identifying fiber terminations.



Product Code	Adapter Positions	Application
1000FC e/w FC Adapters 106 225 923 (MWK-6)	6	Panel equipped with six FC Single-Mode Adapters for use in all standard shelves.

### 1000BK Blank Panel

The 1000BK panel is available to fill a six-pack space with a blank. This panel may be used to reserve a panel position for future use or to partition the front of the shelf from the rear where buffered fibers are stored.



Product Code	Adapter Positions	Application
1000BK Bulk Pack 106 924 483	none	Blank filler panel six per package.

## 1200-Type Connector Panels

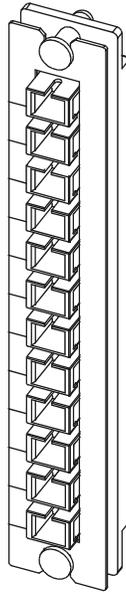
---

The 1200-Type Connector panels are used in 9-inch High Density Termination Shelves. These panels provide a rigid means for mounting fiber optic adapters with snap-in fasteners.

### 1200SC Connector Panels

The 1200SC connector panels are used to mount SC-Type adapters and SC Universal Buildout Blocks in 9-inch High Density Termination Shelves. The SC connector panels are designed to mount simplex adapters, including C6000A-4 Adapters, C6000A-5 Adapters, and A30003 SC Universal Buildout Blocks. Adapters and Universal Buildout Blocks simply snap into the openings in the panel. Alternatively, SC Adapters can be secured with

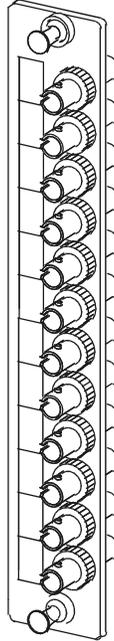
screws supplied with the panels. A stick-on label is supplied with each panel for identifying terminations.



Connector Panel Code	Adapter Positions	Application
1200SC1-12 107 581 720	12	Mounting for 12 simplex adapters in high-density LST1U-144/9 shelves. Adapters ordered separately.
1200SC1-12 e/w SC 107 719 049	12	Panel equipped with 12 SC simplex adapters for use in high-density LST1U-144/9 shelves.

### 1200ST Connector Panels

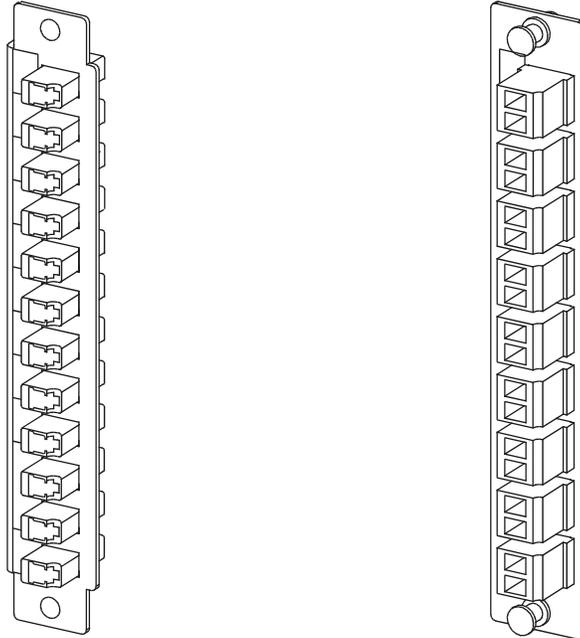
The 1200ST connector panels are used to mount *ST*-Type adapters in high density applications. Adapters can snap in or screw in to the openings in the panel. A stick-on label is supplied with each panel.



Connector Panel Code	Adapter Positions	Application
1200ST1-12 107 599 649	12	Mounting for 12 <i>ST</i> <sup>®</sup> adapters in high-density LST1U-144/9 shelves. Adapters ordered separately.
1200ST1-12 e/w (SM) <i>ST</i> 107 723 439	12	Panel equipped with 12 <i>ST</i> simplex Single-Mode adapters for use in high-density LST1U-144/9 shelves.
1200ST1-12 e/w (MM) <i>ST</i> 108 037 078	12	Panel equipped with 12 <i>ST</i> simplex Multimode adapters for use in high-density LST1U-144/9 shelves.

### 1200LC Connector Panels

The 1200LC connector panels are used to mount LC simplex or duplex adapters in 9-inch high density termination shelves. The simplex panel accommodates C1101A-2 Single Mode LC Adapters or C1001B-2 Multimode LC Adapters. The duplex panel accommodates C1000 Couplings that snap into the openings in the panel. A stick-on label is supplied with each panel for fiber identification.



Connector Panel Code	Adapter Positions	Application
1200LC1 SMPLX-12 108 365 719	12	Panel accepts twelve LC simplex adapters for use in high density LST1U-144/9 shelves. Adapters separate.
1200LC1-DPLX* 107 783 771	18	Panel accepts nine LC duplex adapters for use in high density LST1U-144/9 shelves. Adapters separate.

Φ This panel results in a shelf/panel density that may reduce craft efficiency.

### 1200BK Blank Panel

The 1200BK panel is available to fill a 1200 connector panel space with a blank. This panel may be used to reserve a panel position for future use or to partition the front of the shelf from the rear where buffered fibers are stored.

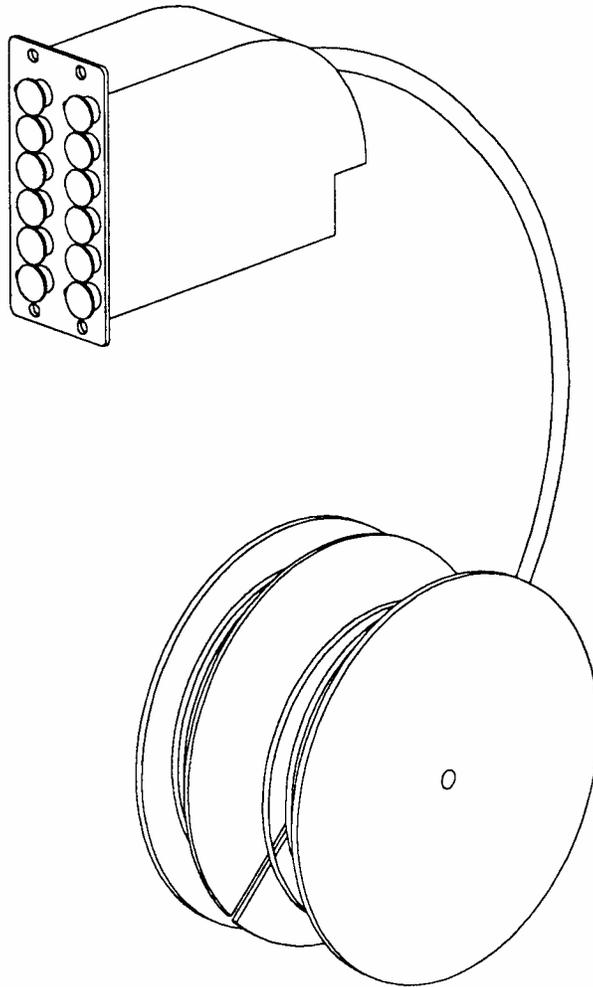


Product Code	Adapter Positions	Application
1200BK Bulk Pack 108 308 248	none	Blank filler panel – six per package

## LCM Connector Modules

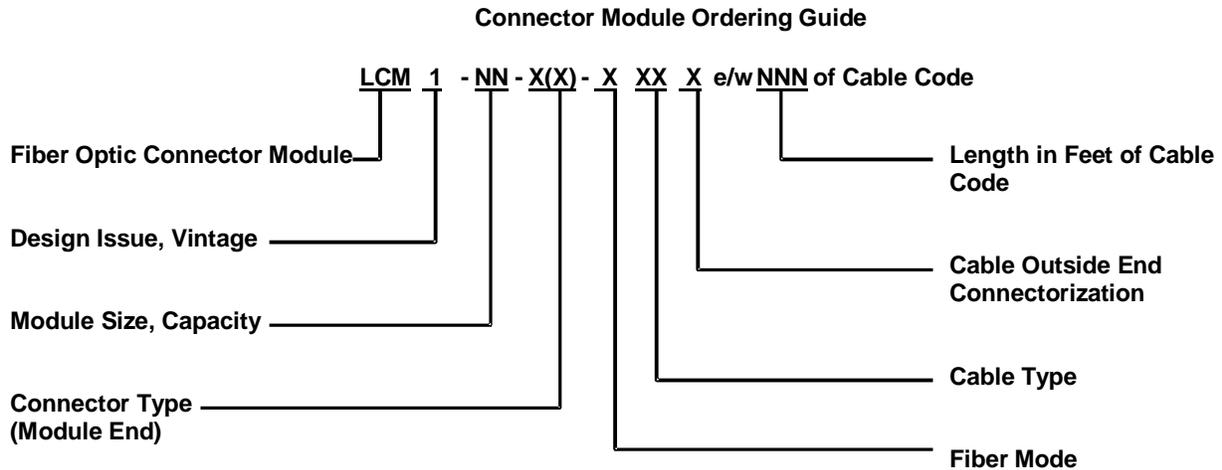
---

The Fiber Optic Connector Module line offers a variety of factory-terminated and tested modules ready for mounting into standard fiber optic termination shelves. Preterminated connector modules offer an economic way to install shelves in complements of 4, 6, 12, 24, or 36 fibers at a time. The modules (see figure below) are preterminated with lengths of cable which are also packaged for easy unreeling. The building cables are unreeled and pulled to the splice point for connection. The final step is to insert the module into the shelf from the rear and snap into place. The building cable neatly dresses into place to finish the installation. The connector modules are designed for installation in LST1U-072/7 and LSC2U-024/5 fiber optic shelves. Preterminated connector modules are available with *AccuMax*<sup>®</sup> building cables *AccuRibbon*<sup>®</sup> interconnection cables. The modules are also available with *SC*, *ST*, and *LC*, adapters.

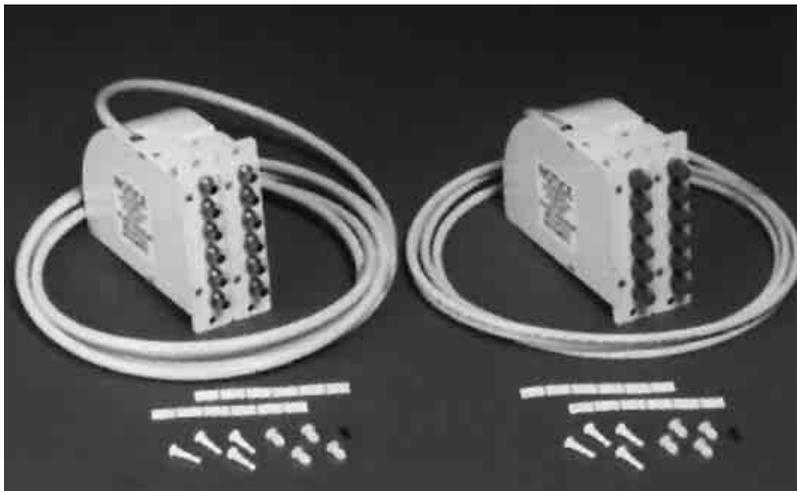


## LCM Module Ordering Guide

LCM Modules are generally specified according to the ordering guide provided below.



<i>Module Size, Capacity</i>	<i>Cable Type</i>	<i>Fiber Mode</i>
4,6,12,24,36 Connectors Connector Type (Inside End)	AR – <i>AccuRibbon</i> <sup>®</sup> Interconnect Riser (CA-8054-12)	S – Single-mode (Cable Fiber and Connector)
	LR - LGBC Riser (LGBC-012A-SRX 0r -LRX)	L - Loop Multimode Cable Fiber and Connector)
<i>ST</i> <sup>®</sup> - <i>ST</i> SC - SC LC - LC FP - FC/PC STB - <i>ST</i> Buildout	Cable (Outside End) Connectorization (Optional)	
	U - Unconnectorized Stub End	



**LCM Connector Module Code**

The LCM Module is ordered by first identifying the appropriate module. Standard module types are listed below.

<b>LCM Connector Module</b>	<b>Comcode</b>
LCM1-04-SC-SLRU	107 977 100
LCM1-04-ST-SLRU	107 993 834
LCM1-04-LC-SLRU	108 034 711
LCM1-06-SC-SLRU	107 977 118
LCM1-06-ST-SLRU	107 993 842
LCM1-06-LC-SLRU	108 034 729
LCM1-12-ST-SLRU	106 430 499
LCM1-12-ST-LLRU	106 430 515
LCM1-12-LC-LLRU	108 034 737
LCM1-12-FP-SLRU	106 430 531
LCM1-12-SC-SARU	106 430 606
LCM1-12-SC-SLRU	106 430 614
LCM1-24-SC-SARU	106 863 871
LCM1-36-SC-SARU	106 863 921

**LCM Module Cable Selection**

**After the LCM Module specified, the desired cable is identified for the application. Cable types available for use with LCM Modules are listed below.**

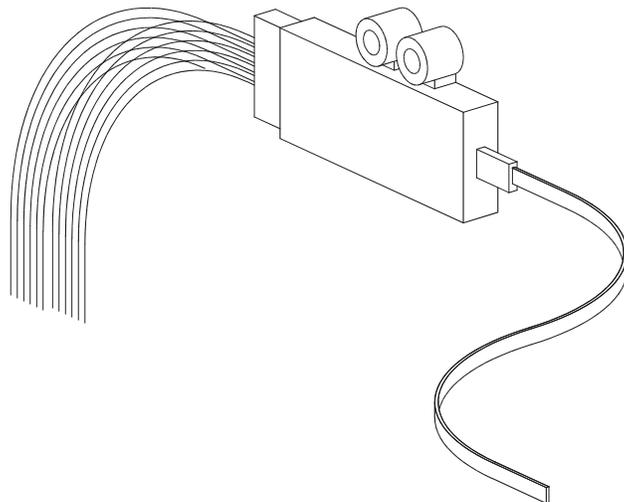
<b>LCM Module Cable Code</b>	<b>Comcode</b>
LGBC-004D-SRX (SM)	106 291 016
LGBC-006D-SRX (SM)	106 291 057
LGBC-004D-LRX (MM)	106 291 008
LGBC-006D-LRX (MM)	106 291 024
LGBC-012D-LRX (MM)	106 291 073
LGBC-012D-SRX (SM)	106 291 081
LGBC-024D-SRX (SM)	107 508 327
LGBC-036D-SRX (SM)	107 508 343
LGBC-024D-LRX (MM)	107 508 335
LGBC-036D-LRX (MM)	107 508 350
NCA6381-001 (12 SM)	106 489 842
NCA6455-001 (24 SM)	106 633 563
NCA6456-001 (36 SM)	106 633 597

## Fanouts

Fanouts are used to transition from multifiber cable construction to individual fiber terminations.

### Mini-Type Fanouts

The Mini-type fanout provides the transition from ribbon fibers to individual single-fiber connection ports. The mini-fanout has a small transition device where the transition and strain relief takes place. These fanouts are typically mounted on a special bracket in the rear of the *LGX* Termination Shelf and may be used with combination shelves where fiber splices are stored in splice shelves. These fanouts are available with *SC*, *ST*, or *LC*, connectors. Fanouts are available with an unconnectorized pigtail length of 72 inches (1829mm) and with individually buffered fiber lengths of 24 inches (610 mm).



Mini-Fanout Product Code	Fiber Type (microns)	Connector
108905647	62.5	<i>ST</i> <sup>®</sup>
107 939 910	8.3	<i>ST</i>
107 810 541	8.3	<i>SC</i>
107 977 019	62.5	<i>LC</i>
108 518 754	8.3	<i>LC</i>
109 030 445	8.3	Angled <i>SC</i>
108 370 065	62.5	<i>SC</i>

## Optical Splitter Modules

---

Passive Optical Component Modules provide a means for inserting passive optical couplers into an LGX Fiber Optic Shelf. An Optical Splitter Module contains high-quality single-mode splitters suitable for use at both the 1310 nm and 1550 nm operating wavelength windows. A module may house one or more components to achieve the desired number of output ports. Each port is terminated on the front of the module on an SC connector and plugged into an SC adapter or Universal Buildout Block. The modules operate in the 1260 nm-to-1360 nm and in the 1430 nm-to-1580 nm passbands.

The optical splitter modules are available in a variety of split ratios. Optical input and multiple output ports are mounted on faceplates similar to 1000-type connector panels. The module actually plugs into the same position on the LST1U-072/7 Fiber Termination Shelf as a 1000-type connector panel.

Splitter modules with up to six optical ports (for example, 1x5 splitter) have a “single width” faceplate and fill one connector panel position on the termination shelf. Splitter modules with up to 12 optical ports are “double-width” and fill two connector panel positions on the termination shelf. Splitter modules having more than 12 optical ports are “triple-width” and fill three connector panel positions on the termination shelf.

Each Optical Splitter Module is supplied with a label to clearly identify input and output ports. Modules with output ports delivering unequal powers (unbalanced splits) are also labeled with the appropriate percentage of input power delivered at each output port.



### SC Optical Splitter Modules

A series of Optical Splitter Modules is available with C6000A-4 SC Single-Mode Adapters. The 1x2 and 1x3 Optical Splitter Modules are available in a variety of

split ratios most commonly used in broadband networks. Other splitter modules including 1x4, 1x5, 1x6, 1x8, and 1x16 are available in balanced splits. Other less common custom splits may also be constructed by concatenating one or more of these Optical Splitter Modules.

<b>Optical Splitter Module</b>	<b>Comcode</b>	<b>Description</b>
LSVFA1-CSX3B-102AABX	107 575 946	1 x 2 Splitter Module, 50/50 split ratio
LSVFA1-CSX3B-102AAUA	107 575 953	1 x 2 Splitter Module, 45/55 split ratio
LSVFA1-CSX3B-102AAUB	107 575 961	1 x 2 Splitter Module, 40/60 split ratio
LSVFA1-CSX3B-102AAUC	107 575 987	1 x 2 Splitter Module, 35/65 split ratio
LSVFA1-CSX3B-102AAUD	107 575 985	1 x 2 Splitter Module, 30/70 split ratio
LSVFA1-CSX3B-102AAUE	107 576 001	1 x 2 Splitter Module, 25/75 split ratio
LSVFA1-CSX3B-102AAUF	107 576 019	1 x 2 Splitter Module, 20/80 split ratio
LSVFA1-CSX3B-102AAUG	107 576 027	1 x 2 Splitter Module, 15/85 split ratio
LSVFA1-CSX3B-102AAUH	107 576 035	1 x 2 Splitter Module, 10/90 split ratio
LSVFA1-CSX3B-102AAUJ	107 576 043	1 x 2 Splitter Module, 5/95 split ratio
LSVFA1-CSX3B-103AABX	107 576 050	1 x 3 Splitter Module, balanced split ratio
LSVFA1-CSX3B-103AAUA	107 576 068	1 x 3 Splitter Module, 20/40/40 split ratio
LSVFA1-CSX3B-103AAUB	107 576 076	1 x 3 Splitter Module, 30/35/35 split ratio
LSVFA1-CSX3B-103AAUC	107 576 084	1 x 3 Splitter Module, 40/30/30 split ratio
LSVFA1-CSX3B-103AAUD	107 576 092	1 x 3 Splitter Module, 50/25/25 split ratio
LSVFA1-CSX3B-103AAUE	107 576 100	1 x 3 Splitter Module, 60/20/20 split ratio
LSVFA1-CSX3B-104AABX	107 576 118	1 x 4 Splitter Module, balanced split ratio

### Universal Optical Splitter Modules

A series of Optical Splitter Modules is available with A3003 Single-Mode Universal Buildout (UBO) Blocks. This configuration allows the user to separately order Universal Buildouts to match the connector application and simply snap them into place in the field. The Universal Buildout Block will accept Universal SC Buildouts (A3060), Universal *ST* Buildouts (A3070), and Universal FC Buildouts (A3080). The 1x2 and 1x3 Optical Splitter Modules are available in a variety of split ratios most commonly used in broadband networks. Other splitter modules including 1x4, 1x5, 1x6, 1x8, and 1x16 are available in balanced splits. Other less common custom splits may also be constructed by concatenating one or more of the Optical Splitter Modules.

Optical Splitter Module	Comcode	Description
LSVFA1-CUX3B-102AABX	107 288 417	1 x 2 Splitter Module, 50/50 split ratio
LSVFA1-CUX3B-102AAUA	107 288 425	1 x 2 Splitter Module, 45/55 split ratio
LSVFA1-CUX3B-102AAUB	107 288 433	1 x 2 Splitter Module, 40/60 split ratio
LSVFA1-CUX3B-102AAUC	107 288 441	1 x 2 Splitter Module, 35/65 split ratio
LSVFA1-CUX3B-102AAUD	107 288 458	1 x 2 Splitter Module, 30/70 split ratio
LSVFA1-CUX3B-102AAUE	107 288 466	1 x 2 Splitter Module, 25/75 split ratio
LSVFA1-CUX3B-102AAUF	107 288 474	1 x 2 Splitter Module, 20/80 split ratio
LSVFA1-CUX3B-102AAUH	107 288 490	1 x 2 Splitter Module, 10/90 split ratio
LSVFA1-CUX3B-102AAUJ	107 288 508	1 x 2 Splitter Module, 5/95 split ratio
LSVFA1-CUX3B-103AABX	107 288 516	1 x 3 Splitter Module, balanced split ratio
LSVFA1-CUX3B-103AAUA	107 288 524	1 x 3 Splitter Module, 20/40/40 split ratio
LSVFA1-CUX3B-103AAUB	107 288 532	1 x 3 Splitter Module, 30/35/35 split ratio
LSVFA1-CUX3B-103AAUC	107 288 540	1 x 3 Splitter Module, 40/30/30 split ratio
LSVFA1-CUX3B-104AABX	107 288 573	1 x 4 Splitter Module, balanced split ratio

**Note: Remember to order the appropriate Universal SC Buildout (A3060), Universal ST Buildout (A3070), or Universal FC Buildout (A3080) separately for each connector port.**



**Terminator Plugs for Passive Component Modules**

Terminators are used to plug into a spare output coupler to prevent the loss of power from the spare port.

Comcode	Description
107 796 864	Terminator, <i>SC-T</i>
108 853 336	Terminator, <i>LC-T</i>

**Buildouts for Passive Component Modules**

Snap-on buildouts are available and ordered separately with the Optical Splitter Modules equipped with Universal Buildout Blocks.

Optical Splitter Accessory	Comcode	Description
A3060 <i>SC</i> Buildout	106 708 951	SC 0-dB Buildout for use with Splitter Modules having Universal Buildout Blocks
A3070 <i>ST</i> ® Buildout	106 795 354	<i>ST</i> 0-dB Buildout for use with Splitter Modules having Universal Buildout Blocks
A3080 <i>FC</i> Buildout	106 795 404	FC 0-dB Buildout for use with Splitter Modules having Universal Buildout Blocks

### Optical Splitter Module Performance Specification

The Optical Splitter Modules have the following performance specification.

Optical Splitter Module	Parameter	Specification
Singlemode 1x2 Wavelength Independent Optical Couplers	Operating Wavelength Window	1310 nm and 1550 nm
	Bandpass	1260 to 1360 nm and 1480 to 1580 nm
	Operating Temperature Range	-40 to +85 °C
	Coupling Ratios	5 percent to 50 percent
	Maximum Insertion Loss* for both Passbands	3.9 dB
	Maximum Uniformity for both Passbands	0.5 dB
	Maximum Directivity/Return Loss	50 dB
Singlemode 1xN Wavelength Independent Optical Couplers	Operating Wavelength Window	1310 nm and 1550 nm
	Bandpass	1260 to 1360 nm and 1480 to 1580 nm
	Operating Temperature Range	-40 to +85 °C
	Coupling Ratios	Balanced
	Configuration	1x2, 1x3, 1x4, 1x5, 1X6
	Maximum Insertion Loss* for both Passbands**	3.9, 5.9, 7.3, 8.4, 9.3 dB
	Maximum Uniformity for both Passbands	0.5, 0.8, 1.0, 1.1, 1.3
Maximum Directivity/Return Loss	50 dB	

The values stated are for the maximum insertion loss of the coupler. The module insertion loss is determined by adding two connector insertions at a typical loss of 0.2 dB each.

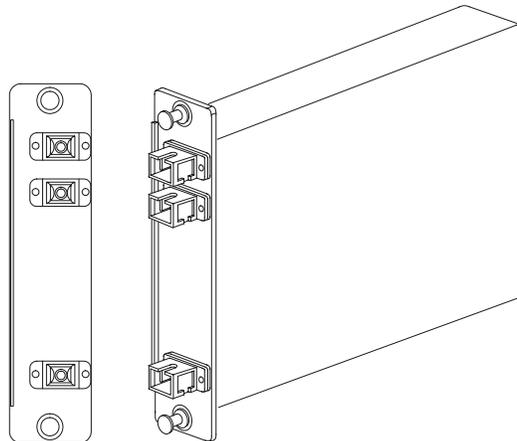
Φ \*\* Maximum Values based upon Balanced coupler ratios.

## Wavelength Division Multiplexer Modules

The Wavelength Division Multiplexer (WDM) modules contain passive optic components used to combine (multiplex) and separate (demultiplex) signals of a different wavelength onto the same fiber. The WDM module is typically used at both ends of a transmission link in simplistic wavelength multiplexing applications. At one end the WDM combines the signals of different wavelengths and at the other end the WDM separates the two signals onto separate fibers. In a typical application, the WDM module can be used to couple/decouple signals of 1310 nm and 1550 nm onto a single fiber.

The WDM modules are available in a variety of return loss performance values. Optical input and multiple output ports are mounted on faceplates similar to 1000-type connector panels. The module actually plugs into the same position on the LST1U-072/7 Fiber Termination Shelf as a 1000-type connector panel.

WDM modules are available with a single device in a module or with two (dual) devices in a module. The dual module is usually selected for applications where the transmit and receive signals are both multiplexed.



Optical Splitter Module	Comcode	Description
LWVFA1-CSXAB-102AA15	107 502 742	WDM Module, SC Adapter, 15-dB Isolation
LWVFA1-CSXAB-102AB25	107 502 775	WDM Module, SC Adapter, 25-dB Isolation
LWVFA1-CSXAB-102AC55	107 502 783	WDM Module, SC Adapter, 55-dB Isolation
LWVFB1-CSXAB-102AA15	107 502 791	Dual WDM Module, SC Adapter, 15-dB Isolation
LWVFB1-CSXAB-102AB25	107 502 809	Dual WDM Module, SC Adapter, 25-dB Isolation
LWVFB1-CSXAB-	107 502 817	Dual WDM Module, SC Adapter, 55-dB Isolation

102AC55		Isolation
---------	--	-----------

**WDM Module Performance Specification**

**The WDM Modules have the following performance specification.**

<b>WDM Parameter</b>	<b>Specification</b>		
Operating Wavelength Window	1310 nm and 1550 nm		
Bandpass	1290 to 1310 nm and 1550 to 1570 nm		
Operating Temperature Range	-40 to +85 °C		
Maximum Directivity/Return Loss	50 dB		
Grade Performance	Low Isolation	Medium Isolation	High Isolation
Isolation (dB)	15	25	55
Maximum Insertion Loss*	0.5	1.0	1.5

**The values stated are for the maximum insertion loss of the coupler. The module insertion loss is determined by adding two connector insertions at a typical loss of 0.2 dB each.**

## Shelf Accessories

4

### Section Contents

---

The *LGX*<sup>®</sup> Fiber Optic Shelves have numerous other accessories for use in certain applications. The additional accessories for splicing, cable management, labeling, and jumper organization are described in this section.

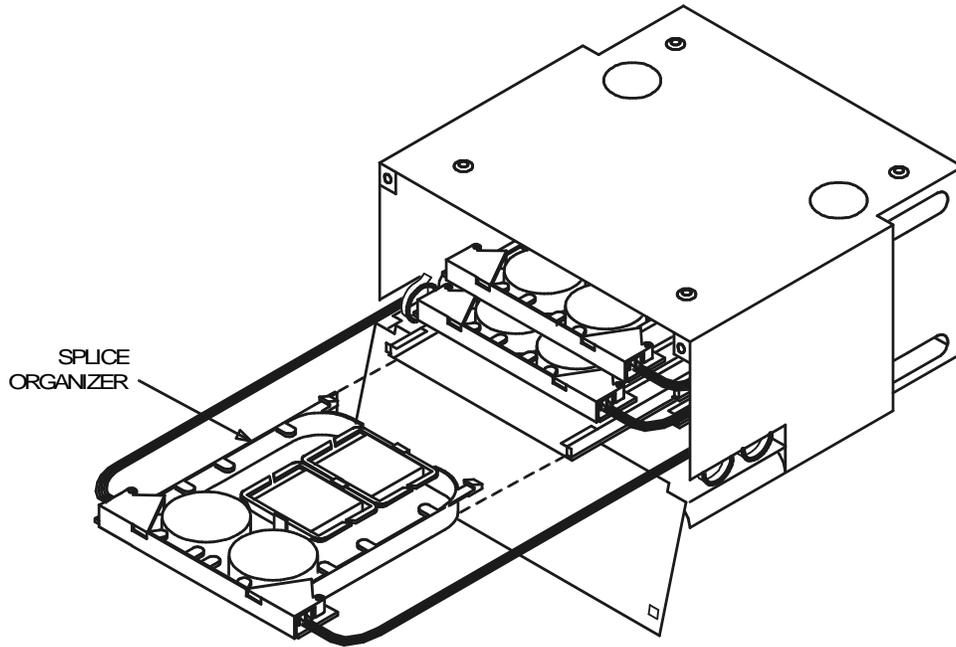
- Splice Organizers 4-2
- Associated Splice Holders 4-6
- Cable Clamps 4-9
- Cable Shields 4-13
- Shelf Security 4-14
- Labels 4-16
- Radius Guides 4-19
- European Telecommunication Standard (ETSI) Brackets 4-20
- Replacement Parts 4-21

### Splice Organizers

---

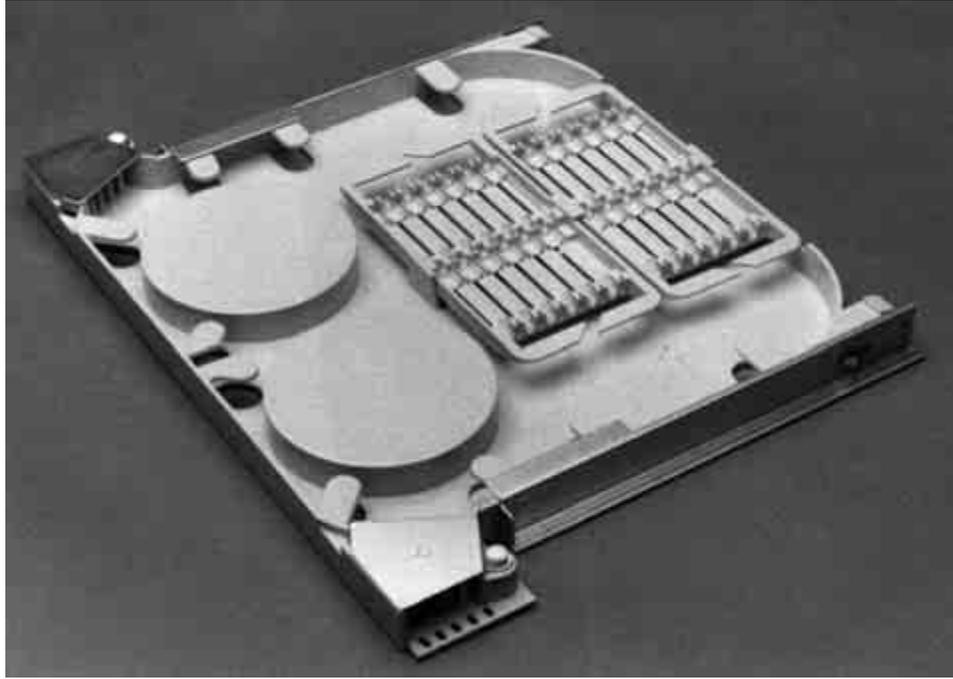
Splice organizers are used for storing fiber optic splices. Splice organizers are compatible with standard splice shelves (LSS1U-072/5 and LSS1U-144/7) and combination shelves (LSC2U-024/5, LSC1U-072/12, and LSC1U-144/21). Splice organizers options are available to store individual mechanical splices, individual fusion splices, and mass fusion splices. Splice organizers are simply installed into the front of the shelf into guides provided with these shelves. All organizers are equipped with telescopic extensions to allow the organizer to slide off the shelf to provide full access to all parts of the plastic tray. The entrance to the splice tray consists of a series of channels where fibers are strain relieved. These channels provide entrance guides to strain relieve most fiber buffer tubes or jackets as they enter the tray. Slack storage drums are located on each side of the tray to store slack coils and maintain a 1.5-inch (38 mm) bend radius. The plastic tray also accommodates slack for pigtailed or unbuffered fiber in the base of the tray beneath the splice holders. Each tray provides two positions for snap-in splice holders used to secure splices in place. The tray is also easily removed from the shelf for off-frame splicing. These

trays may be used in the **LGX Splice Shelves** or in the **Optical Cable Entrance Facility (OCEF)**.



### Mechanical Splice Tray

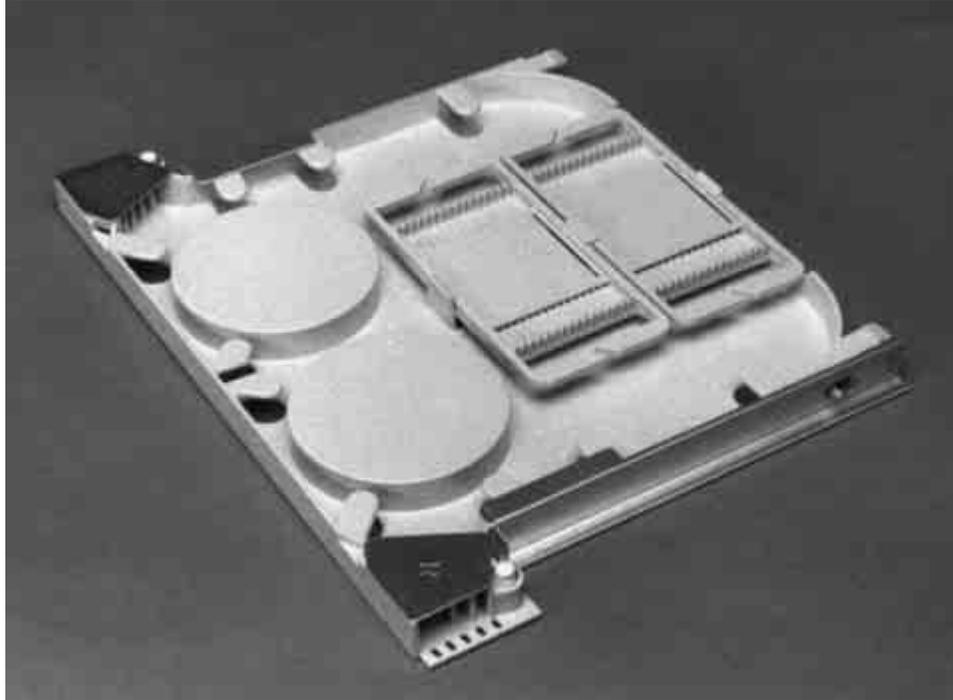
The mechanical splice organizer provides storage for individual mechanical fiber splices. This splice organizer is supplied with two mechanical splice holders. Each splice holder provides storage for 12 individual mechanical splices. Therefore, the total capacity for this organizer is 24 individual fiber splices.



<b>Product Code</b>	<b>Application</b>
LT1A-M/M Splice Organizer 105 339 907	This organizer is typically used to store mechanical splices. Mechanical splices are stored in two mechanical splice holders supplied with each organizer. Each mechanical splice holder can accommodate up to twelve splices.

### Fusion Splice Tray

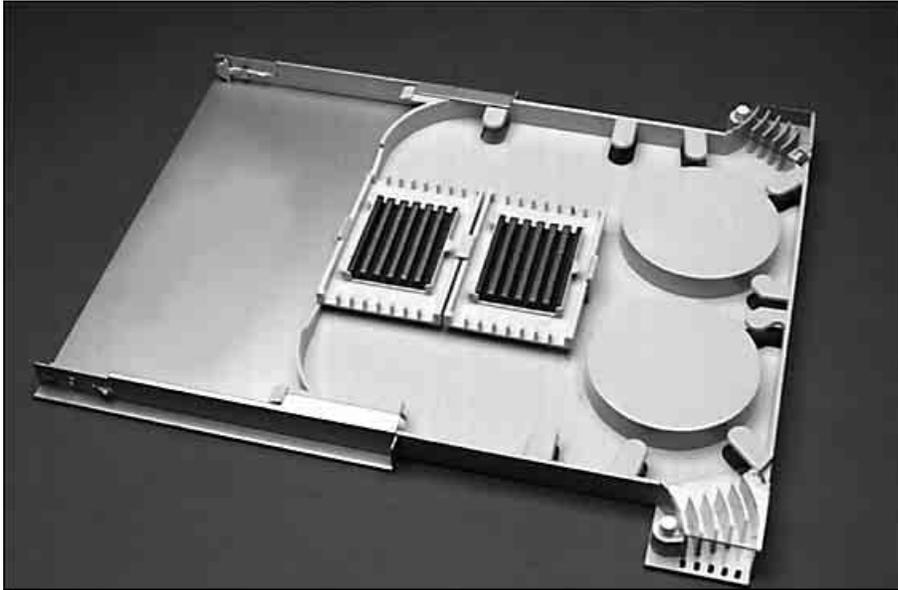
The fusion splice organizer provides storage for individual fusion fiber splices. This splice organizer is supplied with two fusion splice holders. Each splice holder provides storage for 16 individual fusion splice protectors. Therefore, the total capacity for this organizer is 32 fiber splices. However this splice organizer is typically used for a nominal fiber splice count of 24 splices. In this case, the remainders of the splice positions are spare.



Product Code	Application
LT1A-F/F Splice Organizer 105 339 899	This organizer is used to store individual fusion splices. Fusion splices are organized in two fusion splice holders supplied with the organizer. Each fusion splice holder can accommodate up to (16) individual fusion splices for a total capacity of 32 individual splices. The four additional positions in each holder are intended as spares. Fusion splice holders are also equipped with magnetic tape and snap-on covers to secure the splices in place.

### Mass Fusion Splice Tray

The mass fusion splice organizer provides storage for mass fiber splices and organization for fiber slack. These trays may be used in the LGX Splice shelves or in the Optical Cable Entrance Facility (OCEF). The entrance to the splice tray consists of a series of channels where fibers are strain relieved. Each tray is supplied with two mass fusion splice holders. Each mass fusion holder provides storage for six mass fusion splices providing a total capacity of 12 mass fusion splices per tray. An intermediate slide allows the splice tray to be pulled out to access the entire tray. The tray is also easily removed from the shelf for off-frame splicing. A label is provided to easily identify the contents of the tray.



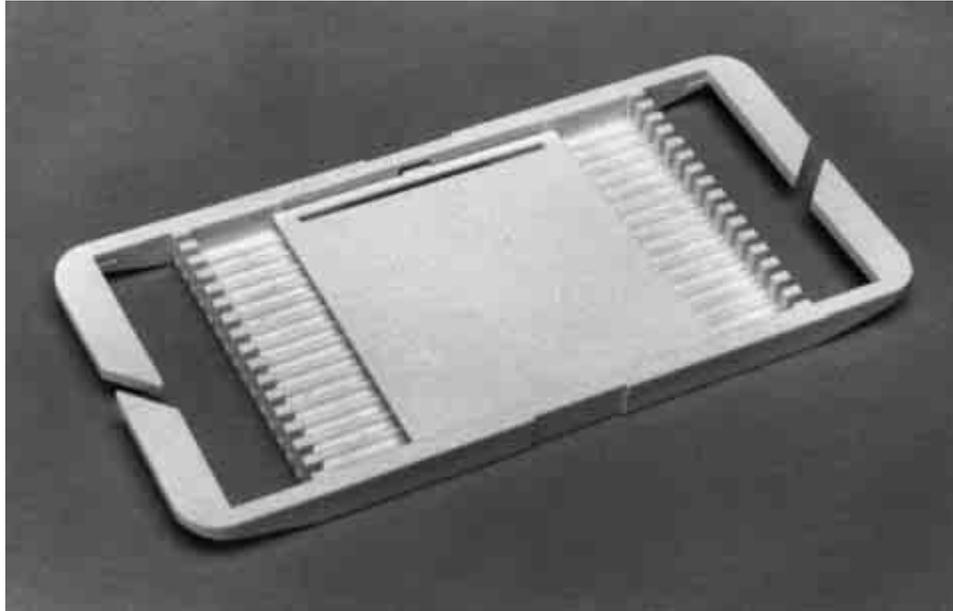
Product Code	Application
LT2A-MF/MF Splice Organizer 108 663 998	This splice organizer is used to store mass fusion splices. Each organizer comes with two mass fusion splice holders. Each mass fusion splice holder provides storage for six mass fusion splices. Up to 12 mass fusion splices can be stored per tray. In most situations these trays will be used for storing 6 to 12 mass fusion splices.

### Associated Splice Holders

Several splice holders are available for use in upgrades, conversions and replacements. These holders are fully compatible with the LT1A-type splice trays and are simply installed in the tray.

### Fusion Splice Holder

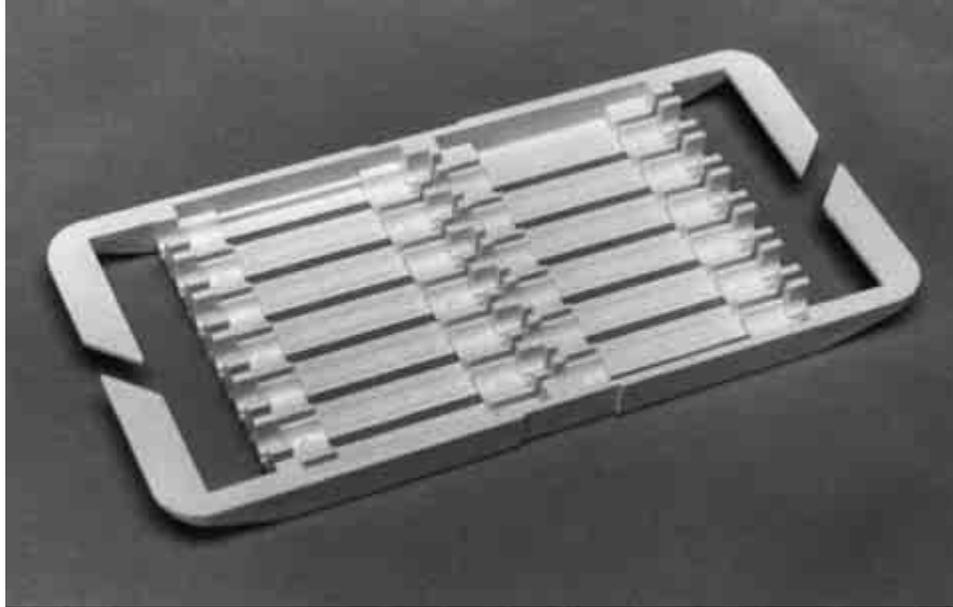
This splice holder is used to store individual fusion splices. The holder is fully compatible with the LT1A-type splice trays and is simply installed in the tray with an integrated snap design in the tray. Each fusion splice holder accommodates up to 16 individual fusion splices. This holder is used to nominally store 12 splices but provides four additional positions in each holder as spares. Fusion splice holders are also equipped with magnetic tape to secure splice protectors containing metallic reinforcement members and snap-on covers to secure dielectric splice protectors. Fibers are organized beneath the retaining bar at both ends of the holder.



<b>Product Code</b>	<b>Application</b>
1AF1-16LG 105 356 562	Individual Fusion Splice Holder – holds up to 16 fusion splices. Qty of ten per package

### Mechanical Splice Holder

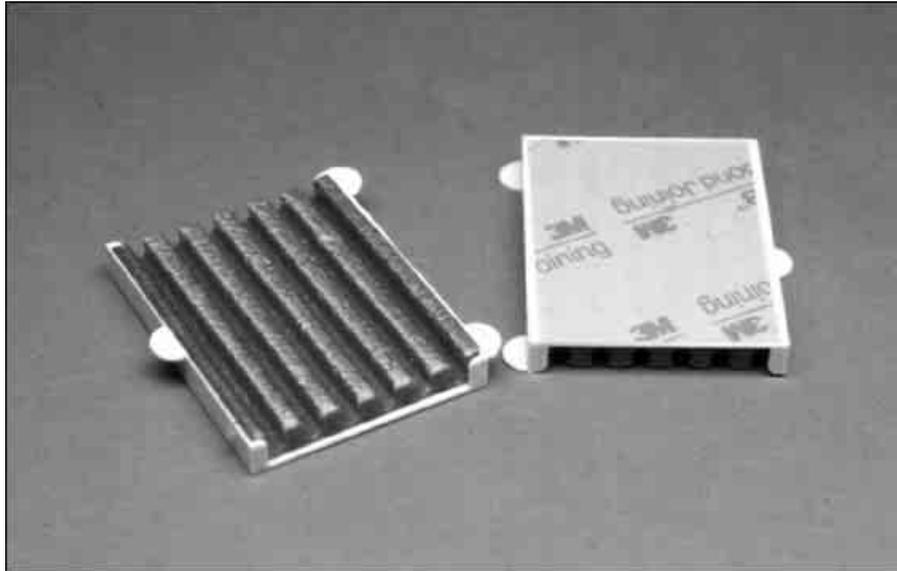
This holder is used to store mechanical splices. The holder is compatible with most all mechanical splices. Each mechanical splice holder accommodates up to 12 splices. Splice holders are designed so that the mechanical splices are retained in place using press-fit retention. Fibers are organized beneath the retaining bar at both ends of the holder.



<b>Product Code</b>	<b>Application</b>
1AM1-12LG 105 356 570	Mechanical Splice Holder holds 12 mechanical splices. Qty of ten per package

### Mass Fusion Splice Holder

This splice holder is used to store mass fusion splices. Each holder provides storage six mass fusion splices. Each splice holder is supplied pre-equipped with adhesive-backed tape. The holder may be affixed in place by simply removing the adhesive-backed tape cover and positioning the holder in place. One common use is to apply the holder in the base of the LT1A-type splice tray as an alternative if a mass fusion splice tray (LT1A-MF/MF) is not available. The adhesive backed tape allows the holder to be flexibly installed in any convenient position. In typical situations these holders will be used two to a tray for storing a total of 6 to 12 mass fusion splices in the tray.



Product Code	Application
Mass Fusion Holder 109116046	Mass-Fusion Splice Holder holds six mass fusion splices. Qty of 12 per package

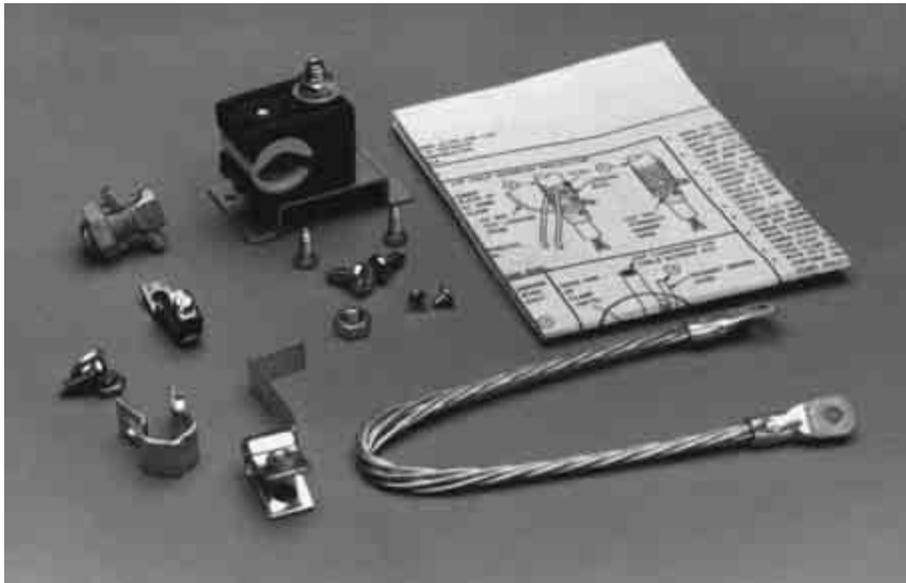
## Cable Clamps

### 12A-Type Cable Clamps

Three types of 12A cable clamps are available: 12A1, 12A2 and 12A3L. The 12A1 clamp is used with metallic sheath cables that require grounding. The 12A2 clamp is used with nonmetallic sheath cables that do not require grounding. The 12A3L clamp is similar to the other 12A clamps except it accommodates larger cable diameters .25inch (6.25 mm) to 1.50 inch (38.1 mm). The same clamps are used with the Optical Cable Entrance Facility (OCEF) splice cabinet.

#### 12A1 Cable Clamp

This clamp provides all the materials for clamping one metallic sheath Outside Plant (OSP) cable to the side of the shelf. A typical outside plant cable is secured between the 12A1 clamp halves using two V-groove inserts to grip the cable. The V-groove inserts accommodate a wide range of cables ranging from 0.4 inch (10 mm) to 1.0 inch (25.4 mm) in diameter. Preconnectorized cable equipped with sheath termination hardware is clamped with a standard 0.75 inch (19 mm) insert and B bond clamp inserted into the clamp. Grounding hardware is also provided to connect the metallic strength members to an approved ground terminal. The clamp easily attaches to the brackets supplied with the LGX Fiber Optic Shelves.



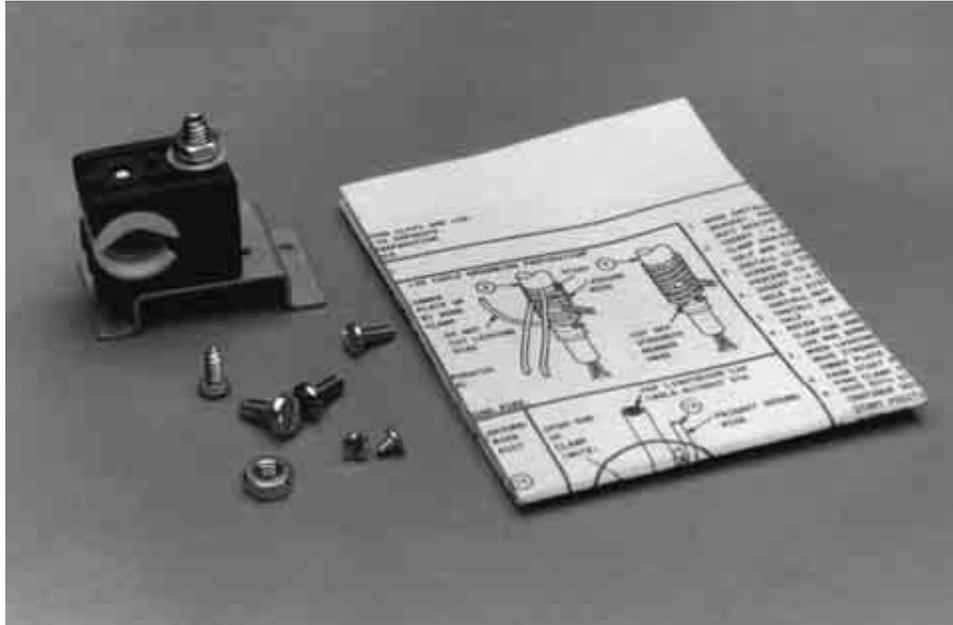
Product Code	Application
12A1 Clamp 104 384 490	12A1 Cable Clamp secures one metallic cable sheath to the side of the Fiber Optic Shelf.

#### 12A2 Cable Clamp

This clamp provides all the materials for clamping one nonmetallic sheath OSP cable to the side of the shelf. A typical outside plant cable is secured

between the 12A1 clamp halves using two V-groove inserts to grip the cable. The V-groove inserts accommodate a wide range of cables ranging from 0.4 inch (10 mm) to 1.0 inch (25.4 mm) in diameter. The 12A2 clamp is similar to the 12A1 clamp except no ground hardware is provided. If required, the 12A2 clamp can be used to secure cables with metallic members by supplying the D-182212 Kit.

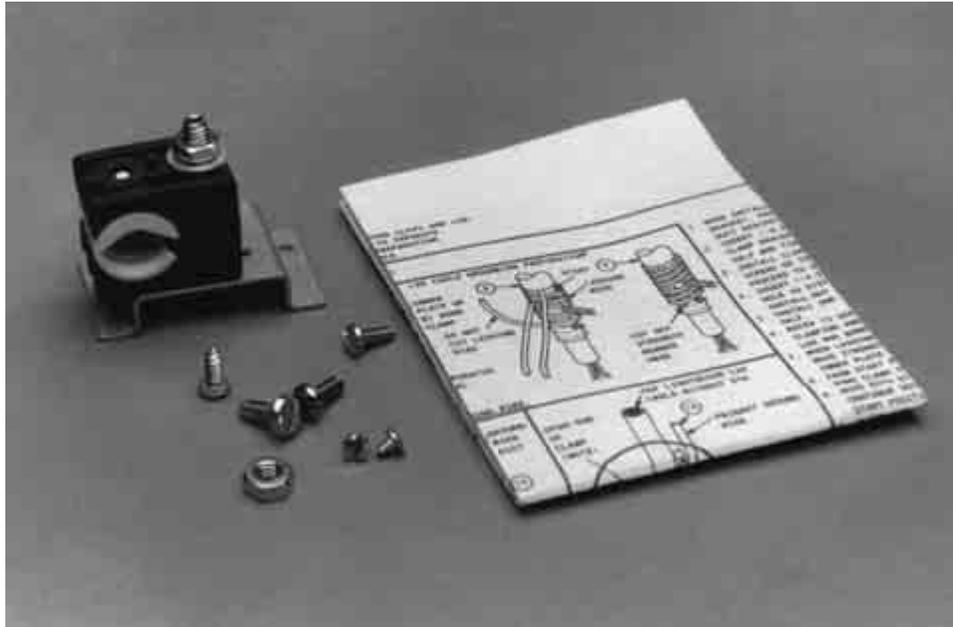
The clamp easily attaches to the brackets supplied with the LGX Fiber Optic Shelves.



Product Code	Application
12A2 Clamp 106 230 337	12A2 Cable Clamp secures one nonmetallic cable to the side of the Fiber Optic Shelf.

**12A3L1 Cable Clamp**

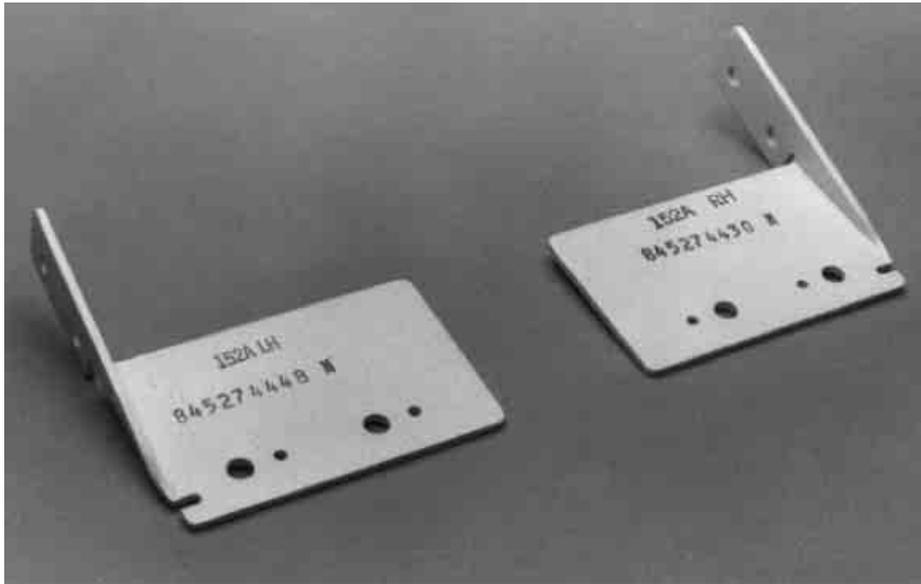
This clamp provides all the materials for clamping one metallic sheath Outside Plant (OSP) cable to the side of the shelf. A typical outside plant cable is secured between the 12A3L clamp halves using V-groove grips. The V-groove accommodates a wide range of cables ranging from 0.25 inch (6.3 mm) to 1.50 inch (38.1 mm) in diameter. Grounding hardware is also provided to connect the metallic strength members to an approved ground terminal. The clamp easily attaches to the brackets supplied with the LGX Fiber Optic Shelves.



Product Code	Application
12A3L Clamp 108 527 433	12A3L Cable Clamp secures one nonmetallic cable to the side of the Fiber Optic Shelf.

### Optional 152A Cable Bracket

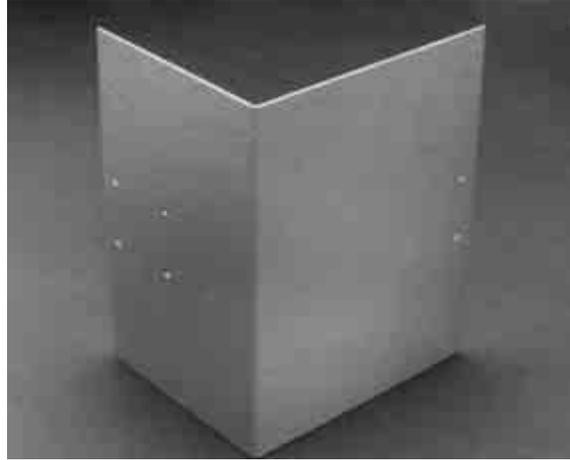
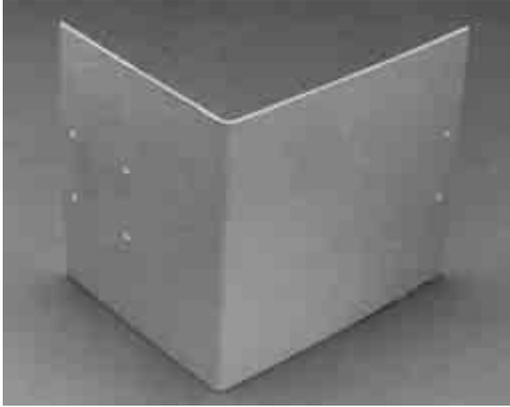
The 152A cable bracket provides an optional means of securing outside plant cables entering fiber optic shelves. Brackets can be installed above or below the shelf to allow top or bottom entry. The brackets mount directly to the upright of the 23-inch Network Bay Frame. The 152A code actually consists of a left-hand bracket and a right-hand bracket. The 152A brackets are typically only used in bottom entry situations since the brackets supplied with the LGX Fiber Optic Shelves provide a secure means of attaching top entry cables. Each bracket can accommodate up to two cables. The 152A bracket utilizes 12A-type cable clamps for securing the cable. The 12A-type cable clamps are ordered separately.



Product Code	Application
152A Bracket Set 106 192 602	152A Bracket – Optional bracket set (left and right) for securing cable to the rear of the Network Bay Frame. Typically only used in bottom entry applications.

### Cable Shields

The 81A and 82A shields are optional shields available to protect the cable sheath termination on the side of the shelves. The shields are usually ordered when the shelves are used in stand-alone applications without the LGX frame rear duct or rear duct doors. The shields can be used to protect cables entering the front or rear of the shelf. Shields are usually not required in LGX frame applications where the cables are organized and protected within the rear duct.



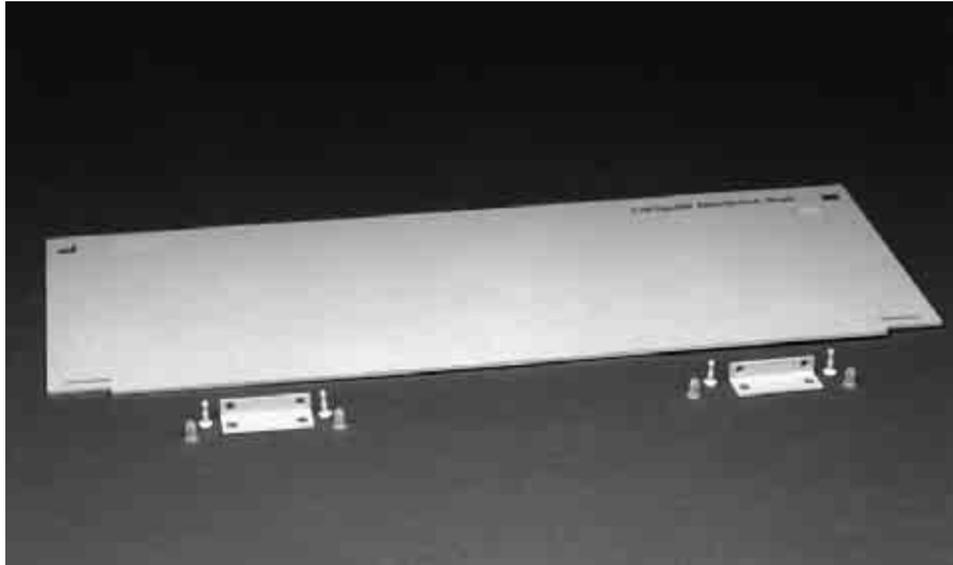
Product Code	Application
81A Shield 104 436 894	The 81A shield contains two shields which are 5 inches (127 mm) high and are used to protect cables terminated on the sides of any 5-inch (127 mm) high shelf. Qty two per package
82A Shield 104 436 902	The 82A shield contains) two 7 inch (178 mm) high shields which are used to protect cables terminated on the sides of any 7-inch (178 mm) high shelf. Qty two per package

## Shelf Security

Each Termination Shelf, Preterminated Shelf or Splice Shelf, comes equipped with removable hinged front and rear doors for protection of fiber connectors and splices. The hinged doors are easy to open and remove from the shelf when desired. The termination shelf front door is constructed of transparent plastic. The transparent front door allows visible inspection into the shelf without opening the door. Labels identifying terminations are protected behind the plastic door but remain legible for quickly locating connectors. The front door of the 5-inch shelf is constructed from opaque plastic. All rear shelf doors are also constructed from opaque plastic. The rear plastic doors have knockouts for standard key locks. If additional security is desired, it can easily be provided by equipping the front of a 7-inch shelf or 5-inch shelf with metal doors and installing LGX key locks on the front and back.

### Metal Doors

If security is required on a 9-inch (229 mm) shelf, 7-inch (178 mm) shelf or a 5-inch (127 mm) shelf, optional metal doors are available to accept key cam-locks. These doors allow the user to replace the front transparent plastic door. The doors come with two lock engagement brackets. One bracket is used with the front metal door; the other with the shelf rear door. This allows both the front and rear of the shelf to be secured using two cam-locks, one per door.



Product Code	Application
9A Door 109 030 886	9-inch Front Metal Door – locking security for front of any 9-inch shelf.
11A Door 104 436 878	7-inch Front Metal Door – locking security for front of any 7-inch shelf.
5-in Metal Door 107 501 595	5-inch Front Metal Door – locking security for front of any 5-inch shelf.

### Lock Kits

Lock kits are available for locking the front and back doors on any of the shelves. A kit contains a pair of locks equipped with keys for locking the front and rear doors. All *LGX* Shelf Locking Kit cam-locks are keyed alike. A pair of engagement brackets is also included for mounting to the shelf in order to secure the lock.



Product Code	Application
LGX Shelf Locking Kit 106 386 857	Lock kits are available for locking the front and back doors on any of the shelves. A kit contains a pair of locks equipped with keys for locking the front and rear doors. All <i>LGX</i> Shelf Lock Kits have cam-locks and are keyed alike. A pair of 145A Lock Brackets is also included for mounting to the shelf in order to secure the lock.
145A Lock Bracket 104 436 852	The 145A bracket provides lock engagement brackets for locking shelves with metal doors. The 145A bracket contains two engagement brackets for securing both the front and rear doors of a shelf. These brackets are required if the users provide their own lock other than the <i>LGX</i> Shelf Locking Kit.

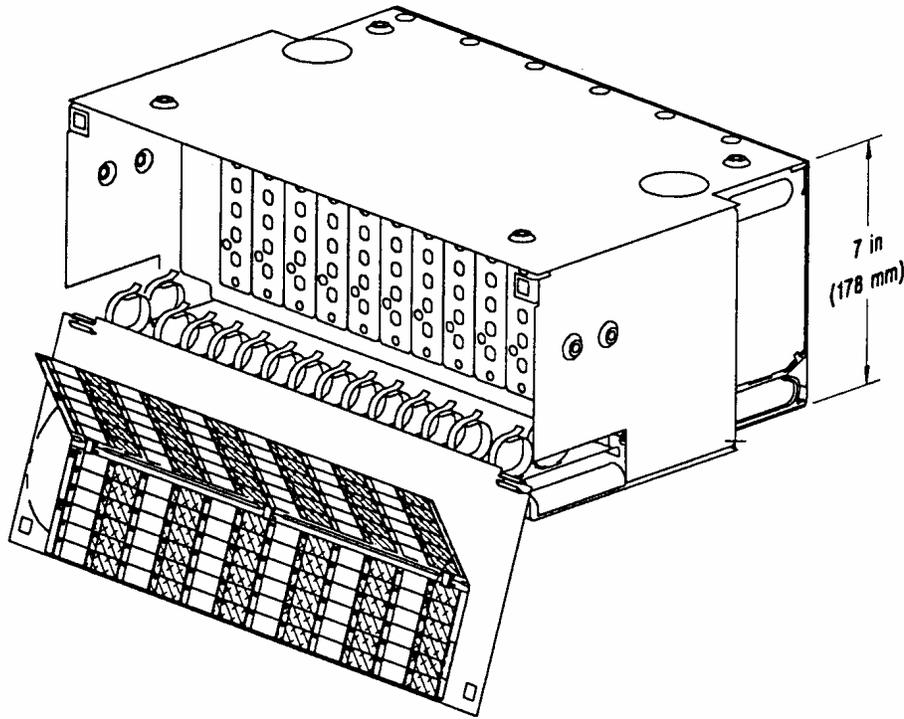
## Labels

---

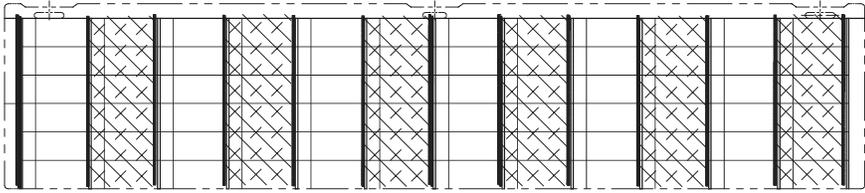
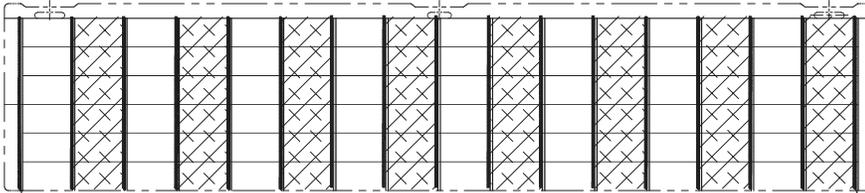
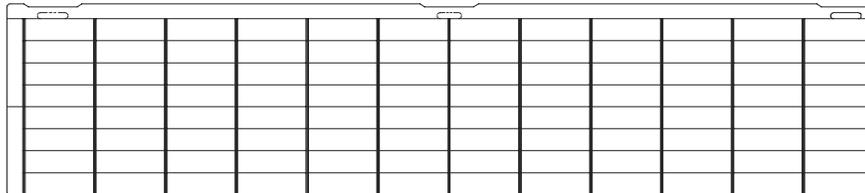
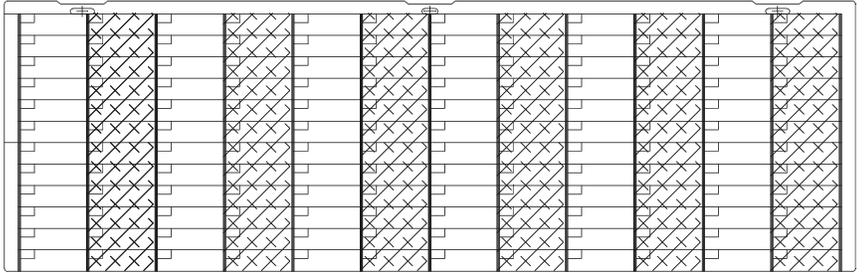
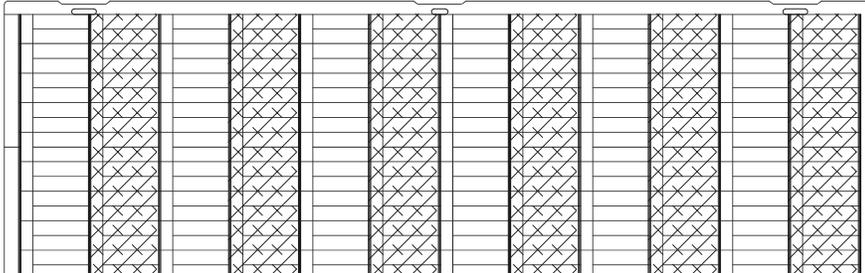
Labels are provided as a standard item with the *LGX* shelves and jumper retainers. Optional labels are provided for additional fiber termination and circuit identification. Termination shelf labels are mounted on the termination shelf. Jumper circuit labels are mounted on the frame jumper retainers.

### Hinged Shelf Label

All fiber termination shelves are supplied with hinged shelf labels that provide identification space for fiber terminations. The shelf label is supplied with each shelf as part of the front transparent door. The hinged label is attached to the front door and is legible when the shelf is open or closed. The shelf label provides more writing space and can easily be removed for stenciling or printing designations. This hinged label is also offered as a replacement part, and can be retrofitted onto any existing *LGX* shelf in service.

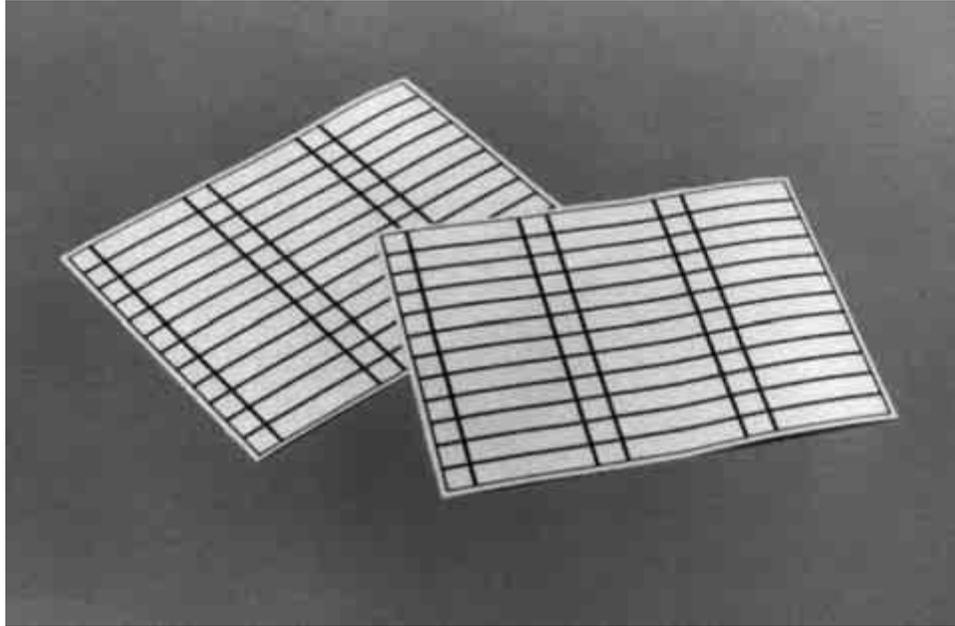


Several hinged label options are available as shown in the figure below.

<p>12S1-72 Label 106 718 851 Label numbered 1 through 72 (on front and back) for use on standard fiber termination shelf.</p>	
<p>12S1-96 Label 106 718 869 Label numbered 1 through 96 (on front and back) for use on standard fiber termination shelf.</p>	
<p>12S1-8x12 Label 106 972 334 Label for use with 1000SC1-8 (8-pack) Connector Panels.</p>	
<p>12S-144 Label 108 056 946 Label numbered 1 through 144 for use in high-density shelves.</p>	
<p>12S-216 Label 108 056 938 Label numbered 1 through 216 for use in high-density shelves.</p>	

### Jumper Retainer Labels

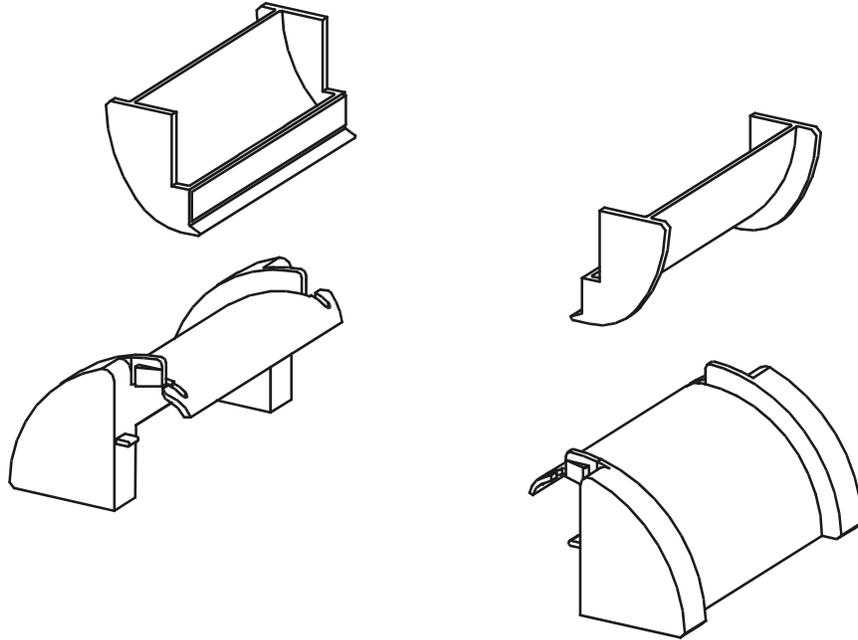
The optional 11A labels are used to identify circuit or system information for jumper cables. The 11A labels are placed on the jumper retainers adjacent to each shelf. The 11A labels are preformatted and unnumbered with 36 entry positions on each label. The retainer labels are stenciled in the field per local practice. These labels are shown in the figure below.



Product Code	Application
11A Label 104 436 084	11A Jumper Retainer Label provides pack of 12 unformatted labels for use in identifying fiber circuits on jumper retainers adjacent to Fiber Optic Shelves.

## Radius Guides

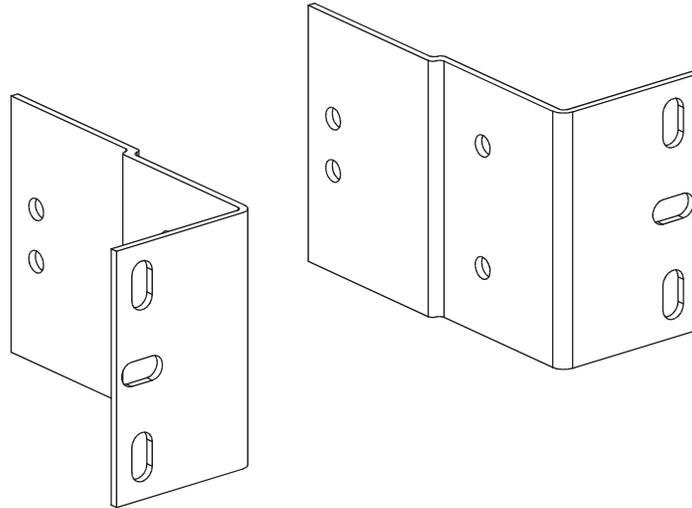
A radius guide kit is available for use in standard termination shelves (LST1U-072/7) and high-density termination shelves (LST1U-144//9). This kit supplies plastic molded details that may be attached to the standard shelves to guide jumpers exiting the shelf while maintaining a radius of 1.5 inches (38 mm). This kit is used for upgrading in place older shelves not equipped with the 1.5-radius guides. These radius guides are supplied with all newer shelves and therefore are only needed on older shelves.



Product Code	Application
Bend Limiters 107 330 565	Provides bend limiters for termination shelf to maintain minimum bend radius of 1.5 inches (38 mm). Contains sets of upper and lower bend limiters. These bend limiters are only for retrofit of older shelves or for replacement on new shelves. New shelves are provided with two upper and two lower bend limiters. Qty package of five sets

## ETSI Brackets

The standard brackets provided with the *LGX* Fiber Optic Shelves provide for mounting in 23-inch frames, 19-inch frames, and for direct wall mounting. Adapter brackets are required in order to mount the standard *LGX* Fiber Optic Shelves in European Telecommunication International Standard (ETSI) racks. These brackets allow the installer to replace the brackets supplied with the shelf with a bracket set exactly matched to the horizontal and vertical dimensions required on an ETSI frame or rack. The same set of brackets will allow either the 7-inch shelf or the 5-inch shelf to be mounted to the ETSI rack.



Product Code	Application
ETSI Brackets 107 648 271	ETSI Mounting Bracket – set of two (left and right) mounting brackets for mounting standard 5-inch or 7-inch high <i>LGX</i> Fiber Optic Shelves to ETSI standard frames and racks.

## Replacement Parts

Several plastic components are used on the *LGX* Fiber Optic Shelves. Under normal circumstances these components should provide useful service over the life of the equipment. In special circumstances, should one of these plastic rings or fasteners become damaged or lost, replacement parts are available. Replacement parts are available for the fiber retainer rings and for the *Nylatch*\* fasteners used to hold panels in place.

Product Code	Application
107 679 680	Low Profile Jumper Retainer Rings used for replacing lost or damaged rings on the front of the Fiber Optic Shelves utilizing the larger oval shaped low profile ring system.  55 per package
106 472 194	Single Fiber Ring used for replacing lost or damaged rings on the front of older Fiber Optic Shelves that used the smaller round fiber rings.  25 per package
107 889 446	<i>Nylatch</i> * Plungers and Grommets used to replace broken or lost push-pull <i>Nylatch</i> fasteners that secure connector panels to the bulkhead.  1,000 per package
106 013 204	Plastic Front Door – Front Door for 7-inch Shelf used on the LST1U-072/7 shelves or the LST1F-072/7 shelves as a replacement for front doors that may have been damaged or lost. Supplied without label.

Registered trademark of Hartwell corporation.

## FDF Equipment

5

### Section Contents

---

The LGX<sup>®</sup> Fiber Distributing Frame (FDF) consists of frames, hardware, and other equipment assembled together to form a complete system for cable and jumper management. This section describes all of the LGX Fiber Distributing Frame equipment components.

- *LGX* FDF Description 5-2
- Pre-assembled *LGX* Frames 5-6
- Network Bay Frames 5-9
- *LGX* Frame Groups (Kits) 5-13
- Broadband Bays (Kits) 5-18
- Rear Doors 5-22
- End Guards 5-23
- Jumper Retainers 5-26
- Horizontal Raceways 5-29
- Cable Brackets and Retainers 5-30
- Floor Mounting Hardware 5-31
- Filler Panel 5-32
- Cross-Aisle Bridge 5-33

### LGX FDF System Description

---

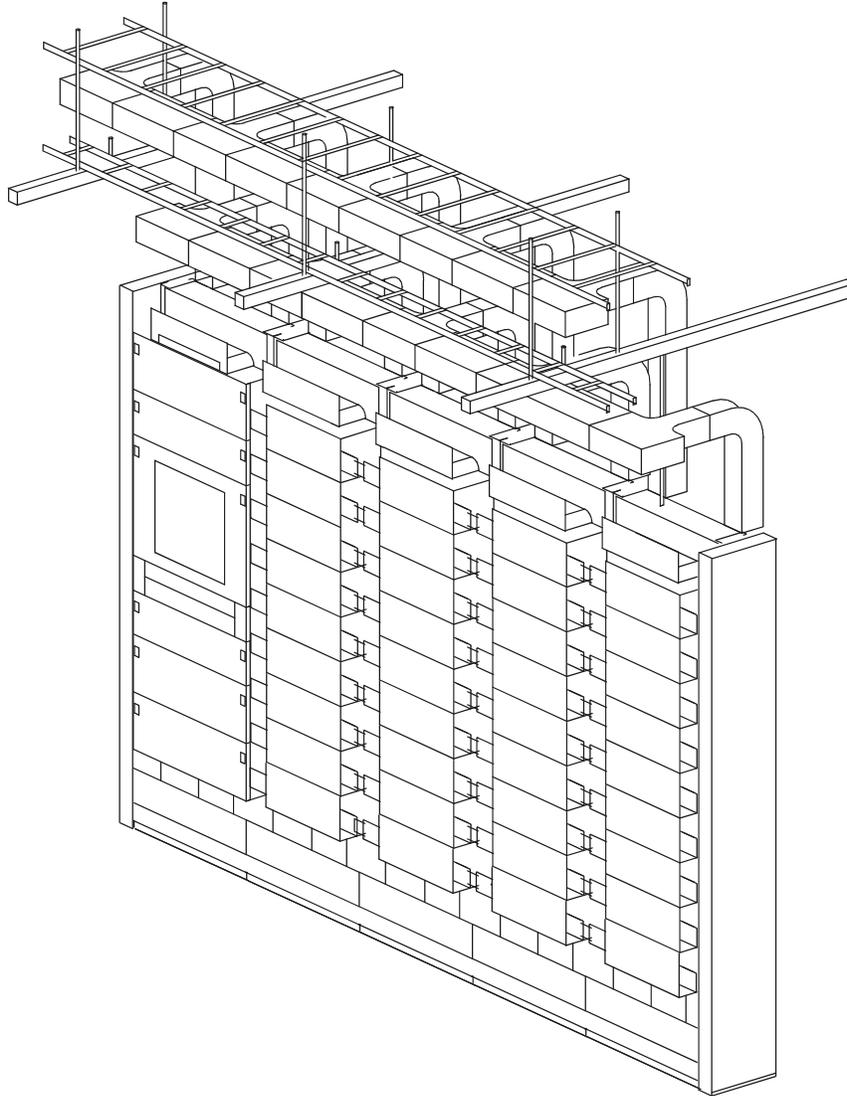
The LGX<sup>®</sup> Fiber Distributing Frame (FDF) offers significant advantages over other Fiber Distributing Frames. The LGX FDF has superior cable and jumper management and can serve the fiber distribution needs of most any application. In addition, the FDF can be customized with special hardware features to meet the user's desired configuration.

The LGX FDF dedicates entire bays for terminating, splicing, and cross-connecting fiber cables. It can be installed as a single bay or in a lineup of multiple bays. The Network Bay Frame or Seismic Network Bay Frame is utilized as the FDF backbone. LGX Fiber Optic Shelves used for splicing and terminating cables are mounted in the frame. The modular shelf concept allows various shelf and fiber connecting apparatus to be installed to optimize frame space. Modular

shelves are added to the bay as required for fiber terminations. As a bay becomes full, another bay is added to form a continuous frame lineup, with front facing connector access. Specifying the following components configures the LGX Fiber Distributing Frame:

- **LGX Frame** — The **LGX** frame consists of specially designed hardware components affixed to a rigid bay frame. The Network Bay Frame (NBF) or the Seismic Network Bay Frame (SNBF) forms the essential structural component of an **LGX** Frame. The **LGX** Frame assembly design is optimized to receive Fiber Optic Shelves and Fiber Optic Cables. The **LGX** frame includes a rear duct used to enclose and protect fiber cables and the front jumper troughs and raceways used to organize fiber jumpers. The **LGX** frame may be ordered in several different ways including 1) preassembled, 2) as a group, and 3) as individual kits. A preassembled frame provides a completely assembled frame on a pallet thus allowing rapid field installation. Alternatively, when ordered as a single group, or as multiple kits, the **LGX** frame is assembled in the field from kits. If ordered as kits, the LGX frame parts and Network Bay Frame are ordered separately.
- **LGX Duct Doors** — One set of duct doors is recommended for each bay to fully enclose the rear of the frame, thus enclosing all fiber cables.
- **LGX End Guard** — One end guard is recommended for each end of the frame lineup to protect equipment and eliminate any possible safety hazard.
- **Maintenance Equipment** — An FDF lineup may be equipped with maintenance equipment such as communications panels and test equipment. For example, a maintenance communication panel may be located in every fourth bay.

The equipment listed here is combined with the Fiber Optic Shelves (section 2), Connector Panels and Modules (section 3), and Shelf Accessories (section 4) to provide a complete FDF system. The FDF should be installed with a total cable and fiber management system. For this reason, other associated equipment (see section on Related Equipment) is usually specified including the Optical Cable Entrance Facility (OCEF), the Fiber Protection System (FPS), and the Cable Management System (CMS). In addition, communications panels and other maintenance equipment may be specified for use with the FDF system. Once the equipment configuration has been specified and installed, the FDF can easily be populated with shelves and associated apparatus. The following sections describe the principle equipment required to construct an FDF.



## **LGX Frame**

---

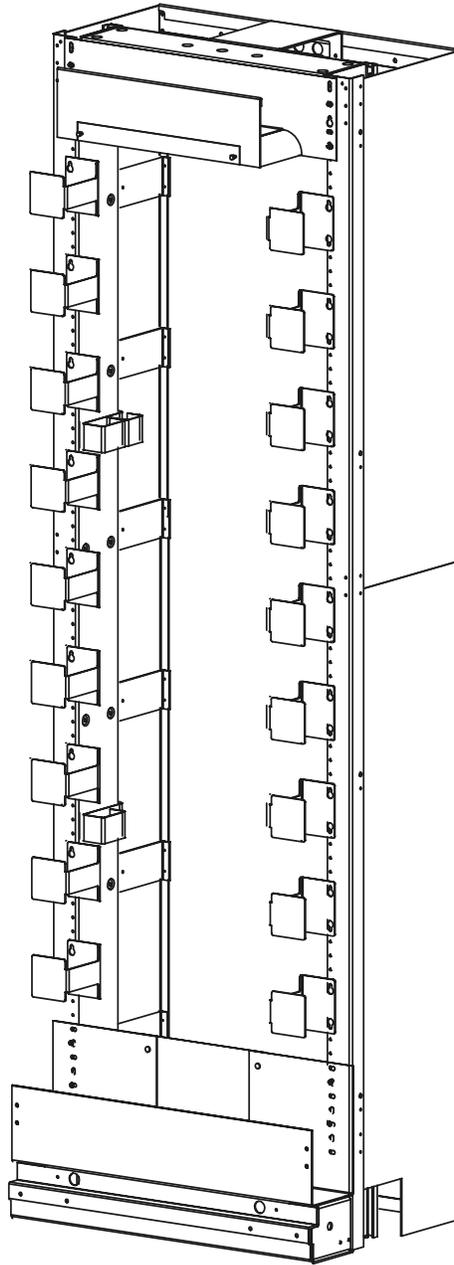
The *LGX* Bay Frame is available in a 12-inch (305 mm) footprint or a 15-inch (381 mm) footprint. The *LGX* frame uses the extended equipment mount arrangement such that the *LGX* shelves extend from the front flanges by 5 inches (127 mm). The assembled size of the *LGX* Bay Frame is 7 feet (2.1 m) high and 26 inches (660 mm) wide.

Upper and lower horizontal express raceways are attached to the front flange allowing jumpers to be run between bays. The upper raceway has radius guides on either side to maintain minimum bending radius for the fibers. The lower raceway contains bay joining holes to secure adjacent bays and end guards. The combined cross-sectional jumper running area of the upper and lower raceway is 40 square inches (258 square centimeters). The capacity of the horizontal raceways is important in determining the permissible length of a multibay *LGX* Distribution Frame.

Jumper retainers mount on the wide front flanges of the Network Bay Frame forming a vertical trough for running jumpers vertically between bays. The vertical trough allows fan-through placement of fiber jumpers. The combined cross-sectional jumper running area of the vertical trough is 32 square inches (206 square centimeters).

A cable duct is constructed on the rear of the bay frame by attaching brackets, braces, and walls. The rear duct can accommodate either buffered building cables or Outside Plant (OSP) cable sheaths. Retainer brackets protect and organize the buffered cables as they transition from the overhead rack onto the termination shelf. The cables are then routed down the side of the frame. The duct is designed to allow cables to enter from either the top or bottom of the frame. If populated with OSP cables, up to eighteen ½-inch (12.7 mm) diameter OSP cables can be placed in each side for a total frame capacity of 36 cables.

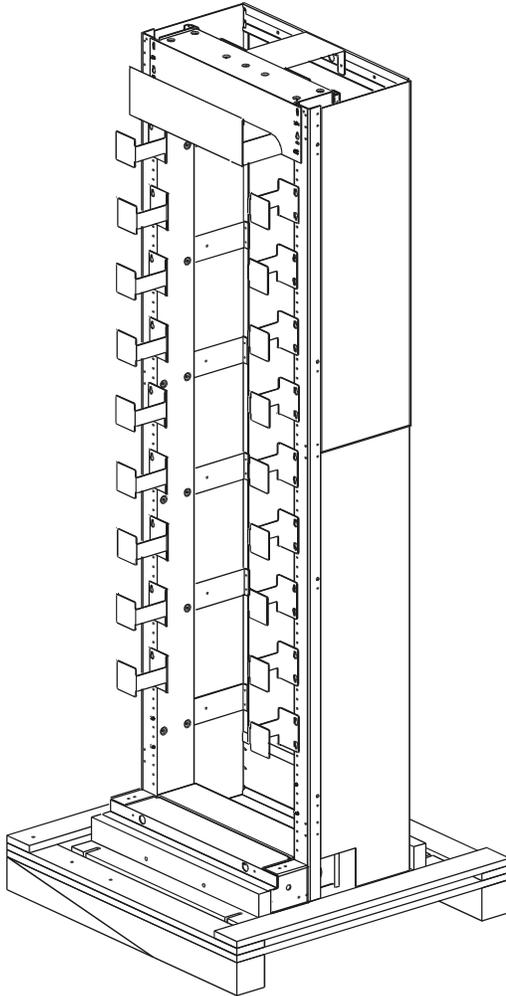
The main difference between the 12-inch (305 mm) footprint and the 15-inch (381 mm) footprint is the depth of the rear cable duct. The 12-inch footprint provides 36 square inches (232 square cm) of effective rear cable area for cables. This is usually adequate for most large count fiber cabling applications such as placing riser cables associated with preterminated shelves. The 15-inch (381 mm) footprint provides 70 square inches (451 square cm) of effective cable area. Thus the 15-inch (381 mm) footprint provides almost twice as much effective cable area over the 12-inch (305 mm) footprint.



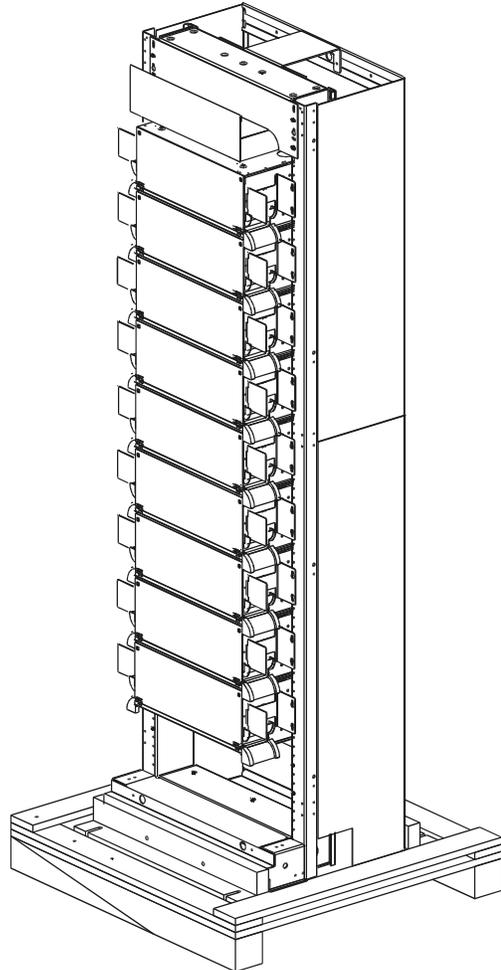
## **Preassembled LGX Frames**

The fastest way to install an *LGX* frame is to use the preassembled frame equipment. The preassembled *LGX* frame saves the installer valuable time by providing factory-assembled components thus reducing the overall time to fasten frame parts together in the field.

The preassembled *LGX* Frame is available in one container and is ordered with just one comcode. The preassembled *LGX* Frame supplies all of the frame hardware already assembled to the Network Bay Frame or Seismic Network Bay Frame and ready to receive *LGX* Fiber Optic Shelves. The preassembled frame options include choice of Network Bay Frame or Seismic Network Bay Frame and choice of 12-inch (305 mm) or 15-inch (381mm) deep footprint. The preassembled frame also provides the option to include rear duct doors for the bay. Preassembled bays also may be supplied with Fiber Termination Shelves and optical adapters.



Preassembled Bay w/o Shelves



Preassembled Bay e/w Shelves

**Preassembled LGX Frame — 12-Inch (305 mm) Depth**

The Preassembled LGX frame is available in a 12-inch (305 mm) footprint. The 12-inch (305 mm) bay is available with the Network Bay Frame or Seismic Network Bay Frame and may be specified with or without rear doors. The version with rear doors is also supplied with a full complement of 18 JR4A Jumper Retainers and end caps. This frame is fully compatible with and can be installed along side all 12-inch (305 mm) LGX Frames that may have already been installed.

<b>Preassemble d LGX® Frame Product Code</b>	<b>12-inch (305mm) Pre-assembled LGX Frame Contents</b>			
	<b>Bay Frame</b>	<b>LGX Frame Parts ED-6C321-50, G2</b>	<b>Rear Doors ED-6C321-50, G3</b>	<b>End Caps JR4C-9</b>
107 489 858	Network Bay Frame	1		
107 382 343	Network Bay Frame	1	1	
107 382 327	Network Bay Frame	1	1	1
107 489 866	Seismic Network Bay Frame	1		
107 382 350	Seismic Network Bay Frame	1	1	
107 382 335	Seismic Network Bay Frame	1	1	1

**Preassembled LGX Frame - 15-Inch (381 mm) Depth**

The Preassembled LGX Frame is available in a 15-inch (381 mm) footprint. The 15-inch (381 mm) is available with the Network Bay Frame or Seismic Network Bay Frame and may be specified with or without rear doors. This frame is fully compatible with and can be installed along side all 15-inch (381 mm) LGX Frames that have been installed to date.

<b>Pre-Assembled LGX<sup>®</sup> Frame Product Code</b>	<b>15-Inch (381 mm) Pre-assembled LGX Frame Contents</b>		
	<b>Bay Frame</b>	<b>LGX Frame Parts ED6-C321-50, G2</b>	<b>Rear Doors ED-6C321-50, G3</b>
107 856 528	Network Bay Frame	1	
107 910 044	Network Bay Frame	1	1
107 872 616	Seismic Network Bay Frame	1	
107 910 051	Seismic Network Bay Frame	1	1

## Network Bay Frames

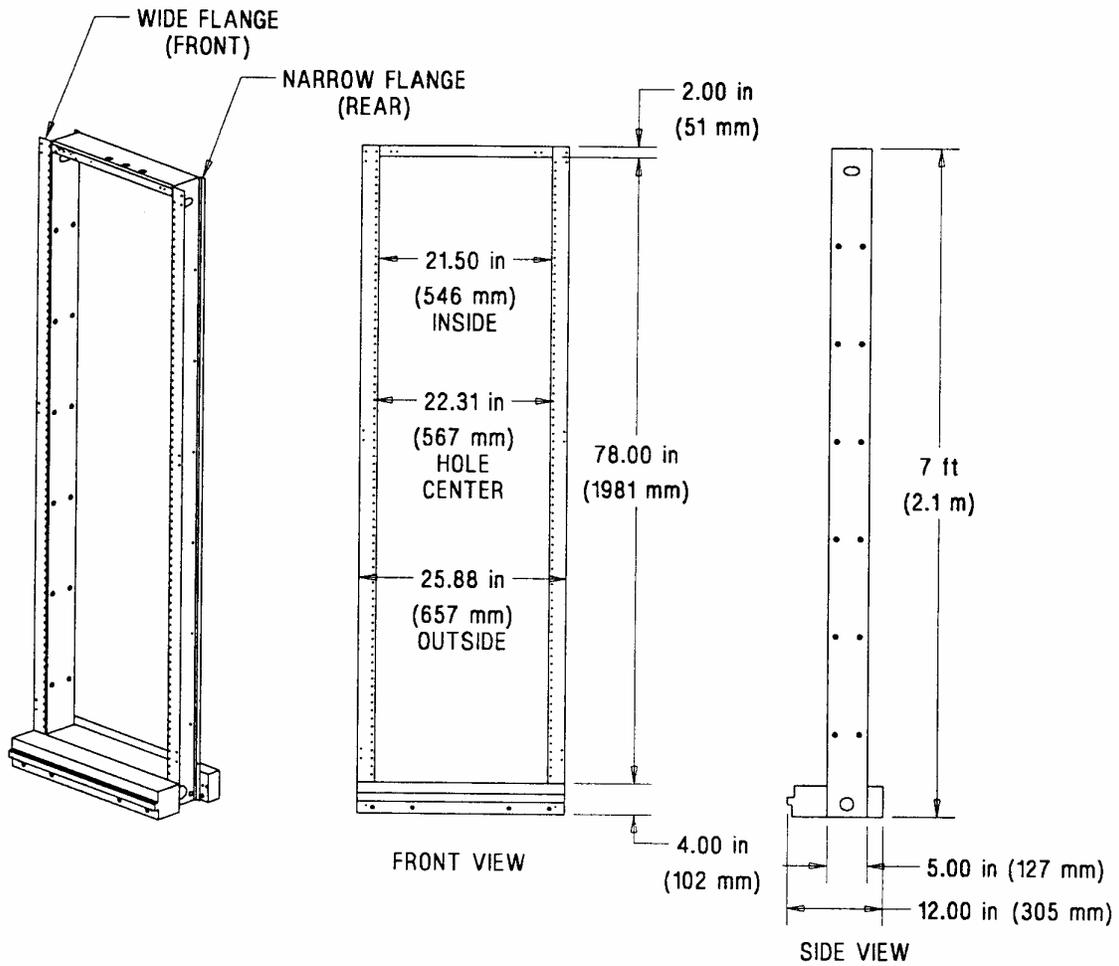
### Network Bay Frame

The LGX FDF is typically installed with the 7-foot (2.14 m) tall ED-8C501-50 Group 1 Network Bay Frame shown in the figure on the next page or the Seismic Network Bay Frame described in the following section. However a common application may be to install the frame in a 9-foot (2.74 m) or 11.5-foot (3.5 m) frame. When LGX frame parts are installed in these taller frames, only the lower 7 feet (2.1 m) is equipped with shelves. The upper raceways and the jumper retainers, however, may be placed above the 7-foot (2.1 m) level for organizing jumper cables if desired. The following network bay frames are recommended for use with the LGX frame parts.

<b>Network Bay Frame Product Code</b>	<b>Height</b>
ED-8C501-50, Group 1 601 390 271	7' 0" (2.14 m)
ED-8C501-50, Group 2 601 390 289	9' 0" (2.74 m)
ED-8C501-50, Group 3 601 390 297	11' 6" (3.5 m)

Other unequal flange equipment frames may be equipped with LGX frame parts, but these frames may not have as much vertical mounting space as the Network Bay Frame. Therefore, frames other than the Network Bay Frame (or the Seismic Network Bay Frame) are not normally recommended for full lineups. Individual shelves may, however, be universally mounted in most any frame.

A complete set of accessory hardware is available for use with the Network Bay Frame. The accessories include equipment and wiring for supplying AC power, and grounding hardware. See Frame Accessories.



Network Bay Frame

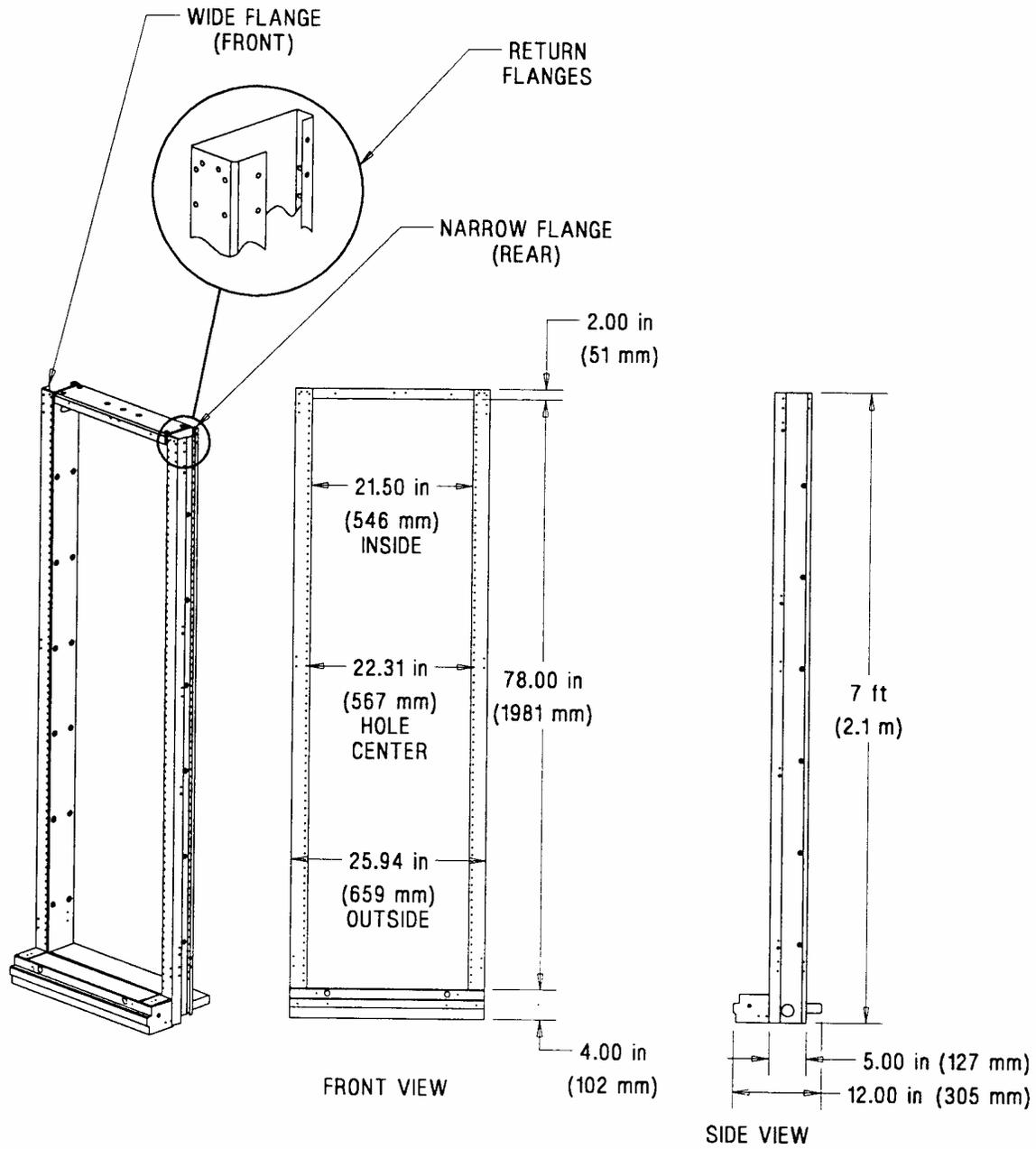
### **Seismic Network Bay Frame**

OFS LGX Fiber Distribution Frame has been thoroughly tested and fully meets all seismic requirements for installation in Zone 3 and Zone 4 earthquake areas. An FDF constructed with Network Bay Frames must be installed with proper floor attachment and top bracing. For instances where frames must be installed without overhead support, the Seismic Network Bay Frame should be used. Unsupported bay frames satisfy all stiffness criteria for Zone 3 and Zone 4 earthquake areas. This new criteria for structural frames uses a static test which is much easier to repeat than dynamic tests that have been done in the past. The OFS Seismic Network Bay Frame shown on the next page fully complies with all requirements for Zone 3 and Zone 4 installation.

Seismic requirements for unsupported frames only cover 7-foot (2.14 m) applications. However the Seismic Network Bat Frame design is available in taller heights as well. When used in Zone 3 or Zone 4 earthquake areas, Seismic Network Bay Frames can be used with the LGX frame parts.

<b>Seismic Network Bay Frame Product Code</b>	<b>Height</b>
ED-8C801-50, Group 1 601 398 225	7' 0" (2.14 m)
ED-8C801-50, Group 2 601 398 241	9' 0" (2.74 m)
ED-8C801-50, Group 3 601 398 266	11' 6" (3.5 m)

Many of the accessories utilized for the Network Bay Frame can also be used with the Seismic Network Bay Frame. Application guidelines and ordering details for Seismic Network Bay Frame accessories are provided in ED-8C800-70.



Seismic Network Bay Frame

## LGX Frame Groups

The *LGX* Frame Hardware groups are designed to provide convenient ordering kits for field assembly of an *LGX* frame. The groups can be selected to configure a complete *LGX* Frame or to supply only those parts necessary to convert an existing bay frame to the *LGX* frame. Duct doors for the rear of the frame and end guards for the ends of a frame lineup are other optional groups that can be ordered.

A listing of the ED-6C321-50 groups is provided in the following table.

Equipment ED-6C321- 50 Group	Comcode	Description
1	601 426 794	<i>LGX</i> <sup>®</sup> Frame – Includes NBF and Group 2 <i>LGX</i> Frame Parts.
2	601 248 354	<i>LGX</i> Frame Parts – Includes 12-inch (305 mm) deep hardware kit for converting an NBF or SNBF into an <i>LGX</i> Frame.
3	601 248 404	<i>LGX</i> Frame Rear Door – Set of duct doors with key lock to cover the rear of any <i>LGX</i> Frame or any OpCenter Frame.
4	601 248 388	<i>LGX</i> Frame End Guard – 12-inch (305 mm) End Guard for the end of a 12-inch (305 mm) deep lineup.
5	601 373 178	<i>LGX</i> Frame Rear Duct – 12-inch (305 mm) deep rear duct for attachment to an NBF or SNBF without front troughs/raceways.
6	601 427 347	<i>LGX</i> Frame – Includes Seismic NBF and Group 2 <i>LGX</i> Frame Parts.
7	601 835 713	<i>LGX</i> Frame Parts – Includes 15-inch (381mm) deep hardware kit for converting an NBF or SNBF into an <i>LGX</i> Frame.
8	601 835 721	<i>LGX</i> Frame End Guard – 15-inch (381 mm) End Guard for the end of a 15-inch (381 mm) deep lineup.
9	601 842 214	<i>LGX</i> Frame – Includes NBF and Group 7 <i>LGX</i> Frame Parts.
10	601 842 222	<i>LGX</i> Frame – Includes Seismic NBF and Group 7 <i>LGX</i> Frame Parts.

**LGX Frame Groups – 12-Inch (305 mm) Footprint**

The *LGX* Frame Groups are available in the 12-inch (305 mm) footprint. Groups may be ordered to include the Network Bay Frame or Seismic Network Bay Frame or to provide just the frame hardware kits where an existing Network Bay Frame or Seismic Network Bay Frame may already be in place.

The ED-6C321-50, Group 1 *LGX* Bay Frame provides the Network Bay Frame and the Group 2 *LGX* frame parts. These components are assembled in the field to construct an *LGX* frame.

When the ED6C321-50 Group 2 *LGX* frame parts are ordered, a bay frame must be provided separately. This option allows conversion of frames that may already be installed or installation of taller frames such as the 9-foot (2.74 m) or 11-foot 6-inch (3.5 m) bay frames. The Group 2 parts include the rear duct, horizontal troughs, vertical jumper retainers, and other hardware that attaches to the Bay Frame to construct an *LGX* Frame. The Group 2 *LGX* frame parts are compatible with the Network Bay Frame or the Seismic Network Bay Frame. Equipping frames other than the NBF or the SNBF with the Group 2 is possible but may require a nonstandard equipment arrangement. Thus to optimize frame and floor space, the use of the NBF and SNBF is recommended with the Group 2 *LGX* Frame Parts to construct an *LGX* Fiber Distribution Frame.

The ED-6C321-50, Group 6 *LGX* Bay Frame provides the Seismic Network Bay Frame and the Group 2 *LGX* frame parts. These components are assembled in the field to construct an *LGX* frame.

The ED-6C321-50, Group 5 *LGX* Rear Duct provides a hardware kit that includes the rear duct of a 12-inch (305 mm) *LGX* frame. This kit allows field assembly of a custom *LGX* frame where front jumper troughs and retainers are ordered separately.

<b>Equipment</b>	<b>Comcode</b>	<b>Description</b>
ED-6C321-50, Group 1	601 426 794	<b><i>LGX</i></b> ® Frame – Provides the Network Bay Frame and the Group 2 <b><i>LGX</i></b> Frame Parts.
ED-6C321-50, Group 2	601 248 354	<b><i>LGX</i></b> Frame Parts – Provides a 12-inch (305 mm) deep hardware kit for converting a NBF or SNBF into an <b><i>LGX</i></b> Frame.
ED-6C321-50, Group 6	601 427 347	<b><i>LGX</i></b> Frame – Provides a Seismic NBF and Group 2 <b><i>LGX</i></b> Frame Parts.

**LGX Frame Groups – 15-Inch (381 mm) Footprint**

The *LGX* Frame Groups are available in the 15-inch (381 mm) footprint. Groups may be ordered to include the Network Bay Frame or Seismic Network Bay Frame or to provide just the frame hardware kits where an existing Network Bay Frame or Seismic Network Bay Frame may already be in place.

The ED-6C321-50, Group 9 *LGX* Bay Frame provides the Network Bay Frame and the Group 2 *LGX* frame parts. These components are assembled in the field to construct a 15-inch (381 mm) deep *LGX* frame.

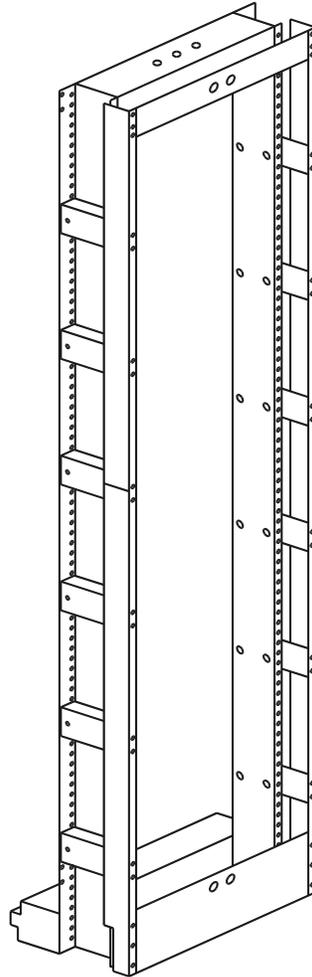
When the ED-6C321-50, Group 7 *LGX* frame parts are ordered, a bay frame must be provided separately. This option allows conversion of frames that may already be installed or installation of taller frames such as the 9-foot (2.74 m) or 11-foot 6-inch (3.5 m) bay frames. The Group 7 parts include the rear duct, horizontal troughs, vertical jumper retainers and other hardware that attaches to the Bay Frame to construct an *LGX* frame. The Group 7 *LGX* frame parts are compatible with the Network Bay Frame or the Seismic Network Bay Frame. Equipping frames other than the NBF or the SNBF with the Group 7 is possible but may require a nonstandard equipment arrangement. Thus to optimize frame and floor space, the use of the NBF and SNBF is recommended with the Group 7 *LGX* frame parts to construct an *LGX* Fiber Distribution Frame.

The ED-6C321-50, Group 10 *LGX* Bay Frame provides the Seismic Network Bay Frame and the Group 7 *LGX* Frame Parts. These components are assembled in the field to construct a 15-inch (381 mm) deep *LGX* frame.

<b>Equipment</b>	<b>Comcode</b>	<b>Description</b>
ED-6C321-50, Group 7	601 835 713	<b>LGX</b> <sup>®</sup> Frame Parts – Provides a 15-inch (381mm) deep hardware kit for converting a NBF or SNBF into an <b>LGX</b> Frame.
ED-6C321-50, Group 9	601 842 214	<b>LGX</b> Frame – Provides a Network Bay Frame and the Group 2 <b>LGX</b> Frame Parts.
ED-6C321-50, Group 10	601 842 222	<b>LGX</b> Frame – Provides a Seismic NBF and Group 7 <b>LGX</b> Frame Parts.

**Group 5 – LGX Frame Rear Duct**

The ED-6C321-50 Group 5 LGX Frame Rear Duct consists of the same rear duct hardware as in the Group 1 LGX Bay Frame and in the Group 2 LGX frame parts. The principle difference is that the Group 5 LGX Frame Rear Duct does not include any of the hardware for the front of the frame such as horizontal raceways or vertical jumper retainers or brackets for organizing cables in the rear. The Group 5 LGX Frame Rear Duct is intended for use when it may be desired to equip a bay frame with separate parts; for instance when a customized front trough arrangement is specified.

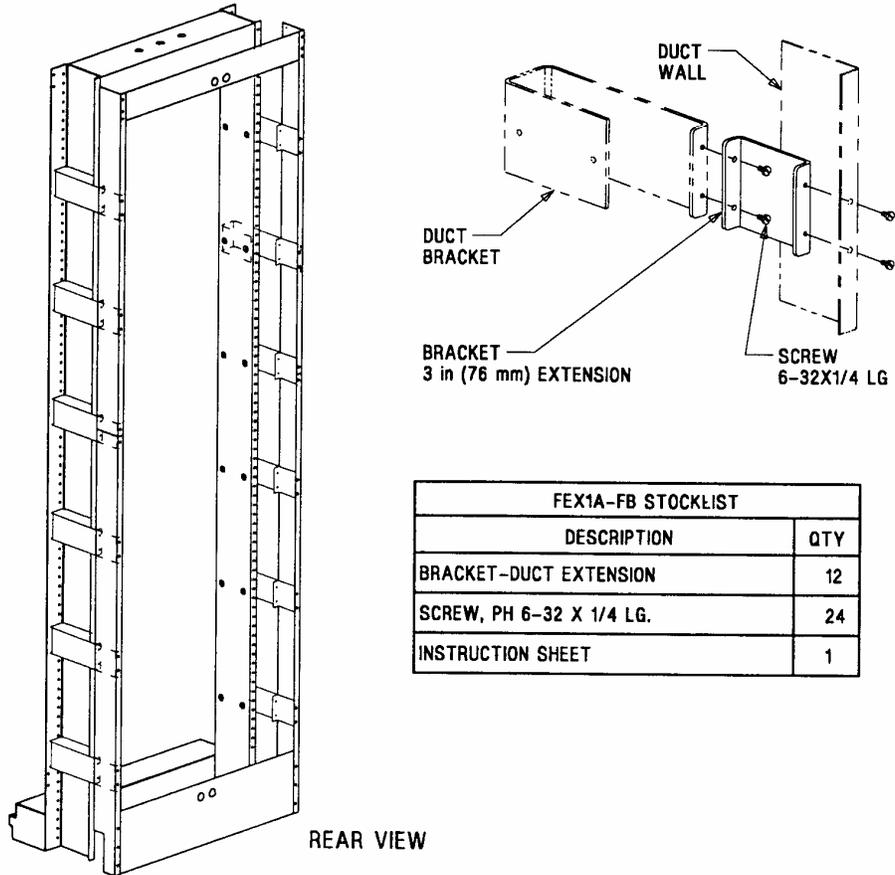


Equipment	Comcode	Description
ED-6C321-50, Group 5	601 373 178	LGX <sup>®</sup> Frame Rear Duct – 12-inch (305 mm) deep rear duct for attachment to an NBF or SNBF without front troughs/raceways.

**Rear Duct Extension Kit**

The FEX1A-FB Rear Duct Extension Kit provides a set of extension brackets and hardware to extend the rear duct and frame braces of the LGX frame and Rear Duct by 3 inches (76.2 mm). This converts the standard 12-inch (305 mm)

footprint to 15 inches (381 mm). The kit shown in the figure below is typically used when additional rear cabling space is desired for special applications using larger size fiber optic cables. The kit can be used to retrofit existing frames or can be integrated during the initial assembly of the ED-6C321-50, Group 2 (Frame Parts) or Group 5 (Rear Duct) for new installations.



FEX1A-FB STOCKLIST	
DESCRIPTION	QTY
BRACKET-DUCT EXTENSION	12
SCREW, PH 6-32 X 1/4 LG.	24
INSTRUCTION SHEET	1

Product Code	Description
FEX1A-FB 106 929 961	Frame Extender – Set of twelve 3-in (76 mm) extender brackets and associated screws. Used to convert the footprint of the frame from a depth of 12 in (305 mm) to a depth of 15 in (381 mm).

## **Broadband *LGX* Frame and Parts**

---

The Broadband *LGX* Frame System is also for use in the *LGX* Broadband Fiber Management System. This system utilizes the modular *LGX* frame as the basis for organizing Fiber Optic Shelves, Optical Splitters, Laser Transmitter Equipment and cable management hardware. The Broadband management system provides convenient cross-connection between outside plant fibers, optical splitters, and broadband equipment. The *LGX* Broadband Frame consists of two main bays: the Fiber Distribution Bay and the Electronic Equipment Bay.

The Fiber Distribution Bay is used to terminate all OSP cables on optical connectors and provides users with a point for test access and flexible rearrangement in the same way the *LGX* Frame performs these functions. The Fiber Distribution Bay is typically equipped with preterminated *LGX* shelves that organize permanent cables in the rear and provide front access to optical ports. The Fiber Distribution Bay essentially contains the same hardware as the *LGX* frame. The FDF Bay includes the rear duct, horizontal troughs, vertical jumper retainers and other hardware that attaches to the bay frame to construct an *LGX* frame. The FDF Bay Frame Parts are compatible with the Network Bay Frame or the Seismic Network Bay Frame which is ordered separately.

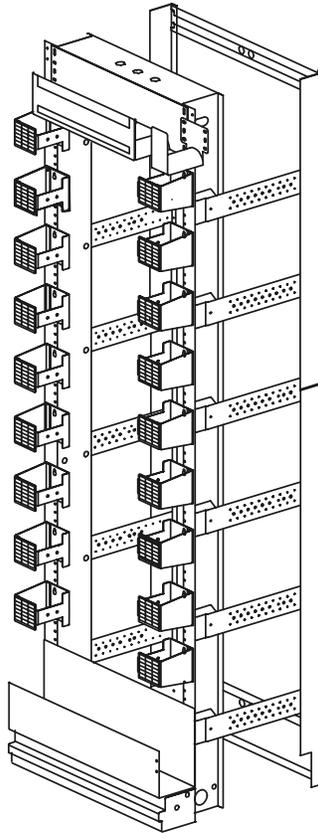
The Electronic Equipment Bay (EEB) is used in conjunction with the FDF Bay to install Laser Transmitter Equipment into the same lineup with the OSP fiber terminations. The Electronic Equipment Bay is used to mount optical/electrical equipment in a bay adjacent to the Fiber Distribution Bays. The optical/electrical equipment mounted in these bays is typically the equipment used to convert electrical video signals on coaxial cable to optical video signals on fiber optic cables. The Electronic Equipment Bay is arranged so that coaxial cables are organized in the rear of the bay while the optical fiber cables are organized in the front. The fiber interconnect jumpers in the front of the bay can be routed in a contiguous trough system to the Fiber Distribution Bay or to a splitter shelf as required.

The main difference between the *LGX* frame and the Broadband *LGX* Frame system is the depth. Whereas the *LGX* frame is available in frame depths of 12 inches (305 mm) and 15 inches (381 mm), the Broadband *LGX* Frame is only available in a 24-inch (610 mm) deep arrangement. The extra depth is required to accommodate the optical/electrical equipment mounted in the EEB. Also, because the EEB must be 24 inches (610 mm) deep, the FDF Bay is designed at 24 inches (610 mm) in order to have uniform depths when EE Bays and FDF Bays are installed in the same lineups. The assembled size of the Broadband *LGX* Bays is 7 feet (2.1 m) high and 26 inches (660 mm) wide – same height and width as the *LGX* frame.

### Fiber Distribution Bay (FDB)

LGX Fiber Distribution Bay (FDB) Parts consist of all the parts needed to construct a Fiber Distribution Frame Bay using the Network Bay Frame or a Seismic Network Bay Frame as the structural backbone. The Fiber Distribution Bay Parts include upper and lower horizontal raceways, vertical jumper retainers, upper and lower duct walls, and duct brackets. The upper raceway has a radius guide at each end for maintaining a minimum fiber bend radius as fiber traverses from a horizontal to a vertical direction. Jumper retainers attach to the front flanges of the Bay Frame to form a vertical trough on either side for running jumpers. A duct is constructed on each side in the rear of the frame using brackets, braces, and walls. Cables may enter the duct from the top and bottom of the frame. All of the Fiber Distribution Frame Bay parts are provided as a kit and assembled to the Bay Frame on site.

The Network Bay Frame or Seismic Network Bay Frame is specified and ordered separately.

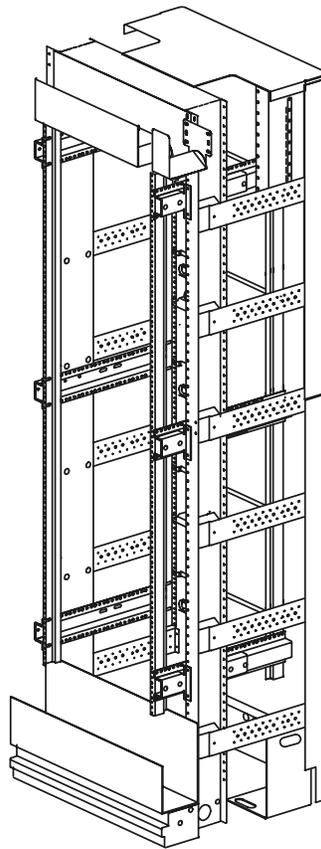


Comcode	Description
107 136 830	Broadband <i>LGX</i> <sup>®</sup> FDB Parts – Includes 24-inch (610 mm) deep hardware kit for assembly to an NBF or SNBF to form a Broadband <i>LGX</i> FDB Frame.

### Electronic Equipment Bay (EEB)

LGX Electronic Equipment Bay (EEB) Parts consist of all the parts needed to configure a Network Bay Frame into an Electronic Equipment Bay. The Electronic Equipment Bay Parts include vertical channels that reduce the center-to-center hole spacing on the front to accept 19-inch (483 mm) wide only equipment. The Electronic Equipment Bay Parts also include an AC power strip to distribute AC power to the equipment. The EEB provides hardware for routing and securing coaxial cables in the rear of the bay. The EEB hardware also includes fiber ring brackets for routing fiber from the rear to the front. The vertical channels extend 5 inches (127 mm) from the front of the Network Bay Frame thereby projecting any mounted electronic equipment by the same amount. This aligns the front of the Electronic Equipment Bay flush with other FDBs in the lineup.

The Network Bay Frame or Seismic Network Bay Frame is specified and ordered separately.



Comcode	Description
107 136 848	<b>Broadband LGX<sup>®</sup> EEB Parts</b> – Includes 24-inch (610 mm) deep hardware kit for assembly to an NBF or SNBF to form a Broadband <b>LGX</b> EEB Frame.

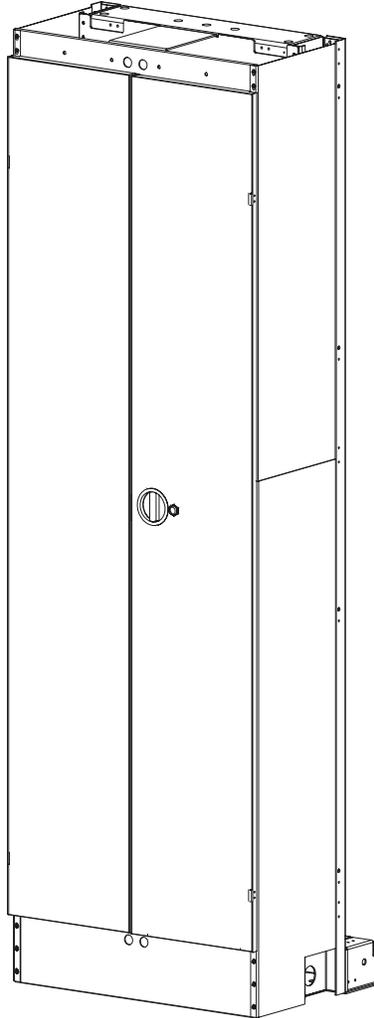
### Broadband LGX Frame Accessories

The Broadband LGX Frame is available with a full range of accessories for organizing equipment, cables, and performing other functions. The Broadband Frame accessories are listed below.

Comcode	Description
107 269 888	Kit, Fiber Management – Provides equipment to route fiber jumpers from the rear of an EEB to the front of an EEB.
107 257 958	Kit, 24 LGX-UMP – Universal Mounting Plate – Plate mounted in rear of EEB to mount miscellaneous combiners and splitters.
107 139 180	Kit, 24 LGX-VTTP – Vertical Trough Trim Panel – Trim panel provides closure over the front of the vertical jumper troughs on the EEB.
107 139 255	Kit, 24 LGX-LL2MK – Laser Link II Mounting Bracket Assembly – Used on 24-inch FDF bay when electronic equipment shelves and LGX shelves are mounted together on a mixed bay.
107 221 996	Kit, 24 LGX-FP1 – 1.7-in Filler Panel – Filler panel provides closure on the front of the EEB.
107 222 002	Kit, 24 LGX-FP3 – 3.45-in Filler Panel – Filler panel provides closure on the front of the EEB.
107 222 010	Kit, 24 LGX-FP5 – 5.2-in Filler Panel – Filler panel provides closure on the front of the EEB.
107 225 757	Kit, 24 LGX-CCRK – Coaxial cable Routing – Bracket used to support and organize coaxial cables on the rear of a FDB or mixed bay.
107 139 222	Kit, 24 LGX-PSK – Power Strip Mounting – Auxiliary bracket and one electrical outlet strip used in EEB.
107 301 178	Kit, 24 LGX-BPLL2 – 8.7-in Filler Panel – 8.7-in filler panel used on EEB.
107 294 258	Kit, 24 LGX-JR5A-K – Jumper Retainer – Includes two JR5A Jumper Retainers, two JR4C Retainer Caps, and one 11A label.

## LGX Frame Rear Door – Group 3

The ED-6C321-50, Group 3 duct door assembly covers the rear of the frame as shown in the figure below. One Group 3 is recommended for each LGX Bay Frame. The purpose of the duct doors is to protect and provide security while allowing easy access for cable placement. They mount to the rear left and right duct walls and can be installed any time after the installation is complete. The duct doors are hinged and can easily be removed from the frame altogether whenever necessary. Each set of duct doors is provided with locking mechanism and key lock.



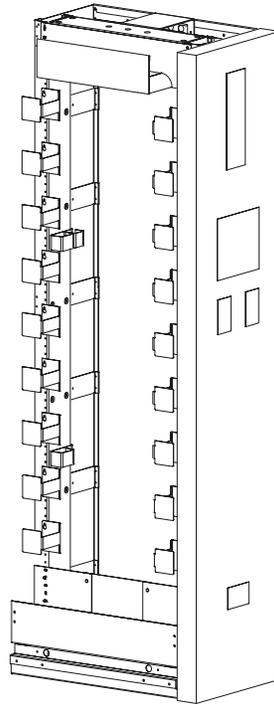
Equipment	Comcode	Description
<b>ED-6C321-50, Group 3</b>	601 248 404	<b>LGX<sup>®</sup></b> Rear Duct Doors – Provides one set of protective rear doors with locking mechanism and key lock.

## End Guards

The *LGX* End Guard encloses the end of an *LGX* frame lineup as shown in the figure below. End Guards are selected based on the footprint of the frame lineup to be enclosed. *LGX* Frame lineups may be 12 in (305 mm), 15 in (381 mm), 18 in (457 mm) or 24 in (610 mm) deep. All End Guards are 7 feet (2.1 m) high and 3 inches (76 mm) wide. All End Guards provide access for AC power from the overhead racks to the base raceways.

The 12 in (305 mm) and 15 in (381 mm) End Guards have positions (cutouts) in the end panel to mount light switches and alarm/indicator lamps and outlets. End guard extenders are also available for the 12 in (305 mm) and 15 in (381 mm) End Guards to provide closure for taller frames. See End Guard Extenders.

The 18 in (457 mm) or 24 in (610 mm) deep End Guards do not have positions (cutouts) in the end panel for appliance mounting.



Product Code	Description
<b>ED- 6C321-50, Group 4</b> <b>601 248 388</b>	12-in <i>LGX</i> <sup>®</sup> End Guard – One End Guard for use in <i>LGX</i> lineups that are 12 in (305 mm) deep.
<b>ED- 6C321-50, Group 8</b> <b>601 835 721</b>	15-in <i>LGX</i> End Guard – One End Guard for use in <i>LGX</i> lineups that are 15 inches (381mm) deep.
<b>107 762 775</b>	18-in <i>LGX</i> End Guard – One End Guard for use in <i>LGX</i> lineups that are 18 in (457 mm) deep.
<b>107 136 897</b>	24-in <i>LGX</i> End Guard – One End Guard for use in <i>LGX</i> lineups that are 24 in (610 mm) deep.

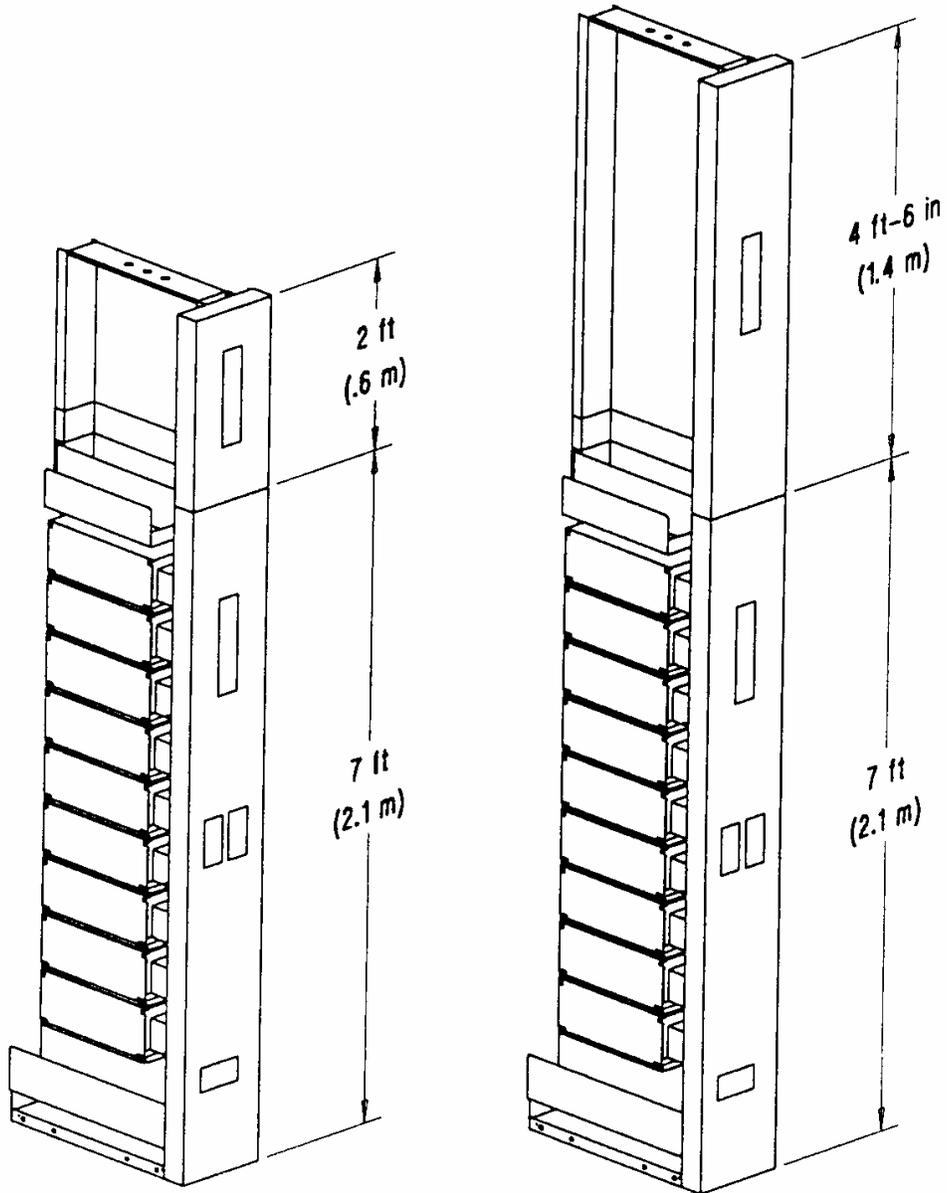
**End Guard Extenders**

End Guard extensions shown in the figure on the following page are used when installing 12-inch (305 mm) deep frames that are taller than 7 foot (2.1 m). It is usually desirable to install an End Guard to the full height of the frame to protect equipment and safe guard personnel. The way this is done with the LGX Frame is to install a 7-foot (2.1 m) high ED-6C321-50, Group 4 End Guard and then install an appropriate extender to cover the remaining gap. Extenders are available to match typical heights of 9 feet (2.74 m) and 11 feet 6 inches (3.5 m).

In some instances, the depth of the frame arrangement may be 15-inches (381 mm). Examples include where the 15-inch (381 mm) Operations Center is used or when the 3-inch (76 mm) Rear Duct Extension Kit are used. In these cases it is usually recommended to install a 15-inch (381 mm) deep End Guard and appropriate extensions.

<b>Product Code</b>	<b>Description</b>
ED-6C172-30, Group 9 601 265 556	End Guard Extension – The End Guard Extension is used in combination with the 12-in (305 mm) deep End Guard to form an End Guard that is 9 feet (2.74 m) tall, 3 in (76mm) wide, and 12 in (305mm) deep. The End Guard Extension is equipped with hardware to match any mounting position of the G4 End Guard.
ED-6C172-30, Group 10 601 265 580	End Guard Extension – The End Guard Extension is used in combination with the 12-in (305 mm) deep End Guard to form an End Guard that is 11 feet 6 in (3.5 m) tall, 3 in (76 mm) wide, and 12 in (305 mm) deep. The End Guard Extension is equipped with hardware to match any mounting position of the G4 End Guard.
ED-6C157-30, Group 34 601 423 510	End Guard Extension – The End Guard Extension is used in combination with the 15-in (381 mm) deep End Guard to form an end guard 9 feet (2.74 m) tall, 3 in (76 mm) wide, and 15 in (381 mm) deep.
ED-6C157-30, Group 35 601 423 528	End Guard Extension – The End Guard Extension is used in combination with the 15-in (381 mm) deep End Guard to form an end guard 11 feet 6 in (3.5 m) tall, 3 in (76 mm) wide, and 15 in (381 mm) deep.

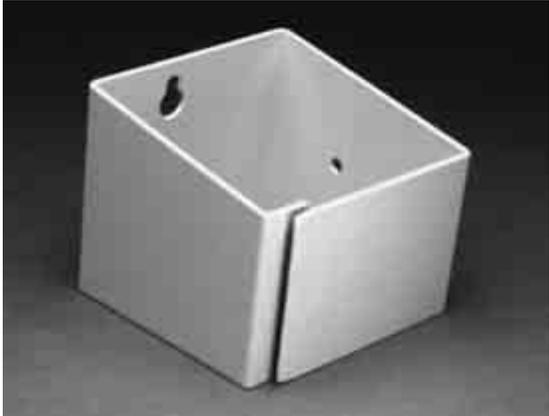
Note: These End Guard extensions are part of the DSX product family and are referenced for LGX installations requiring taller End Guards.



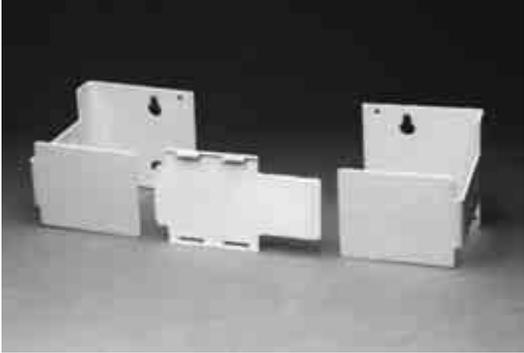
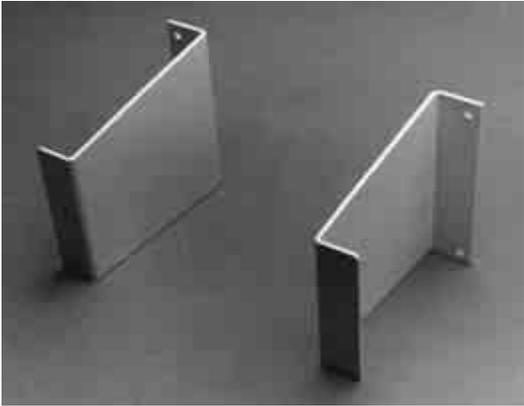
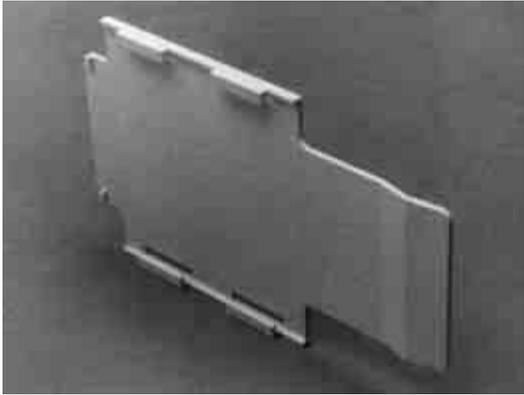
End Guard Extensions for 9-Foot (2.74 m) and 11.5-Foot (3.5 m) Frames

## Jumper Retainers

A series of Jumper Retainers are available for additions to LGX Fiber Distribution Frames vertical troughs. These can also be used to fill out an existing FDF configuration, or for customizing the vertical trough in new fiber distribution frame applications. The retainers are also used in several other applications in addition to the LGX Fiber Distribution Frames, such as data cabinet and wall-mounted LGX Fiber Distribution Shelves.

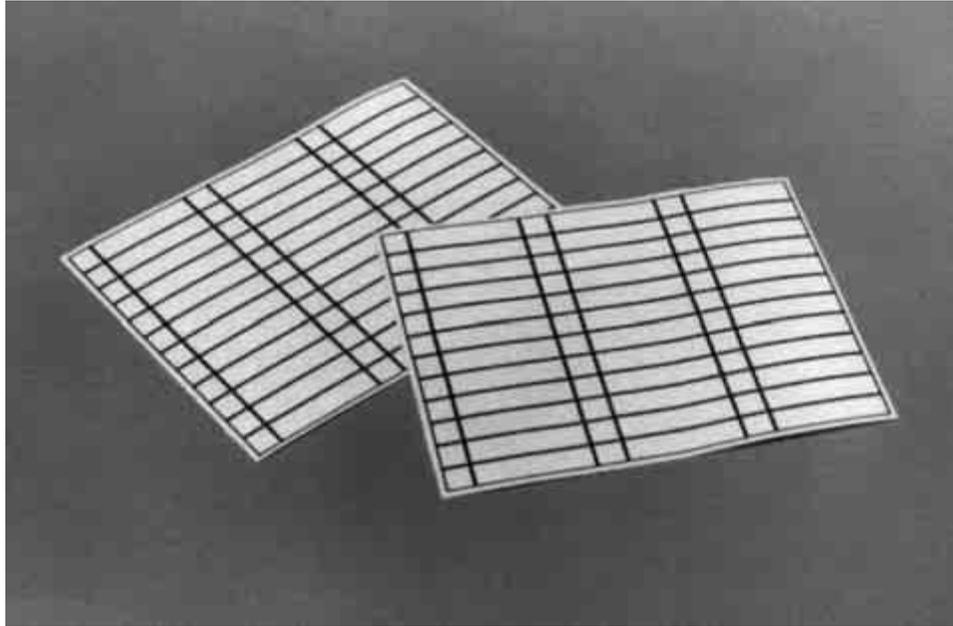
Description	
<p>JR1A Jumper Retainer (104 411 277)</p> <p>The JR1A Retainer provides a set of two jumper retainers. The JR1A Retainers are smaller than the JR2A Retainers and are typically used for 19-inch (483 mm) frame or data cabinet mounting. These JR1A Retainers are typically <i>not</i> used with the <b>LGX</b><sup>®</sup> Fiber Distribution Frame.</p>	
<p>JR2A Jumper Retainer (104 436 092)</p> <p>The optional JR2A Retainer provides a set of two jumper retainers, two labels, and hardware for mounting on the front flange of a network bay frame 23-inch (584 mm) mounting. JR2A Retainers can be added to the <b>LGX</b> FDF to fill a vertical trough arrangement.</p>	

**JR4-Type Jumper Retainer Hardware**

Description	
<p>JR4A-1 Retainer – package of one (106 565 344)                      JR4A-9 Retainer – package of nine (106 565 351)</p> <p>The JR4A Retainer provides one three-piece retainer which is intended to mount between two termination shelves that are mounted side-by-side on adjacent <b>LGX</b><sup>®</sup> Bays. The JR4A Retainer can be used in place of the JR3A Retainer and provides the advantage of snap-in placement that permits large or small diameter cables to be placed easily in the vertical trough. This arrangement also accepts the JR3A-JS Storage Dowel. The JR4A brackets can serve as mounting supports for an <b>LGX</b> Termination Shelf, thus eliminating the need to remove retainers (JR2A or JR3A must be removed to add shelves) when adding shelves. A cap (JR4C) may be attached to each bracket to provide a retainer similar to the JR2A Retainer for use at the end of a lineup. The JR4A is supplied in packages of one JR4A-1 or nine JR4A-9. These retainers are supplied with the ED-6C321-50, Group 1, Group 2, Group 6, Group 7, Group 9, and Group 10.</p>	
<p>JR4C-1 Retainer Cap – package of one (106 565 369)                      JR4C-9 Retainer Cap – package of nine (106 565 377)</p> <p>This retainer is intended to be installed to the brackets of the JR4A Retainer to form a retainer similar to the JR2A Retainer – this is for use at the end of a lineup. This is supplied in packages of one JR4C-1 or nine JR4C-9.</p>	
<p>JR4E-9 Extension – package of nine (106 565 385)</p> <p>The JR4E-9 Retainer Extension is a kit of nine plastic snap-in retainers. These are used as replacement parts with the JR4A retainer.</p>	

**Frame Jumper Retainer Labels**

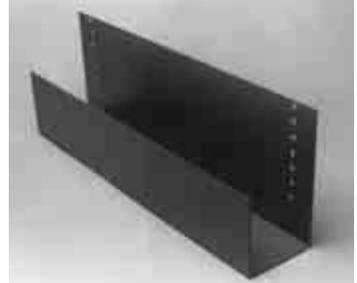
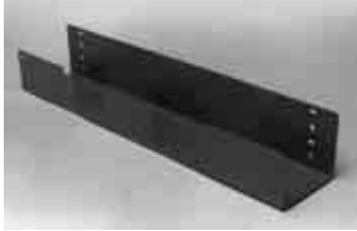
The optional 11A labels are used to identify circuit or system information for jumper cables. The 11A labels are placed on the jumper retainers adjacent to each shelf. The 11A labels are preformatted and unnumbered with 36 entry positions on each label. The retainer labels are stenciled in the field per local practice. These labels are shown in the figure below.



<b>Product Code</b>	<b>Application</b>
11A Label 104 436 084	11A Jumper Retainer Label – Provides pack of 12 unformatted labels for use in identifying fiber circuits on jumper retainers adjacent to Fiber Optic Shelves.

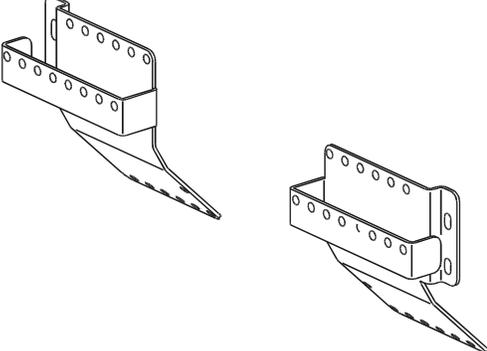
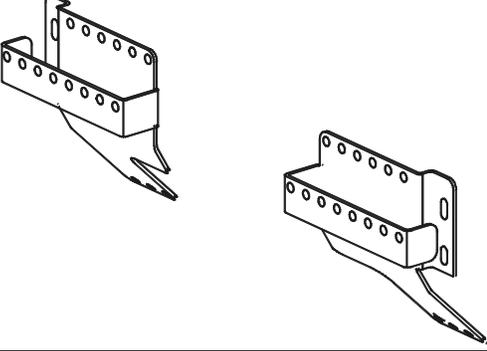
## Horizontal Raceways

Horizontal express troughs shown in figure on next page are available for applications requiring a customized layout where a slightly different configuration is desired.

Description	
<p><b>JS1A Jumper Support (106 574 593)</b>                      This provides one jumper support for mounting between top raceways of two adjacent <b>LGX</b><sup>®</sup> Bay Frames. The jumper support is used to support jumper cables between upper horizontal troughs and to support jumper cables transitioning and looping into vertical troughs.</p>	
<p><b>RU1A-23/5-6 Upper Raceway (106 574 551)</b>                      This upper raceway mounts on the 23-inch (584 mm) standard Network Bay Frame, extends from the flange 5 inches (127 mm), and is 6 inches (152 mm) high. This raceway has the same basic dimensions as the standard <b>LGX</b> Group 1 or Group 2 frame parts and therefore can be considered as a replacement for the standard upper trough.</p>	
<p><b>RL1A-23/5-9 Lower Raceway (106 574 577)</b>                      This lower raceway mounts on the 23-inch (584 mm) standard Network Bay Frame, extends 5 inches (127 mm) from the front flange, and is 9 inches (229 mm) high for mounting at the bottom of the frame. This raceway has the same basic dimensions as the standard <b>LGX</b> Group 1 or Group 2 frame parts and therefore can be considered as a replacement for the standard lower trough.</p>	
<p><b>RU1A-23/5-3 Upper Raceway (106 555 931)</b>                      This low-profile upper raceway mounts on the 23-inch (584 mm) standard Network bay Frame, extends 5 inches (127 mm) from the front flange and is 3 inches (76 mm) high for mounting at the top of the frame.</p>	
<p><b>RL1A-23/5-5 Lower Raceway (106 555 170)</b>                      This low-profile lower raceway mounts on the 23-inch (584 mm) standard Network Bay Frame, extends 5 inches (127 mm) from the front flange and is 5 inches (127 mm) high for mounting at the bottom of the frame.</p>	

## Cable Brackets and Retainers

In a cable intensive environment, it may be desirable to order additional cable retainers, brackets, or aligners for any variety of applications to help channelize, organize, and protect fiber cables as they transition into the frame and into the shelves. Following is a list and description of the cable brackets and retainers.

Description	
<p>CR1A Cable Bracket (106 518 327)</p> <p>This assembly provides one left-hand and one right-hand cable retainer bracket that mount to the rear top frame for securing building cables into the vertical area immediately adjacent to the shelf.</p>	
<p>CR1A-M Cable Bracket (106 555 360)</p> <p>This assembly provides one left-hand and one right-hand cable retainer modified with a cutout for use with optional raceways that allow additional space for mounting shelves.</p>	

## Floor Mounting Hardware

---

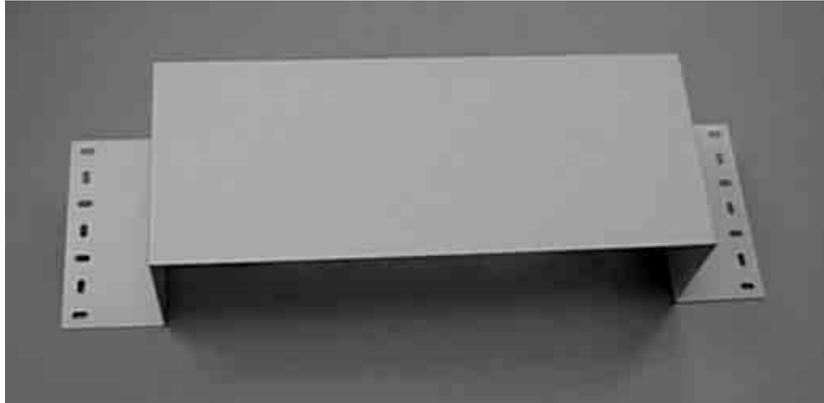
The following mounting kits are used for securing the Network Bay Frame or Seismic Network Bay Frame to the floor.

<b>Product Code</b>	<b>Description</b>
Floor Mounting Kit 107 264 707	Provides all the necessary equipment to secure the Network Bay Frame or Seismic Network Bay Frame to a concrete or raised floor. The kit is used for securing frames to concrete floors (all Earthquake Zones) and raised floors (Earthquake Zones 0 and Zone 1).
Floor Mounting Kit 107 264 715	Provides all the necessary equipment to secure the Network Bay Frame or Seismic Network Bay Frame to a raised floor over concrete. The kit is used for securing frames to raised floors (Earthquake Zones 2, 3, and 4).

## Filler Panel

---

A 7-inch (128 mm) high blank filler panel is available to reserve frame space for mounting shelves or other equipment. The filler panel also serves as a partition shielding the exposed rear cabling area from activity in front of the frame.

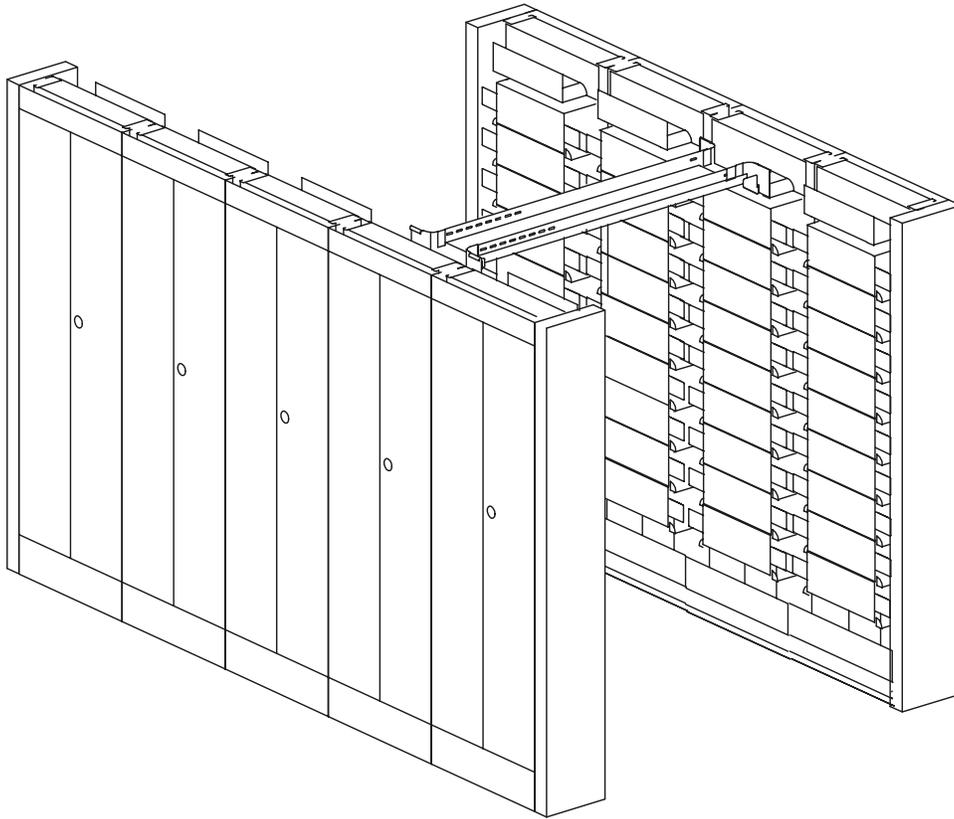


Product Code	Application
LF PF/7 Filler Panel 107 048 746	This product provides a 7 in (128 mm) shelf filler panel for the <b>LGX</b> ® Frame.

## Cross-Aisle Bridge

A cross-aisle bridge may be used to connect jumper pathways on frame lineups that are facing each other across an aisle. The cross-aisle bridge connects the upper raceways on two bays that face each other. The cross-aisle bridge consists of two upper raceways and a cross-aisle jumper trough supported by a ladder-type rack. The cross-aisle bridge upper raceways replace a standard raceway where the cross-aisle bridge is to be connected. The cross-aisle jumper trough is firmly attached to the new upper raceways supplied with the bridge.

This cross-aisle bridge can span an aisle of 72 in (1828 mm) maximum between frames. The cross-aisle bridge is located at a height of 80 in (2032 mm) above the floor, providing clearance to craft beneath the bridge. The cross-aisle jumper trough has a width of 10 in (254 mm).



Product Code	Application
Cross-Aisle Bridge 107 765 844	<b>Fiber Jumper Cross-Aisle Bridge Assembly</b> – Connects two <i>LGX</i> <sup>®</sup> lineups at the upper raceway position. Includes two cross-aisle bridge upper raceways and cross-aisle jumper trough. Requires removal of existing upper raceway for installation.

## Related Equipment

6

### Section Contents

---

Several related systems are typically specified for use with the LGX<sup>®</sup> Fiber Distributing Frame. This section describes some of the more common related equipment items.

- Communications Panel 6-2
- Optical Cable Entrance Facility (OCEF) 6-4
- Fiber Protection System 6-9
- Cable Management System 6-11

## Communications Panel

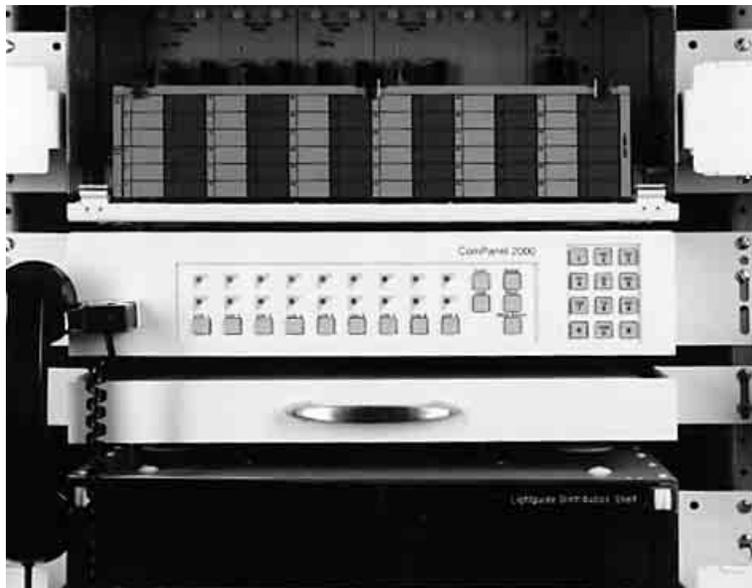
---

Other accessory equipment may be mounted in the *LGX* frame for maintenance purposes. For instance a communications panel is typically recommended to facilitate interoffice or intra-office communications necessary in normal maintenance or daily operations. A communications panel is recommended for every fourth bay. See Section on Engineering Recommendations.

### 2000A Communications Panel

Illustrated in the figure below is a front view of OFS ComPanel-2000 (2000A Communication Panel) designed for flexible mounting on standard 19-inch (483 mm) or 23-inch (584 mm) relay rack or Network Bay Frames. The panel provides a versatile multi-line telephone facility for access of up to nine 2-wire voice lines – via standard switch access or 1A2 Key Telephone Unit (KTU) connections to a local Private Branch Exchange (PBX). When connected to a 1A2-type KTU, the 2000A ComPanel also provides access to a user-selectable mix of intercom and paging/signaling lines. Additional features common to all lines include Hold, Redial, Flash, Conference, and On-Hook/Off-Hook Control.

The rear of the panel provides –48 VDC power and ground connection terminals, three 50-pin male ribbon connectors for line connections. The connectors are internally wired in parallel to provide bridging capability with other communication panels. Rear configuration controls are provided for line, ringer, and pulse/tone mode options. Also available with the 2000A ComPanel are such communication support items as 1A2 KTUs, headsets, handsets, and modular-to-dual 310-type plug adapters for connecting modular handset cords to the 2000A ComPanel headset jack.



**ComPanel 2000 and Related Equipment**

**ComPanel 2000 and Related Equipment are available as listed below.**

<b>Product Code</b>	<b>Description</b>	<b>Comcode</b>
2000A	Horizontal ComPanel with Mounting Brackets	106 727 662
2000A1	2000A with Headset, Mounting Brackets, Cord, and Plug	106 727 670
2000A2	2000A with Handset, Mounting Brackets, Cord, and Plug	106 727 688
2000V	Vertical ComPanel with Mounting Brackets	107 049 629
2000V1	2000V with Headset, Mounting Brackets, Cord, and Plug	107 058 364
2000V2	2000V with Handset, Mounting Brackets, Cord, and Plug	107 058 380
2000A/CP	Mounting Brackets for 2000A, A1, A2	106 746 019
2000V/CP	Mounting Brackets for 2000A, A1, A2	107 063 307
2000HHH	Headset/Handset Hanger	107 063 299
2000A-Head	Headset, Cord, and Plug	106 746 043
2000A-Hand	Handset, Module	106 746 035
2000A-04	Handset Cord, Coiled, Modular (15 ft)	106 746 027
2327A	Adapter, Modular to 327-Plug	106 746 001
S17	Writing Shelf w/ 19-in and 23-in Brackets	106 952 344
2000A/V/C	Adapter Cable – 660 ComPanel to 2000-Series Communications Panel	107 107 807
2000A/V	Instruction Manual	106 790 181

## **Optical Cable Entrance Facility (OCEF)**

The Optical Cable Entry Facility (OCEF) is a water-resistant enclosure that is intended for storing optical fiber splices between incoming Outside Plant (OSP) cables and building cables. Fiber bend limiting brackets and retaining rings are provided to protect, route, and organize the fibers.

The cabinets provide protection against wind-blown dust, water spray, and hose-directed water. The cabinets feature removable cable mounting brackets, each capable of accepting up to three cables. The cable mounting brackets have provisions for attaching the 12A-type cable clamps and accommodate either moisture-tight cable connectors or hole seals.

### **Side Entry Cabinets**

#### **OCEF1-720/42 Cabinet**

The OCEF1-720/42 cabinet is 42 inches (1067 mm) high, 30 inches (762 mm) wide, and 12 inches (305 mm) deep. It has 28 cable mounting brackets (with three entry/exit ports each) for a total of 84 cable entry/exit ports. The cabinet also has two cable openings at the top of the cabinet for purposes of venting or routing fibers to other OCEFs.

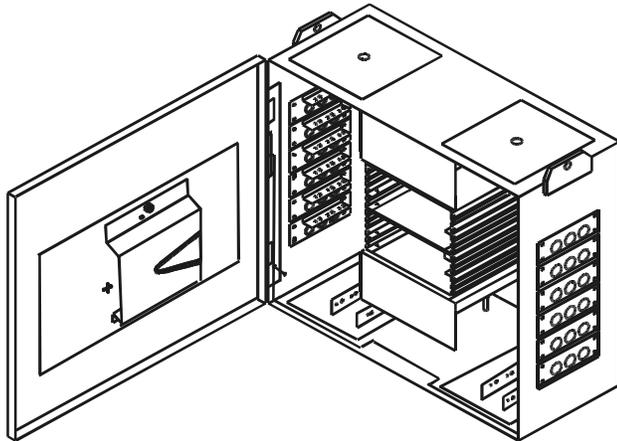
The OCEF1-720/42 cabinet allows the use of 30 LT1A-M/M Splice Organizers to store up to 720 mechanical splices, 30 LT1A-F/F Splice Organizers to store up to 960 fusion splices, or 30 LT1A-MF/MF Splice Organizers to store up to 4320 mass fusion splices.

#### **OCEF1-288/22 Cabinet**

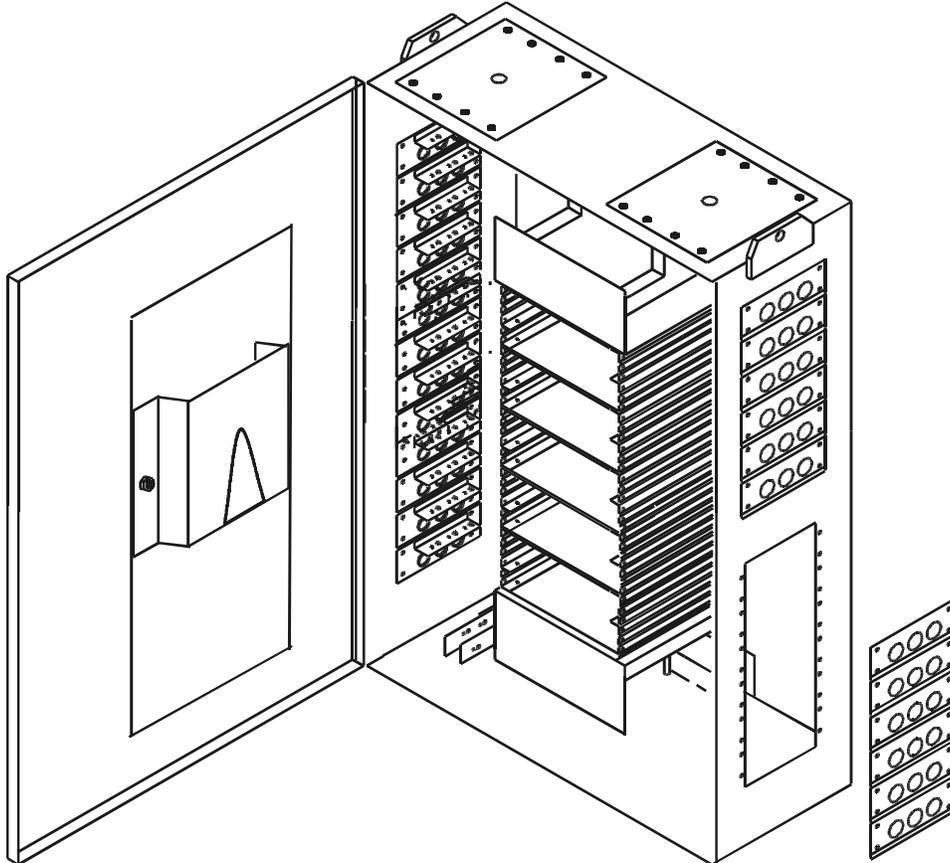
The OCEF1-288/22 cabinet is 22 inches (559 mm) high, 30 inches (762 mm) wide, and 12 inches (305 mm) deep. It has 16 cable mounting brackets (with three entry/exit ports each) for a total of 48 cable entry/exit ports. The cabinet also has two cable openings at the top of the cabinet for venting or routing fibers to other OCEFs.

The OCEF1-288/22 cabinet allows the use of 12 LT1A-M/M Splice Organizers to store up to 288 mechanical splices, 12 LT1A-F/F Splice Organizers to store up to 384 fusion splices, or 12 LT1A-MF/MF Splice Organizers to store up to 144 mass fusion splices.





OCEF1-288/22 Side Entry Cabinet

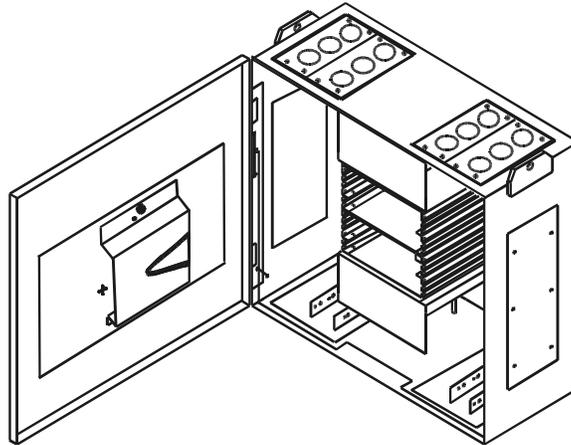


OCEF1-720/42 Side Entry Cabinet

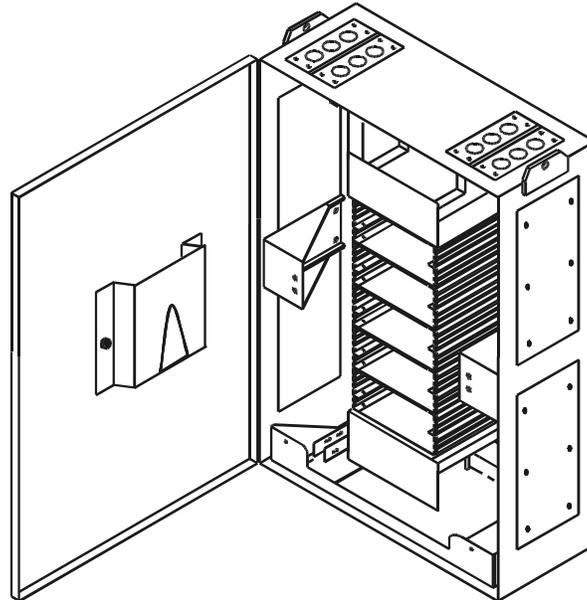
## Top/Bottom Entry Cabinets

### OCEF2-720/42 Cabinet / OCEF2-288/22 Cabinet

The OCEF2-Type cabinets are identical to the OCEF1-Type cabinets, except for the number and location of entry/exit ports on the cabinet. The OCEF2-Type cabinets have 24 cable entry/exit ports, which are located on the top and bottom of the cabinets. The sides of the cabinets have blank panels which can be replaced with cable mounting brackets.



OCEF2-288/22 Top/Bottom Entry Cabinet



OCEF2-720/42 Top/Bottom Entry Cabinet

### OCEF Associated Equipment

#### Shingles

Cable mounting brackets, or shingles, may be ordered separately (D-182718 Kit) to be used for replacement of the blank panels on the OCEF cabinet.

**Express Shingles**

**Express shingles, or subassemblies (D-182656), may be ordered for cables with diameters of up to 1 inch (25 mm) that need to be routed into the OCEF cabinet. These shingles have three cable ports and take up the space of two regular shingles.**

**OCEF and Related Products**

<b>Product Code</b>	<b>Comcode</b>	<b>Description</b>
OCEF1-288/22	106 642 911	Optical Cable Entrance Facility, small, side entry
OCEF1-720/42	106 642 937	Optical Cable Entrance Facility, large, side entry
OCEF2-288/22	106 767 197	Optical Cable Entrance Facility, small, top/bottom entry
OCEF2-720/42	106 767 205	Optical Cable Entrance Facility, small, top/bottom entry
12A1	104 384 490	Clamp for metallic sheath cable
12A2	106 230 337	Clamp for dielectric sheath cable
12A3L	108 527 433	Clamp for metallic sheath cable (0.25” to 1.50”)
LT1A-M/M	105 339 907	Mechanical Splice Organizer
LT1A-F/F	105 339 899	Fusion Splice Organizer
LT2A-MF/MF	108 663 998	Mass Fusion Splice Organizer
D-181781 Kit	105 342 463	6 to 1 Unit Splitter
D-181683 Kit	105 277 792	8 to 1 Unit Splitter
D-182212 Kit	105 694 038	Grounding Kit (for use with 12A2 Clamp)
D-182355 Kit	106 217 003	<i>AccuRibbon</i> ® Preparation Kit
D-182410	106 359 516	Cable Tube Blocking Kit
D-182655	106 690 142	Two Standard Cable Grommets 0.236 in to 0.708 in (.59 cm to 1.80 cm)
D-182656	106 690 159	One Bracket and one large Cable Grommet 0.709 in to 1.0 in (1.91 cm to 2.54 cm)
	107 829 277	One Large Grommet 0.900-in to 1.26 in ( 2.28cm to 3.2 cm)
D-182718	106 761 315	Six Standard Shingles
D-182657	106 690 167	Two Large Cables Grommets 0.709 in to 1.0 in (1.91 cm to 2.54 cm)
D-182717	106 761 307	Grounding Bar and Two-Hole Terminals for Bellcore requirements.
PVC Tubing	106 298 250	25 ft (7.6m) of white Polyvinyl chloride (PVC) tubing.
	106 894 553	Express Shingle for routing a mid-span cable in and out of the OCEF

## **Fiber Protection System (FPS)**

---

Another important product that has been introduced to facilitate *LGX* Fiber Distribution Frame Cabling is the Fiber Protection System (FPS). The Lucent Fiber Protection System is recommended for use with the *LGX* Fiber Distribution Frame. Shown in the figure on the next page, the FPS is a fully enclosed system to organize and protect fiber cables. The FPS can be installed in different levels above the frame to provide even more capacity. For instance, the OSP fibers may be routed in the upper level duct while the equipment fibers are routed in a lower level duct. The FPS maintains the bend radius of all fibers as they transition into the rear of the *LGX* frame.

The Fiber Protection System can be specified with a variety of duct sizes. The system is usually designed with the larger ducts in the vicinity of the Fiber Distribution Frame, which allows for a larger number of cables that will be concentrated at the frame.

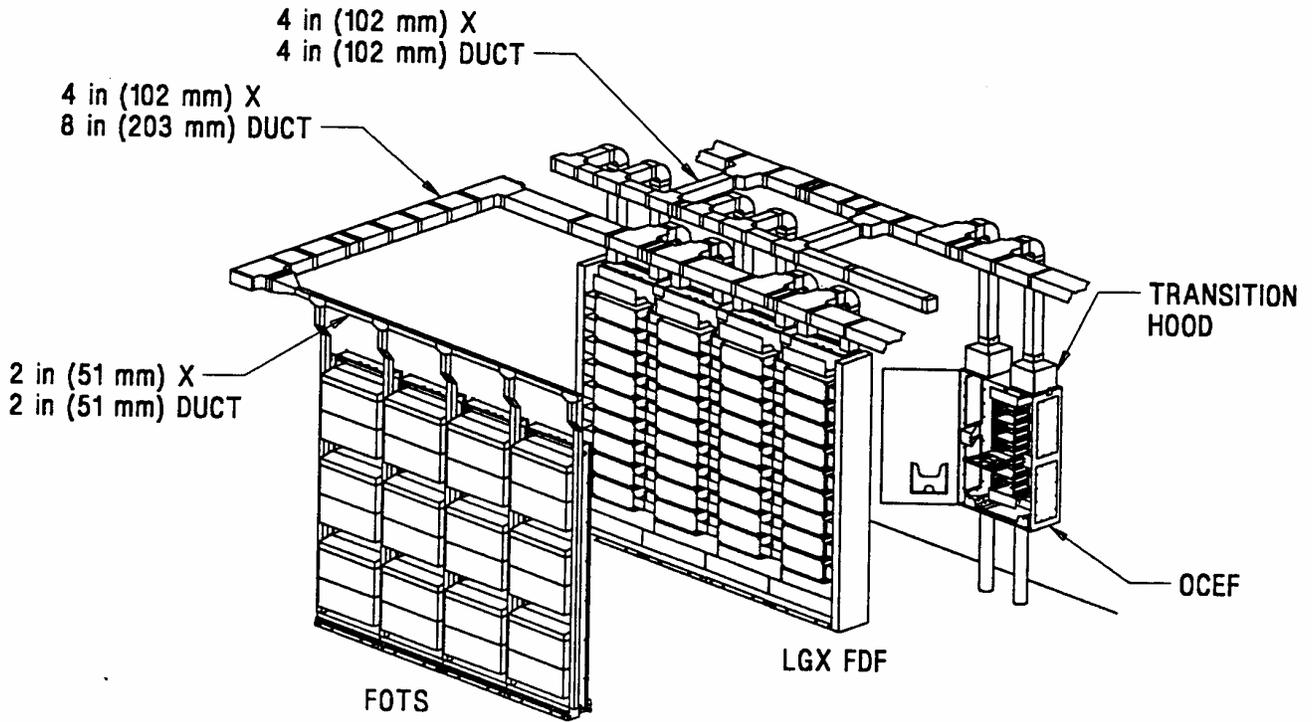
The FPS can also be retrofit into the equipment frame areas to organize and protect fibers routed into existing transmission and interconnect frames. For these applications, the FPS can be installed to clean up and protect the fiber jumper situation. Some of the excess fiber jumper slack can be taken up in storage tracks that are designed into the FPS.

The Fiber Protection System enhances the overall fiber installation with the following features:

- Orderly fiber management and growth.
- Improved reliability — fibers are protected and enclosed.
- Efficient cabling with a complete lay-in capability.
- Maintains fiber minimum bend radius.
- Can easily be customized and retrofit into most any office environment.

For more information on the Fiber Protection System, see OFS 636-299-130 or ED-8C120.

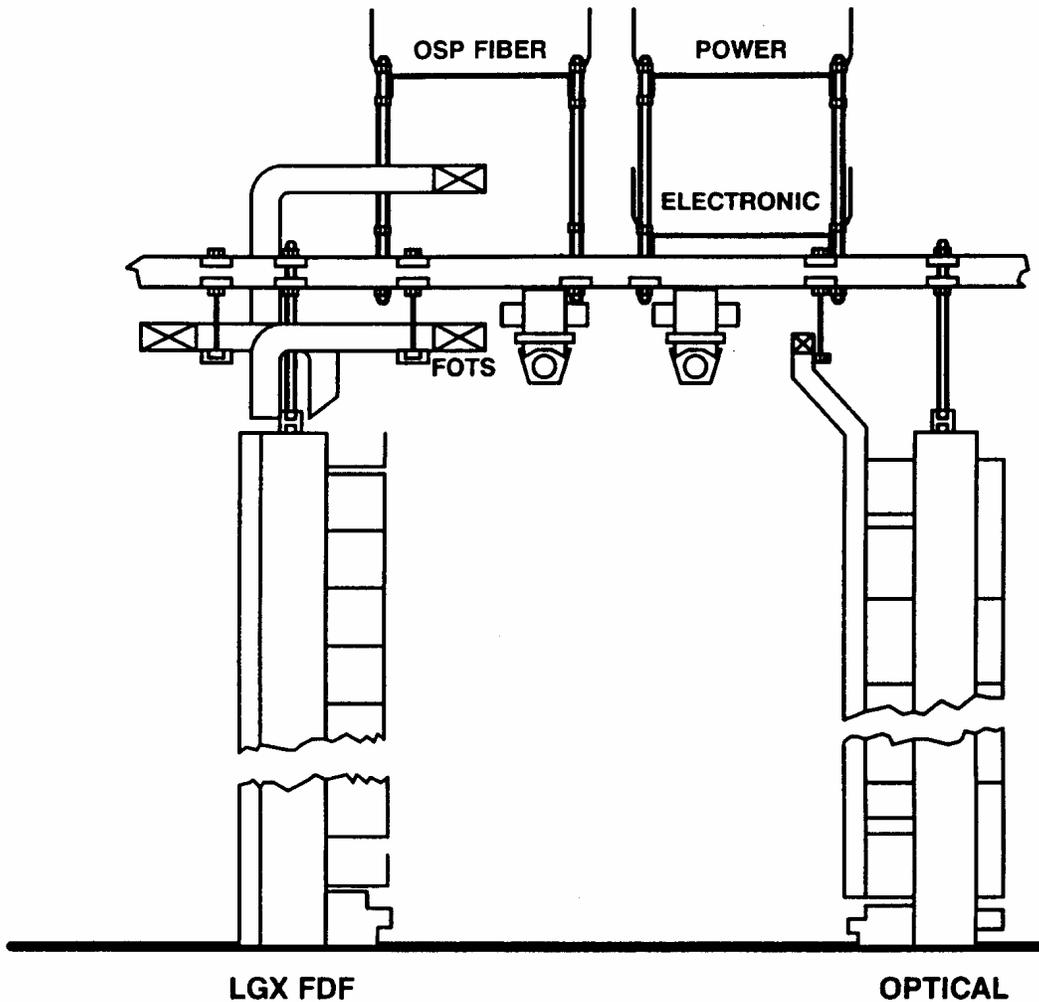
The Fiber Protection System is fully supported by OFS Engineers and Installers to provide a customized service which includes an initial site survey, detailed engineering, establishment of permanent office records, and installation.



Fiber Protection System

## Cable Management System (CMS)

A carefully designed cable racking and management system is vital to providing cable access for future growth. The Lucent Cable Management System is recommended for use with LGX FDF. This system provides a design to segregate different classes of cables that are typically routed into the area of the LGX frame. Shown in the figure below, this example of the Cable Management System integrates the FPS into the cable racking system. Lighting and AC power can also be integrated. See Engineering Section for guidelines on the Cable Management Systems.



Cable Management System

## FDF Jumpers (Patch Cords)

7

### Section Contents

---

It is important to select the appropriate jumpers for use in Fiber Distributing Frame (FDF) applications. The connector and jumper type should be of the highest quality possible. The size of the jumper should also be specified so as to minimize the jumper pileup in the horizontal raceways and vertical troughs. The length of the jumper should also be specified according to guidelines for minimizing excess slack if placed onto the FDF. For all of these reasons, a set of recommended jumpers is specified for use in FDF applications.

- *MiniCord*<sup>™</sup> Jumper Cords 7-2
- SC – SC Single-Mode Patch Cords 7-2
- LC – LC Single-Mode Patch Cords 7-3
- *ST*<sup>®</sup>II+ – *STII*+ Single-Mode Patch Cords 7-3

## **MiniCord Jumper Cords**

The recommended jumpers for FDF application are constructed from *MiniCord* jumper cordage. This cord is available in simplex and duplex varieties. The simplex cord is 1.6-mm diameter.

The most commonly used jumper cords are listed in this section. Other cords including hybrid constructions with different connectors on each end are also available. Multimode jumper patch cords are also available. For additional information and a complete listing consult the Lucent Fiber Optics Products catalog.

## **SC–SC Single-Mode Patch Cords**

<b>Simplex <i>MiniCord</i><sup>™</sup></b>	
<b>SC–SC Single-Mode Patch Cords</b>	
<b>Product Code</b>	<b>Comcode</b>
MS1SC-SC-05	107 198 228
MS1SC-SC-10	107 198 236
MS1SC-SC-15	107 198 244
MS1SC-SC-16	107 849 838
MS1SC-SC-20	107 198 251
MS1SC-SC-25	107 198 269
MS1SC-SC-30	107 198 277
MS1SC-SC-35	107 198 285
MS1SC-SC-40	107 198 293
MS1SC-SC-45	107 198 301
MS1SC-SC-50	107 198 319
MS1SC-SC-75	107 198 327
MS1SC-SC-100	107 198 335

<b>Duplex <i>MiniCord</i><sup>™</sup></b>	
<b>SC–SC Single-Mode Patch Cords</b>	
<b>Product Code</b>	<b>Comcode</b>
MS2SC-SC-05	107 198 640
MS2SC-SC-10	107 198 665
MS2SC-SC-15	107 198 830
MS2SC-SC-16	107 849 853
MS2SC-SC-20	107 198 848
MS2SC-SC-25	107 198 855
MS2SC-SC-30	107 198 863
MS2SC-SC-35	107 198 871
MS2SC-SC-40	107 198 889
MS2SC-SC-45	107 198 897
MS2SC-SC-50	107 198 905
MS2SC-SC-75	107 198 913
MS2SC-SC-100	107 198 921

## LC–LC Single- Mode Patch Cords

<b>Simplex <i>MiniCord</i>™</b>	
<b>LC – LC Single-Mode Patch Cords</b>	
<b>Product Code</b>	<b>Comcode</b>
MS1LC-LC-05	107 735 185
MS1LC-LC-10	107 735 243
MS1LC-LC-15	107 735 250
MS1LC-LC-20	107 735 268
MS1LC-LC-25	107 735 276
MS1LC-LC-30	107 735 284
MS1LC-LC-35	107 735 292
MS1LC-LC-40	107 735 300
MS1LC-LC-50	107 735 318
MS1LC-LC-75	107 735 326
MS1LC-LC-100	107 735 334

<b>Duplex <i>MiniCord</i>™</b>	
<b>LC – LC Single-Mode Patch Cords</b>	
<b>Product Code</b>	<b>Comcode</b>
MS2LC-LC-05	107 735 640
MS2LC-LC-10	107 735 665
MS2LC-LC-15	107 735 830
MS2LC-LC-20	107 735 848
MS2LC-LC-25	107 735 855
MS2LC-LC-30	107 735 863
MS2LC-LC-35	107 735 871
MS2LC-LC-40	107 735 889
MS2LC-LC-50	107 735 905
MS2LC-LC-75	107 735 913
MS2LC-LC-100	107 735 921

## ST – ST Single- Mode Patch Cords

<b>Simplex <i>MiniCord</i>™</b>	
<b>ST®II+ – STII+ Single-Mode Patch Cords</b>	
<b>Product Code</b>	<b>Comcode</b>
MS1EP-EP-05	107 306 268
MS1EP-EP-10	107 306 292
MS1EP-EP-15	107 306 300
MS1EP-EP-16	107 849 820
MS1EP-EP-20	107 306 318
MS1EP-EP-25	107 306 326
MS1EP-EP-30	107 306 334
MS1EP-EP-35	107 306 342
MS1EP-EP-40	107 306 359
MS1EP-EP-50	107 306 367
MS1EP-EP-75	107 306 375
MS1EP-EP-100	107 306 383

<b>Duplex <i>MiniCord</i>™</b>	
<b>ST®II+ – STII+ Single-Mode Patch Cords</b>	
<b>Product Code</b>	<b>Comcode</b>
MS2EP-EP-05	107 306 466
MS2EP-EP-10	107 306 490
MS2EP-EP-15	107 306 516
MS2EP-EP-16	107 849 846
MS2EP-EP-20	107 306 524
MS2EP-EP-25	107 306 532
MS2EP-EP-30	107 306 540
MS2EP-EP-35	107 306 565
MS2EP-EP-40	107 306 573
MS2EP-EP-50	107 306 581
MS2EP-EP-75	107 306 607
MS2EP-EP-100	107 306 615

## FDF Planning

8

### Section Contents

---

Proper planning and engineering of the *LGX*<sup>®</sup> Fiber Distributing Frame (FDF) can ensure trouble free service well into the future. This chapter covers guidelines for planning the Fiber Distributing Frame when used in Central Office (CO) applications and other applications requiring lineups of one or more *LGX* bay frames. Primary concerns in the planning phase are to identify fiber termination requirements and physical space constraints. It is also important to determine the correct size frame and floor space constraints.

- Planning Guidelines 8-2
- Termination Forecast 8-3
- Service Configuration 8-3
- Termination Method 8-4
- Sizing the *LGX* Frame 8-5
- Ultimate frame sizing 8-6
- Floor Space Planning 8-9
- Frame Depth 8-10
- Isle spacing 8-12
- Multiple Lineups 8-13

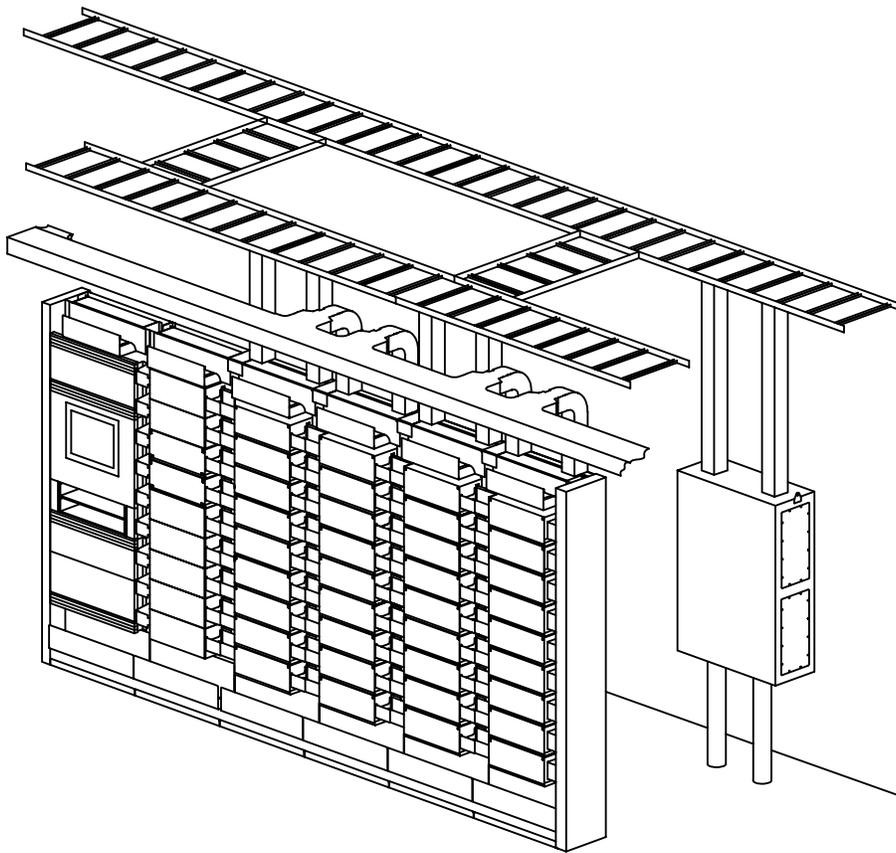
## Planning Guidelines

---

A plan should be developed or updated prior to implementing a multibay LGX Distributing Frame arrangement. The plan need not be elaborate, but should consider several key points. The following simple guidelines should be used to derive the basic FDF plan:

1. Determine termination requirements: initial and growth potential.
2. Select service configuration: cross-connect, interconnect.
3. Identify termination method: preterminated shelves, splicing, etc.
4. Determine the frame size: initial and growth potential.
5. Reserve floor space: initial and growth.

Following these guidelines will result in a plan that can be used to develop an engineering specification for the material, termination layout, and cable access system.



## Termination Forecast

---

It is recommended that a fundamental long-range plan for the **LGX** distribution system be reviewed and updated whenever a new frame is installed or when additions are made to the **LGX FDF**. The plan should include updated forecasts of the number of fibers to be installed in the following scenarios:

- **Ultimate Forecast**—The ultimate number of fibers anticipated for termination at the FDF over the life of the frame.
- **Current Needs Forecast** — The number of fibers planned for the immediate project at hand.

This data is needed to determine the frame size and floor space that will be required both initially and in the future to avoid costly rearrangements. The frame size will also depend on the termination method, service configuration, bay density, and other sizing factors for the particular site. It is strongly recommended that when the **LGX** system is sized for the installation, as many frames as possible should be installed during the initial installation to reserve space for future shelves.

## Service Configuration

---

The **LGX FDF** may be used in a variety of configurations to provide customer service by connecting **Outside Plant (OSP)** cables to the servicing equipment. The connection arrangement should be determined in the planning phase and will usually be either **cross-connect** or **interconnect**.

- **Cross-Connect** — This method of service provisioning connects an **OSP** fiber to servicing equipment with a short jumper cable. With this option, the fiber optic transmission equipment cables and **OSP** cables are routed and terminated to the termination shelves on the **LGX** frame. A short fiber jumper is routed from the outside plant termination connector to the equipment termination connector. The cross-connect provides added flexibility while building two connectors into the circuit.
- **Interconnect** — This method of service provisioning connects an **OSP** cable fiber through one connector to the servicing equipment. The **OSP** cable fiber is terminated to a connector on a termination shelf at the **LGX FDF**. A jumper is routed directly from the **OSP** termination at the FDF to the servicing equipment — typically through the overhead rack of Fiber Protection System. This interconnect provides less flexibility but builds only one connector into the circuit.

Using an interconnect service connection method typically requires only half the bays and shelves. However, the cross-connect configuration usually provides the greatest flexibility for short service intervals. In most instances, the flexibility advantage and related cost savings associated with the cross-connect outweighs the cost of the additional equipment.

## Termination Methods

---

The **LGX FDF** handles a wide variety of fiber cable constructions and can be installed with a variety of termination methods. Fiber cable constructions including **OSP** and building cables are typically terminated at the frame. (See installation instructions supplied with the product for complete cabling details.)

The **FDF size** is impacted by the cable configuration selected. In general, there are four primary ways to terminate cables at the **LGX** frame:

- **Pretermination** — Preterminated shelves or modules provide a convenient way to plan for the installation of an **LGX** frame. The use of preterminated shelves allows splicing to be removed from the FDF resulting in higher termination capacity at the frame. Using preterminated shelves, up to nine 7-inch (178 mm) high shelves can be installed on a bay frame or up to seven 9-inch (228 mm) high shelves can be installed on a bay frame. The termination per bay varies depending on the density of the shelf. In most cases, the preterminated option results in a bay density between 648 and 1,008 fibers.

The preterminated shelf may also be accompanied by a splice shelf as in the with the Multi-fiber Access and Modular Unit (MAMU) arrangement. Here the termination method is similar to high-density splice and termination method described below to provide termination densities of between 432 and 864 fibers per bay.

- **Direct Termination** — Direct termination allows individual fibers to be terminated directly to fiber connectors on the shelf. Using direct termination, up to nine 7-inch (178 mm) high shelves can be installed on a bay frame or up to seven 9-inch (228 mm) high shelves can be installed on a bay frame. The termination per bay varies depending on the density of the shelf. In most cases, the direct termination option results in a bay density between 648 and 1008 fibers.
- **Splice and Termination** — Uses a splice shelf such as the LSS1U-072/5 or LSS1U-144/7 in combination with one or two LST1U-072/7 termination shelves. When using a splice in combination with a termination shelf the frame capacity is diminished. The actual density will vary depending on the termination density and the splice density. The combined splice/termination option typically results in a bay density between 360 and 432 fibers with standard density shelves (LST1U-072/7). With high density shelves (LST1U-144/9) and mass fusion splicing, the combined density could be as high as 864 fibers.

**Thus, with a bay capacity ranging from 360 to 1008 fibers, the termination method is a key factor in determining the frame size. The controlling factor is the number and density of termination shelves that can fit into the bay. Higher densities may be possible but are usually not recommended due to possible jumper congestion that may occur in the LGX trough system.**

## Sizing the LGX Frame

---

### Selecting the Termination Capacity

The **LGX** FDF handles a wide variety of termination capacities. The FDF capacity depends on which termination method is selected and which type of shelf is selected. As a rough guide for sizing, first select the appropriate capacity per bay for the application:

- **Nominal Bay Capacity = 648 fibers** — The recommended nominal capacity for an **LGX** bay is 648 fibers based on nine 7-in (178mm) high 72-fiber termination shelves per bay.
- **High Density Bay Capacity = 1008 fibers** — The recommended capacity for a high density **LGX** bay is 1008 fibers based on seven 9-in (228mm) high 144-fiber termination shelves per bay.
- **Other Capacity** — For combined splice and termination arrangements, specify the planned number of fiber terminations per bay; for example 360, 432, 864 etc.

Note: Higher density bay configurations are feasible; however they may not be recommended. For instance, the 7-inch (178 mm) shelf can be equipped with 72 LC duplex adapters for a shelf density of 144 fibers. A bay equipped with nine of these shelves would have a termination density of 1,296 fibers. Also a 9-inch (228 mm) shelf can be equipped with 108 LC duplex adapters for a capacity of 216 fiber terminations. A bay equipped with seven of these shelves would have a termination density of 1,512 fibers. These bay densities are not recommended for multiple bay FDF lineups since jumper congestion may occur in the vertical or horizontal troughs reducing craft efficiency.

### Sizing Maintenance Equipment

In addition to selecting the desired bay capacity, the frame sizing should also take into consideration space requirements for ancillary equipment. For example an extra bay may be dedicated for an OpCenter to be located in the same lineup as the FDF bays. In addition, other equipment may consume space in the FDF bays including Communications Panel or Passive Optical Component modules such as Splitter Modules or Wavelength Division Multiplexer (WDM) modules. In special cases as with the **LGX** Broadband Fiber Management system, active electronics may be placed in the same lineup with the FDF bays.

If the specific requirements for ancillary equipment are not known, a reasonable estimate should be provided. For example in a large frame arrangement, it may be reasonable to expect that up to two-bays may be reserved in the FDF lineup for ancillary equipment. This may include an OpCenter, Communications Panel, and other miscellaneous modules.

In addition, the FDF lineup should reserve an additional space at the ends of the lineup for End Guards. Since each End Guard is 3 inches (76mm) wide, a total space of 6 inches (152 mm) should be reserved in each lineup for End Guards.

## Ultimate Frame Size

OFS recommends that a new installation be planned and sized for the ultimate termination requirements. This allows reservation of floor space to install and connect the system of LGX bay frames. Another objective is to reserve continuous space so that the total number of bays required over the life of the FDF can be positioned in a continuous lineup.

A simple calculation should determine the ultimate frame size. For example, divide the ultimate fiber termination requirements by the fiber capacity per bay to determine the number of bays required. Add to the number of bays the capacity or number of bays required for ancillary equipment. The total number of bays is multiplied by the width of each bay to determine the length of the lineup required for the ultimate frame. The ultimate frame length will determine the amount of floor space that must be reserved for growth.

For example suppose the ultimate termination requirements for a site is 10,000 fibers and we are using the nominal termination capacity of 648 fibers per bay. The number of bays is equal to  $10,000/648$  or 15.4 bays. This is rounded to the next highest even number of bays or 16 bays for the ultimate size. The capacity of 2 bays of ancillary equipment is added to the 16 fiber termination bays resulting in a total frame size of 18 bays. Since the width of a bay is 26 inches (660 mm), the length of this frame lineup is 26 inches (660 mm) multiplied by 16 bays which equals 468 in or 39 feet (11.8 m). End Guards are added to both ends of the lineup to bring the total length of the ultimate FDF lineup to 474 in or 39.5 feet (12 m).

After computing the ultimate FDF lineup size, the floor space plan should be reviewed (see Floor Space Planning) to make sure that the required space is available or can be made available for the ultimate frame. It may be possible that the initial floor space is not available to meet the ultimate frame length, but that the initial frame can be positioned where it will grow into space that is available. If continuous linear space is not available, it may be possible to divide the FDF into two lineups. The floor space plan should be coordinated with the overall cable management plan to provide access to the FDF for all cables anticipated over the life of the frame.

## Current Needs Frame Size

The LGX system is sized to meet current termination needs following a similar approach to that used for ultimate frame sizing. Factors such as termination method and service configuration and bay density must be considered in the sizing equation. The number of bays needed for the project at hand can be roughly determined by dividing the current fiber termination requirements by the termination capacity per bay. In addition to LGX bay frames and termination shelves, additional space should be allocated for ancillary equipment that may occupy space in the FDF lineup. The initial frame size will determine the floor space equipment that must be ordered to satisfy near term requirements.

For example, suppose that the current project has termination requirements for 5,000 fibers and we are using the nominal termination capacity of 648 fibers per bay. The number of bays is equal to  $5,000/648$  or 7.7 bays. This is rounded to the next highest even number of bays or 8

bays for the current requirements. The capacity of 2 bays of ancillary equipment is added to the eight fiber termination bays resulting in a total frame increment of ten bays. Since the width of a bay is 26 in (660 mm), the length of the FDF bay lineup to be added is 26 inches (660 mm) multiplied by ten bays which equals 260 inches or 21.6 feet (6.6 m). End Guards are added to both ends of the lineup to bring the total length of the current FDF lineup project to 266 inches or 22 feet (6.8 m). Keep in mind that the current frame lineup may be added to an existing lineup. In this case, the total space requirements will be the existing FDF lineup plus the current requirements for the FDF bays to be added.

### Maximum Frame Size

Many factors are considered when recommending the maximum frame size including:

- **Horizontal Raceway Capacity** — The **LGX** FDF utilizes the optimum lineup architecture with two horizontal raceways; one at the bottom and one at the top. The cross-sectional area of these raceways provides a fixed capacity for jumpers routed between bays. As the pileup of jumpers in the horizontal raceway increases, it may be more difficult to remove a jumper. For most applications it is desirable to maintain an FDF frame with a pileup of less than 2 inches (51 mm) to facilitate easy placement and removal of jumpers. The horizontal troughs on the **LGX** system will accommodate a larger pileup of up to 4 inches (102 mm) before the troughs will overflow. However, the maximum frame size is based on a 2-inch (51 mm) limit to ensure efficient operations.
- **Jumper Size/Technology** — The size of the jumper used is a major factor in determining the jumper pileup in the horizontal raceways. Use of newer technologies may significantly reduce the pileup and increase the maximum capacity of the frame. For example jumpers having diameter of 1.6 mm provide a significantly larger frame capacity than jumpers of 3 mm.
- **Frame Layout** — The particular fiber termination layout (Outside Plant and Transmission Equipment fiber) can significantly influence the maximum size of the FDF. In some cases, a spread layout or a zoned layout will result in a more even distribution of cross-connect jumpers if administered properly with preference towards short jumpers. Conversely the lack of an equipment layout or the lack of enforcing short jumpers can lead to greater jumper pileups in the horizontal raceways (see Engineering Section).
- **Jumper Assignment Method** — The jumper assignment method can significantly influence the maximum frame size. A preferential assignment method may be used to select connection points on the FDF that are relatively close to each resulting in the shorter lengths. The preferential assignment method can be used to help keep the length of jumpers short and thereby reduce the overall number of jumpers at any point in the raceway. For the preferential assignment method to be truly effective, it must be enforced at the time the circuit is specified.
- **Software Administration** — As a frame size increases, it becomes increasingly important to follow recommended administrative and operations guidelines. The guidelines for Jumper Selection and Routing become increasingly important. The OFS Fiber Administration System (FAS) is recommended to support FDF frame installations. The FAS system provides an embedded Jumper Selection and Routing algorithm that ensures the

consistent application of jumper routing guidelines. This approach helps to reduce the overall jumper pileup at any point that would occur if jumpers are not distributed throughout the raceway system.

**The maximum size frame is based on parameter studies. The studies make use of empirical data for jumper pileup as well as assumptions about typical layout, assignment, and administration.**

**The maximum size FDF lineup is based on an objective to maintain the jumper pileup less than 2 inches (51 mm). While this may seem arbitrary it has been demonstrated that pileups that exceed 2 inches can reduce craft effectiveness. The table below also includes the assumption that all jumpers used have diameter of 1.6 mm or smaller.**

<b>Maximum Recommended Frame Size</b>		
<b>Parameter</b>	<b>Standard Density</b>	<b>High Density</b>
Termination Shelf	72	144
Shelves per Bay	9	7
Cross-Connect Bay	648	1,008
Maximum Size Lineup	20	12
Maximum No. Fibers	12,960	12,096

### **Considerations for Larger Frames**

**If the frame size exceeds the recommended maximum, other alternatives may be considered. Special planning and engineering will usually be required to ensure full connectivity without congestion. A second lineup should be considered if the lineup exceeds the maximum length or number of bays. In this case, a second lineup should be positioned immediately facing the first lineup across an aisle. The cross-aisle bridge may be used to facilitate jumper routing between the two lineups. A more careful study and analysis may be required as the termination requirements approach the limits of the frame. Also, some form of mechanized administrative system may be needed to manage such a large LGX distribution system. A plan should be developed to closely monitor the jumper pileup. The LGX system makes provisions for larger jumper raceways or adjustable raceways that can be retrofitted to the frame if warranted. OFS technical support can provide assistance in planning and implementing larger lineups or multiple lineups.**

## **Floor Space Planning**

---

**The LGX Distributing Frame may be installed to accommodate the termination requirements of most any size application. An initial application may involve a single LGX frame or several frames. It is desirable to allow sufficient floor space to grow the LGX frames in a continuous lineup. The lineup may be located in a transmission equipment area adjacent to Fiber Optic Transmission System (FOTS) equipment. Alternatively, the LGX FDF may be located over a cable entrance facility on the first floor. Whatever the desired location, the floor space plan should be examined to verify that sufficient space is available for both the initial and ultimate installation.**

### **Lineup Length**

In most applications OFS recommends reserving an entire lineup for FDF growth. A 20-bay frame lineup requires approximately 44 feet (13.4 m) of contiguous space for a frame lineup. Reserving this space for continuous lineup growth will provide a buffer against uncertain fiber termination needs in the future. Additional space may be required if more than one lineup is anticipated. Space should also be reserved for craft operations to the front, rear and sides of the frames.

### **End Guard**

Space should also be reserved at each end of a lineup for a 3-in (76mm) wide end-guard. End Guards are available in 12 inch (305 mm), 15 inch (381 mm), 18 inch (457 mm) and 24 inch (610 mm) varieties. All End Guards are 3 inches (76 mm) wide.

### **Frame Depth**

The floor plan requires that the *LGX* frame dimensions be specified per the desired application. *LGX* frames are available in the following depths:

- **12-inch (305 mm) depth** — Allows the *LGX* FDF to be installed in virtually any existing lineup within the central office equipment area.
- **15-inch (381mm) depth** — Standard *LGX* FDF frame provides additional cabling space in the rear of the frame.
- **24-inch (610 mm) depth** - Broadband Fiber Management System; for example lineup of Fiber Distributing Frame Bays (FDB), Electronic Equipment Bays (EEB), and OpCenter Bays.

FLOOR PLAN DATA SHEET			
IDENTIFICATION	PHYSICAL	CABLING	HEAT RELEASE
MFGR: LUCENT TECH MFGR CODE: ED-6C321-50 RATING: STANDARD DESIGNATION: LGX CLE BASIC CODE: LGX	NEBS COMPATIBLE: YES HEIGHT: 7 FT (2.1 m) DEPTH: 12 IN (305 mm) WIDTH: 26 IN (660 mm) WEIGHT: 300 lb (1334 N) TYPE: UNEQUAL FLANGE	EFFECTIVE CABLING AREA 36 SQ-IN (23,100 SQ-MM)	
<ol style="list-style-type: none"> <li>DIMENSIONS APPLY TO ALL 12-IN (305 mm) SINGLE BAYS.</li> <li>DIRECTION OF LINEUP GROWTH MAY BE LEFT OR RIGHT.</li> <li>INSTALLATION OF OPTIONAL REAR DOOR ADDS 0.75 IN (19mm) TO THE FRAME DEPTH.</li> <li>300 LB LOAD (1334 N) WEIGHT INCLUDES A COMPLETELY LOADED BAY, OVERHEAD RACK, AND MAXIMUM CABLE LOADING.</li> </ol>			
LGX DISTRIBUTING FRAME SINGLE BAY - 12 in (305 mm)		SERIES 801-525-167	

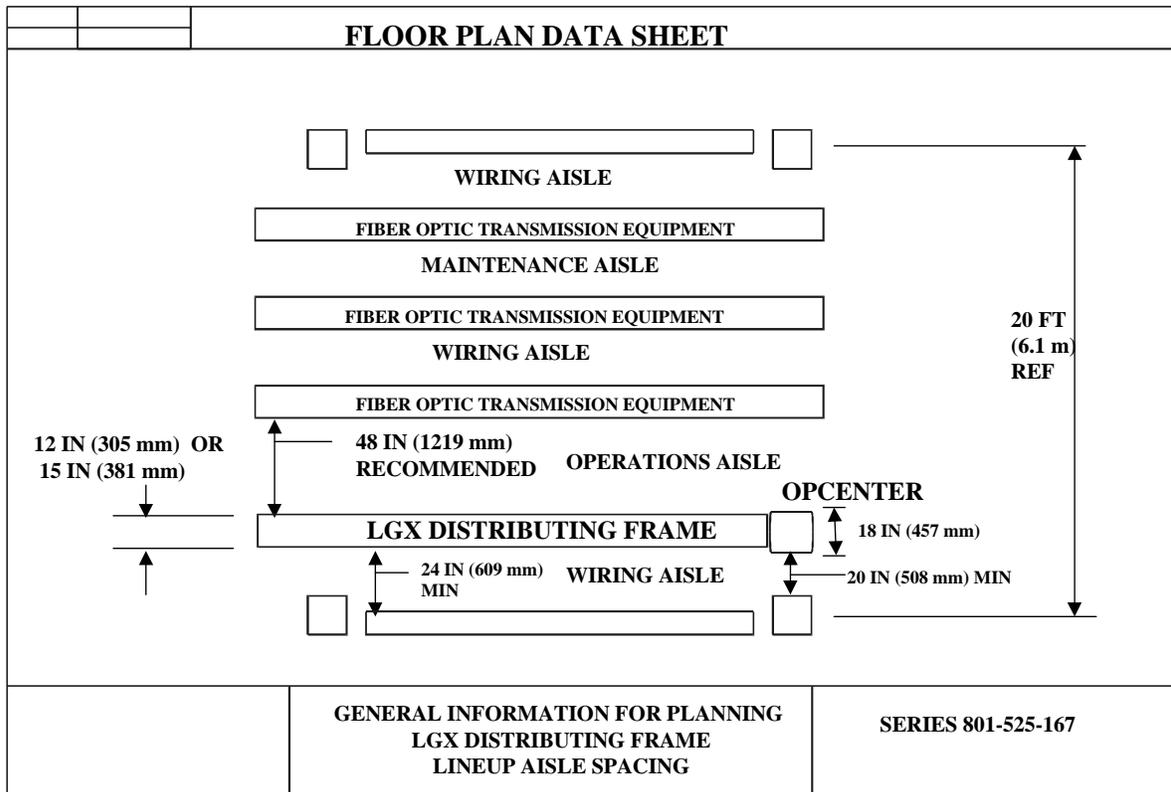
FLOOR PLAN DATA SHEET			
IDENTIFICATION	PHYSICAL	CABLING	HEAT RELEASE
MFGR: LUCENT TECH MFGR CODE: ED-6C321-50 RATING: STANDARD DESIGNATION: LGX CLE BASIC CODE: LGX	NEBS COMPATIBLE: YES HEIGHT: 7 FT (2.1 m) DEPTH: 15 IN (381 mm) WIDTH: 26 IN (660 mm) WEIGHT: 300 lb (1334N) TYPE: UNEQUAL FLANGE	EFFECTIVE CABLING AREA 72 SQ-IN (46,450 SQ-MM)	
<ol style="list-style-type: none"> <li>DIMENSIONS APPLY TO ALL 15-IN (381 mm) SINGLE BAYS.</li> <li>DIRECTION OF LINEUP GROWTH MAY BE LEFT OR RIGHT.</li> <li>INSTALLATION OF OPTIONAL REAR DOOR ADDS 0.75 IN (19 mm) TO THE FRAME DEPTH.</li> <li>300 LB LOAD (1334N) WEIGHT INCLUDES A COMPLETELY LOADED BAY, OVERHEAD RACK, AND MAXIMUM CABLE LOADING.</li> </ol>			
LGX DISTRIBUTING FRAME SINGLE BAY - 15 in (381 mm)		SERIES 801-525-167	

FLOOR PLAN DATA SHEET			
IDENTIFICATION	PHYSICAL	CABLING	HEAT RELEASE
MFGR: LUCENT TECH MFGR CODE: ED-6C321-50 RATING: STANDARD DESIGNATION: LGX CLE BASIC CODE: LGX	NEBS COMPATIBLE: NO HEIGHT: 7 FT (2.1) DEPTH: 24 IN (610 mm) WIDTH: 26-IN (660 mm) WEIGHT: 300 lb (1334 N) TYPE: UNEQUAL FLANGE	EFFECTIVE CABLING AREA 96 SQ-IN (62,000 SQ-MM)	
<p>1. DIMENSIONS APPLY TO ALL 24 IN (381 mm) SINGLE BAYS.</p> <p>2. DIRECTION OF LINEUP GROWTH MAY BE LEFT OR RIGHT.</p> <p>3. INSTALLATION OF OPTIONAL REAR DOOR INCLUDED IN THE FRAME DEPTH.</p> <p>4. 300 LB LOAD (1334 N) WEIGHT INCLUDES A COMPLETELY LOADED BAY, OVERHEAD RACK, AND MAXIMUM CABLE LOADING.</p>			
<p>The diagram shows a side view of the frame. The total width is 26.0 in (660 mm). The height is 24.0 in (610 mm). The depth of the frame is 3.0 in (76 mm). The front depth is 25.87 in (657 mm). An 'END GUARD' is shown on the left side. The 'FRONT' is indicated on the right side.</p>			
<b>LGX BROADBAND FRAME</b> EEB, FDB OPCENTER - 24 in (610 mm)		<b>SERIES 801-525-167</b>	

### Aisle Spacing

Floor Plan Data Sheets (FPDS) show the space requirements and floor space requirements for egress aisles near the FDF lineup. The floor plan requires that the **LGX Distributing Frame** be positioned to allow adequate space around the lineups to service fiber optic terminations and jumpers and to allow craft to safely enter and exit the frame area. The following guidelines should be adhered to:

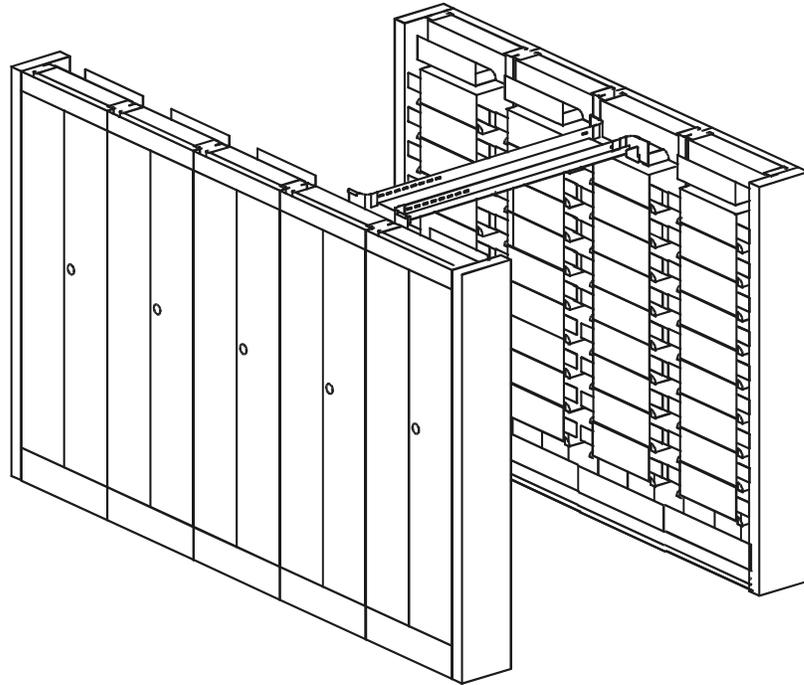
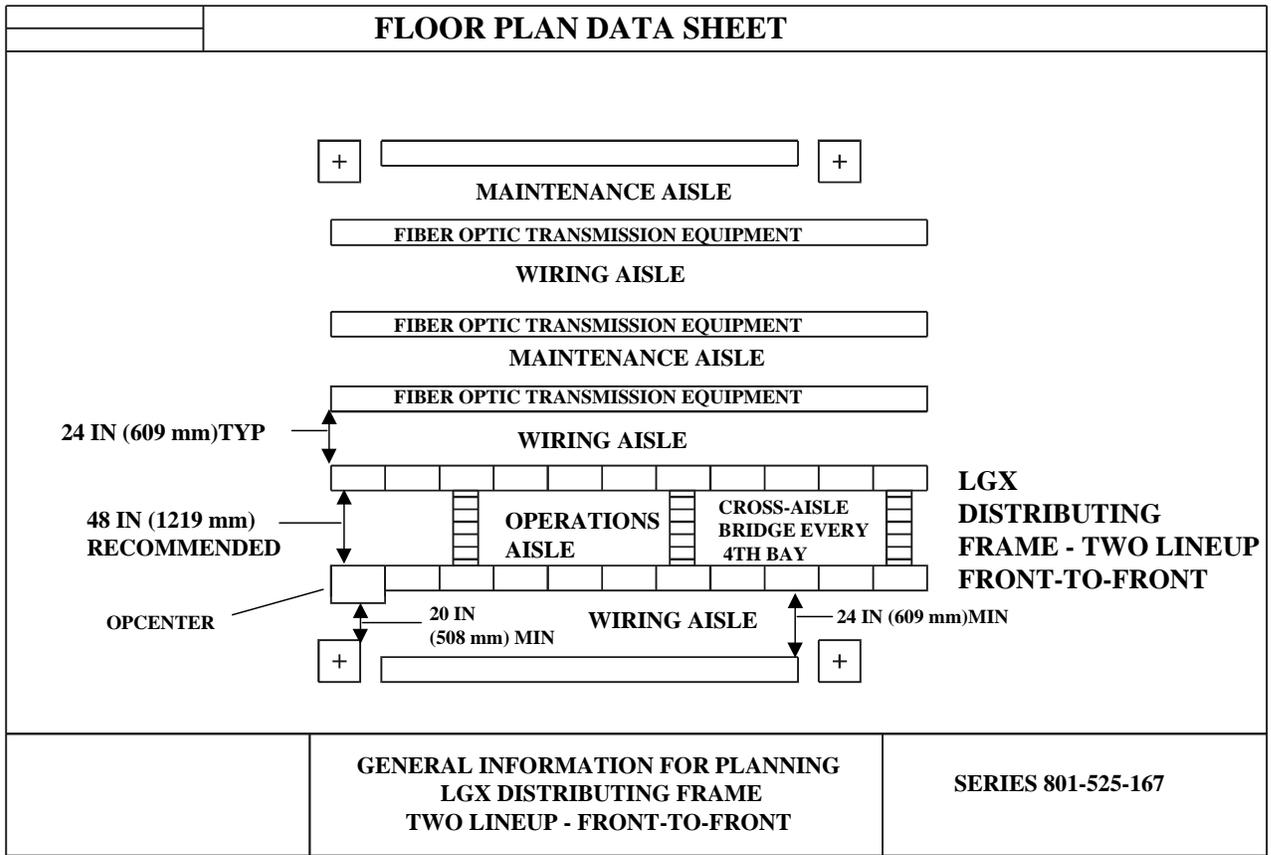
- **Front Aisle**—The front of the **LGX** Distributing Frame lineup should face the Operations Aisle to provide sufficient space for high craft activity. It is recommended that the front Operations Aisle be sized at a 48-in (1219mm) width for normal use. The Operations Aisle may be specified at a smaller size, but jumper activities may be severely constrained if the aisle is specified below 42 inches (1067 mm).
- **Rear Aisle** — The Wiring Aisle to the rear of the **LGX** Distributing Frame lineup should be sized to a minimum of 24 inches (609 mm).
- **Nearest Obstruction** — The **LGX** Distributing Frame should not be located within 20 inches (508 mm) of an obstruction such as a building structural column.



## Multiple Lineups

In cases where the capacity of the frame cannot be fit in one lineup, it is possible to provide two or more lineups and manage multiple lineups as a single system. Where multiple lineups are planned care must be taken to ensure that the jumpers can be routed between the lineups. The following recommendations should be applied:

- **Recommended: Install lineups “front-to-front”** — If a second FDF lineup is installed, it should be positioned so that it faces the front of the first FDF lineup. The front-to-front arrangement requires the exact alignment of frames on both sides of the aisle separating the two frames. The front-to-front arrangement allows the use of a cross-aisle bridge for continuous jumper running from one FDF lineup to the second lineup. The Fiber Administration System software application requires that the bridged frames be facing each other so that the program can properly route short jumpers.
- One cross-aisle bridge may be utilized in short lineups. However, in longer lineups, it is recommended that cross-aisle bridges be installed periodically along the length of the lineup. A typical recommendation is to install the cross-aisle bridge at every fourth bay along a multibay lineup.
- It is not always possible to connect frame lineups with the cross-aisle bridge because the bridge is only effective at connecting two lineups at a time. When three or more lineups are installed, or if a frame is positioned by itself remote from the main FDF lineup, alternate means of interconnection must be provided to route jumpers between lineups. An alternate jumper pathway may be constructed (custom engineered) through use of the fiber protection system (interconnection system) or by using standard cable racking (see cable racking).



## FDF Engineering

9

### Section Contents

---

Proper engineering of the LGX<sup>®</sup> Fiber Distribution Frame (FDF) is essential to ensure trouble free service well into the future. This section provides engineering guidelines for Central Office (CO) applications and other applications requiring lineups of one or more LGX bay frames. The engineer is required to identify an optimal frame arrangement, develop fiber termination details, and specify the proper engineering layout and cable access pathway designs. This chapter covers engineering guidelines as follows:

- Bay Arrangement 9-2
- Lineup Growth Sequence 9-4
- Maintenance Equipment 9-8
- Typical Equipment Layout 9-9
- Single Bay Layout 9-12
- Multiple Frame Lineups 9-13
- Detailed Equipment Specification 9-14
- Structured Cabling Plan 9-19
- Overhead Cable Access 9-21
- Bottom Cable Entry 9-23
- AC Power 9-27

### Bay Arrangement

---

#### Bay Capacity

The FDF arrangement should be established consistent with the planning guidelines and fundamental long-term plan established in the FDF planning section. The FDF arrangement will typically consist of multiple bays in a continuous lineup. The bays will either be standard density (648 fibers/bay) using the 7 in (178 mm) LST1U-072/7 shelves or high density (1,008 fibers/bay) using the 9 in (228 mm) LST1U-144/7. The FDF arrangement may consist of a mixture of these bays within the same lineup. It is also possible to provide a mixture of different density shelves within the same bay. The engineer should verify the density and bay capacity are consistent with the fundamental FDF plan and with the recommended limits as stated in the planning guidelines.

In general the FDF arrangement will be consistent with the following bay and frame lineup capacities.

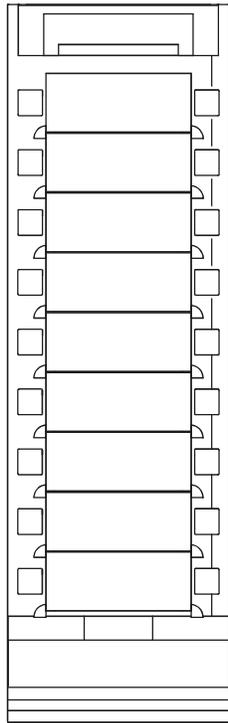
Density	Shelf	Shelves/Bay	Bay Capacity
Standard	LST1U-072/7	9	648 fibers
High	LST1U-144/9	7	1,008 fibers

The FDF arrangement may also require inclusion of maintenance equipment to be installed within the same bay as FDF shelves or within the same lineup as FDF equipment. Installation of maintenance equipment in the lineup may have the effect of somewhat reducing the bay capacity.

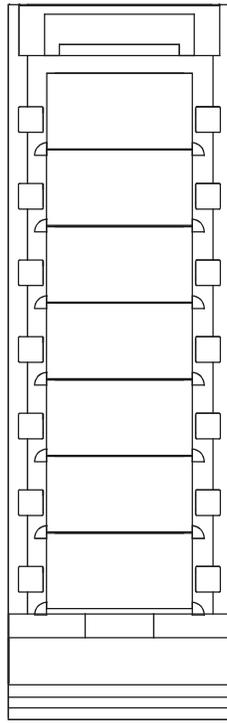
The engineer should verify the termination requirements for the site and determine the termination capacity planned for each bay. This should result in a specification for the type and number of shelves and the number of bays to be provided.

### Alternating Bay Layout

In most applications where more than one LGX bay frame is required, an alternating bay arrangement is recommended. The alternating bay arrangement segregates Outside Plant (OSP) terminations and Fiber Optic Transmission System (FOTS) equipment terminations into alternate bays. The primary advantage of the alternating bay layout is that it organizes OSP and FOTS equipment terminations into alternating bays for administrative purposes, providing an efficient interface for operations and maintenance personnel working at the frame. Note that the alternating bay layout may not always result in a perfectly balanced frame arrangement. In some instances, OSP bays may be more heavily concentrated than FOTS bays. This imbalance is usually acceptable and can accommodate other factors such as maintenance equipment within the less populated bays.

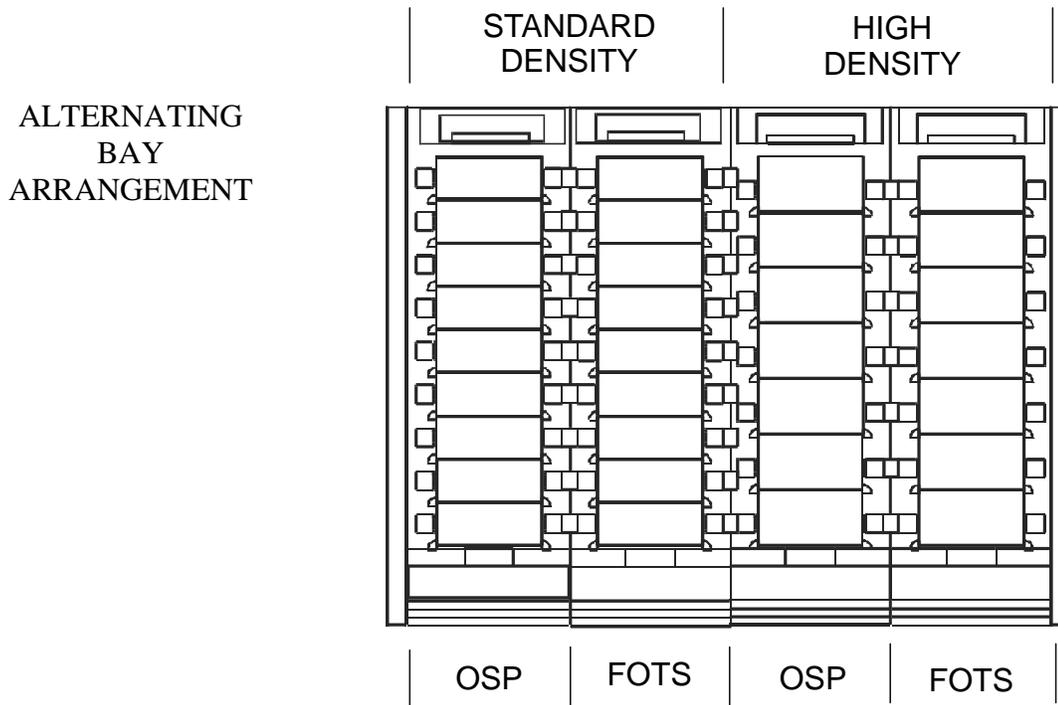


STANDARD BAY



HIGH DENSITY BAY

9 SHELVES – 72 FIBERS EA    7 SHELVES – 144 FIBERS  
EA



## Lineup Growth Sequence

In developing a multiple bay termination arrangement, the engineering process should consider the best approach for growing the frame in the future. The growth plan should be in conformance to the long range plan to provide adequate capacity for the ultimate installation.

### Spread vs. Blocked-In Layout

As part of the engineering process, the engineer is required to specify an FDF layout that accommodates growth. This will typically be in the form of a spread layout or a blocked-in layout. The tradeoffs are discussed as follows:

- Spread Layout** — An FDF “spread” layout initially populates only a few shelves per each bay in the frame lineup. This arrangement usually requires installation of additional frames than are required for the immediate termination needs. Growth is accomplished by adding shelves to the vacant space each bay. The benefit of a spread layout is realized in the future when some of the FOTS equipment is retired in favor of newer electronics with higher capacity or enhanced capabilities. It may be desirable at that time to connect some of the older OSP fibers to newer FOTS equipment. By locating terminations of the newer FOTS equipment close to the older OSP fiber cables, the cross-connection can be made with a relatively short jumper. Another advantage of the spread layout is that space is preserved on each bay for the unforeseen — for example, if growth accelerates in the future, it

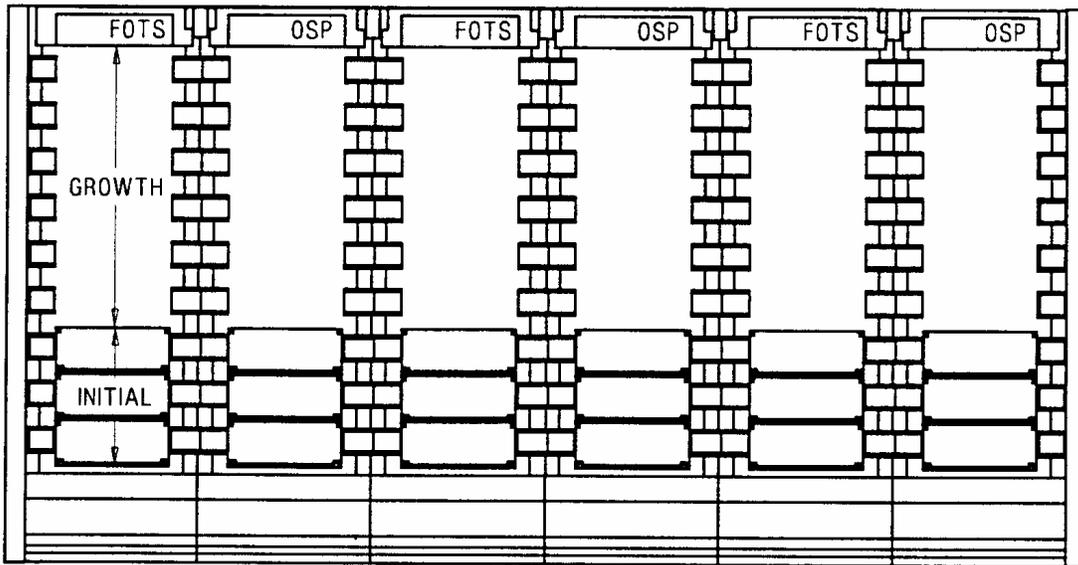
may become necessary to place new high-density termination shelves on each frame to distribute the growth.

- **Blocked-In Layout** — Growing an FDF in small increments can sometimes block-in an equipment arrangement. For instance, if existing OSP terminations are located at one end of the frame in an incremental growth arrangement, then the only space available in the future for enhanced FOTS equipment will be at the opposite end of the frame. The result is that older OSP fibers/customers requesting newer enhanced services must be connected to new FOTS equipment with a longer cross-connect jumper. Also, by blocking-in the fiber terminations, space is not available in the first bays for the unforeseen equipment that may be required in the future.

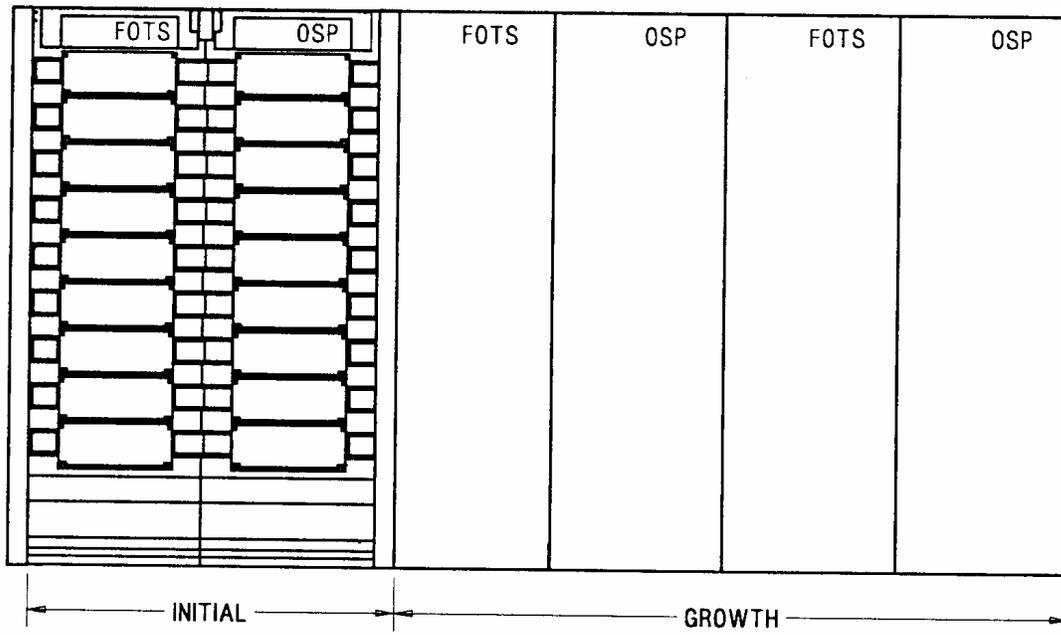
**In larger applications growing to more than just a few bays, the preferred approach is to spread terminations. This will typically involve installing more frames than are initially required, reserving space in all frames, and using the reserved space in the final growth stages of the frame.**

#### **Preferential Equipment Placement**

**When OSP fibers are spread across a long frame, the engineering process should locate the serving FOTS equipment fiber terminations as close as possible to the OSP fiber to be connected. This preferential engineering layout will usually result in OSP fibers and connecting equipment being located in adjacent bays and therefore reducing jumper lengths.**



SPREAD LAYOUT



BLOCKED-IN LAYOUT

### Incremental Growth

An incremental growth plan can be implemented to have the benefits of a spread layout by reserving appropriate space for future growth in each

incremental frame addition. For instance a two-bay or four-bay increment can be installed with only a partial complement of shelves. Some of the reserved space in these incremental bays will eventually be used for termination of OSP and FOTS fibers. Several shelf positions are also reserved for future use — for example, for tie-pairs or for future test access shelves. By reserving shelf positions for future use, a margin of safety can be achieved with the incremental growth arrangement.

#### **Frame Sizing Adjustment**

When space is reserved in the frame for future use, the number of shelf positions reserved effectively reduces the initial termination space in the bay. The initial frame size should be reviewed to determine if more bays are required at the initial installation.

#### **Two-Bay Growth Increment**

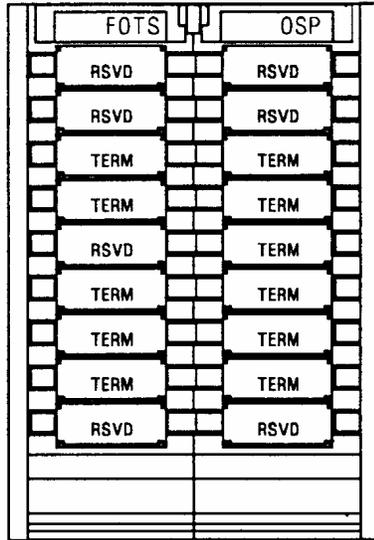
A multiple bay LGX frame can be easily implemented by at first installing two-bays, and then by growing in increments of two-bays. This typical arrangement has populated some of the shelf positions while others are reserved for future use.

#### **Four-Bay Growth Increment**

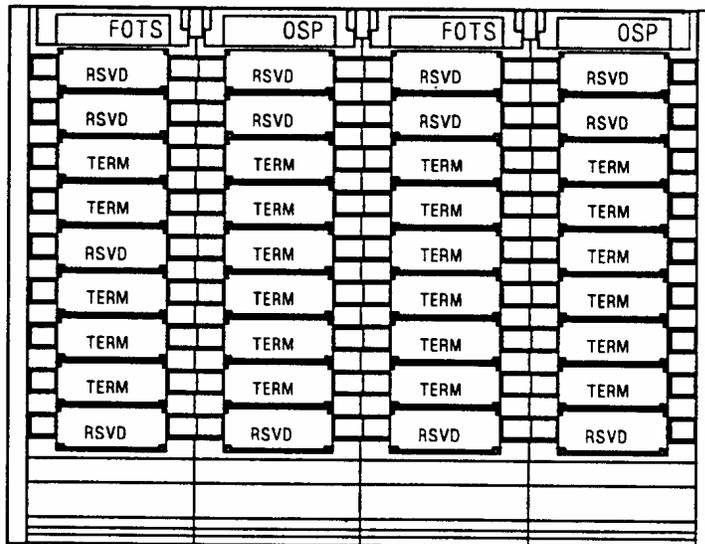
A multiple bay LGX frame can be easily implemented by at first installing four bays, and then by growing in increments of two bays or four bays. The arrangement has populated some of the shelf positions and has reserved space for future terminations or test access shelves.

#### **Growth Sequence**

To accommodate growth, the incremental growth plan provides additional bays at the end of an existing FDF lineup. Use of reserved space on existing bays is deferred until most or all of the ultimate number of bays in the lineup has been installed. Space reserved in the initial bays will be utilized after the ultimate number of bays has been reached. By reserving the appropriate space, frames can be expanded in growth increments of 2 bays, 4 bays, or any desired increment. The frame can be expanded to the desired length — say up to 20 bays in an incremental fashion. After the ultimate number of bays has been installed, the reserved space can be utilized for additional growth terminations. If more than one FDF lineup becomes necessary, the reserved space on the initial lineup should be conserved and used for tie-pairs should they become necessary to connect to another lineup.



TWO-BAY INCREMENT

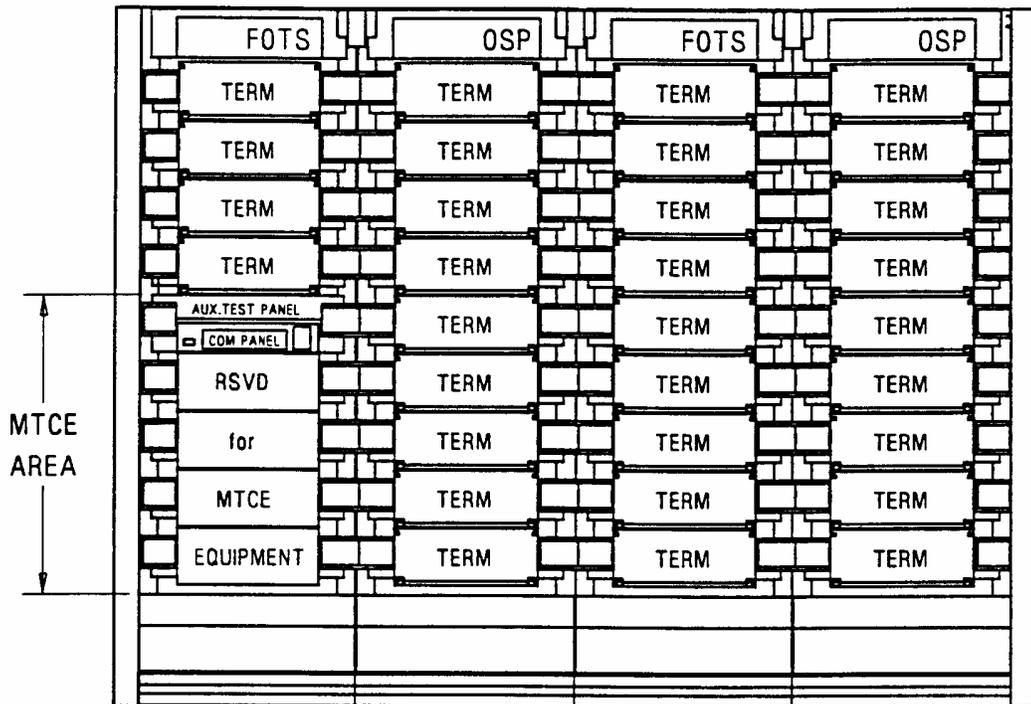


FOUR-BAY INCREMENT

**Reserving Space in Incremental Growth Plans**

## Maintenance Equipment

An FDF multibay equipment layout will often call for Test Access Shelves and other equipment in the FDF lineup. For instance, it is recommended to place a communications panel in every fourth equipment bay — thus providing a convenient means of communicating during operations or maintenance of fiber circuits. Space is also reserved on the frame for Test Access Shelves and other maintenance equipment. All of the equipment used in frame or circuit maintenance can be grouped together on the FDF to form a maintenance area. The maintenance area will typically consume a portion of the FOTS equipment bay on the frame and may be repeated periodically — say every fourth bay. Note that the maintenance equipment reduces the termination capacity of the equipment bay by one or more shelf mounting positions — in sizing the FDF, extra space should be planned for accordingly.



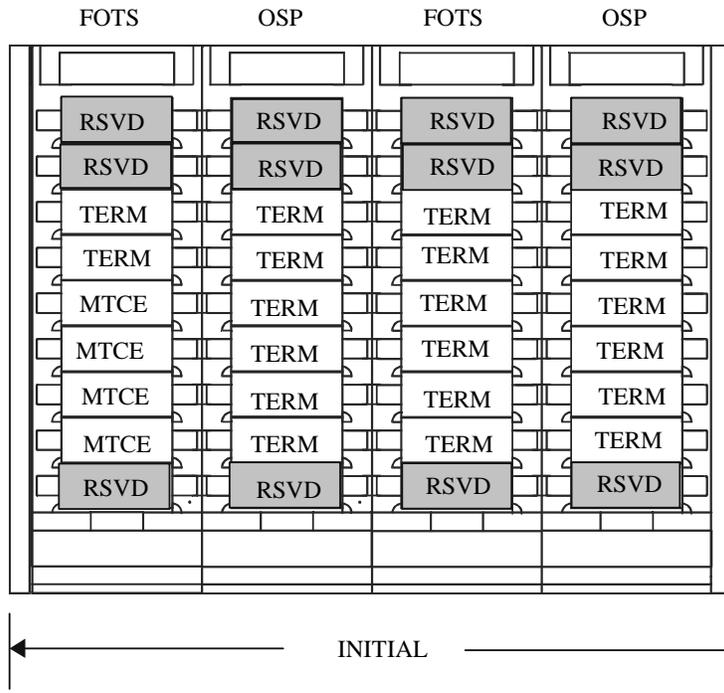
Multibay Arrangement with Maintenance Equipment

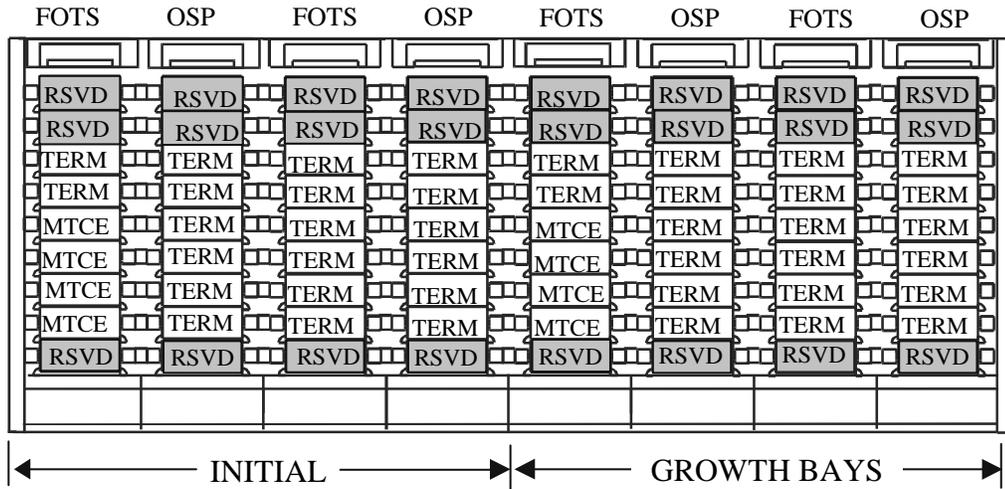
## Typical Equipment Layout

A typical equipment layout should be developed to encompass the initial, growth, and ultimate FDF plan. The multibay layout will typically be specified as follows:

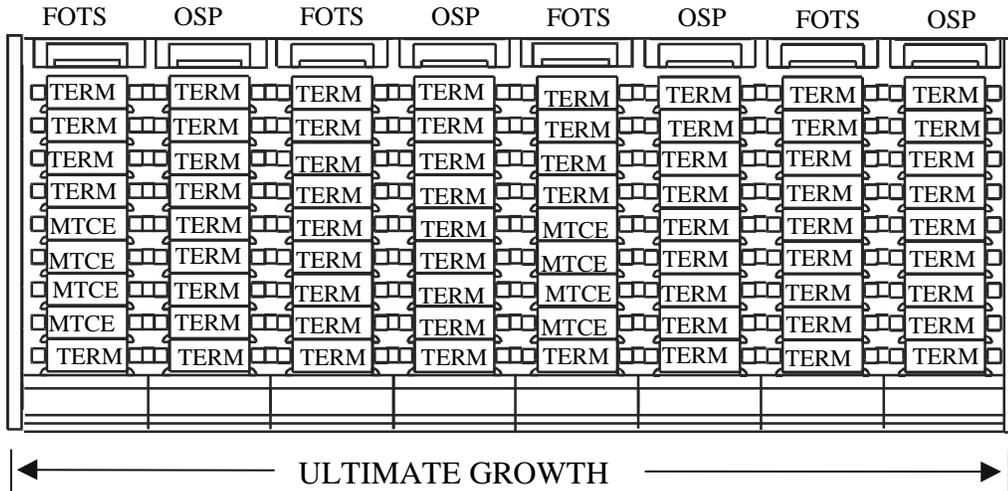
- Select bay capacity — consistent with the fundamental long-term plan for the site — standard density (648 fibers/bay) or high density (1008 fibers/bay).
- Specify alternating bay layout for most multibay arrangements — Outside Plant (OSP) in one bay and Fiber Optic Transmission System (FOTS) terminations in an adjacent bay.
- Specify growth increment (two, four, or more bays).
- Specify spread layout for terminations into the growth increment.
- Specify locations for Fiber Optic Termination Shelves (TERM)
- Reserve shelf positions on bays for growth (RSVD).
- Reserve shelf positions for Test Access Shelves, Communications Panel, and other maintenance Equipment (MTCE).

A typical initial configuration for a multibay equipment layout is shown in the figure below. This initial arrangement is shown with shelf positions reserved for future use. The final growth occurs by using reserved positions in the bays. While this typical example reaches the ultimate size in just a few steps, a more realistic frame will evolve through many steps as OSP and FOTS terminations are added to the frame.





**Typical Equipment Layout — Growth Stage**

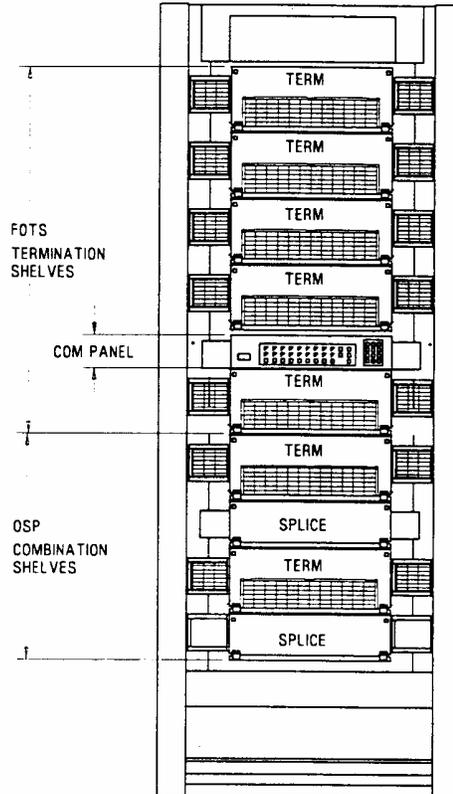


**Typical Equipment Layout — Ultimate**

## Single Bay Layout

In special circumstances, the single bay FDF may be appropriate for smaller applications. Careful planning is required when anticipating future growth. If growth demands will require the addition of more bays into a multibay lineup, OFS recommends that the installation start with a multiple bay lineup as described in the previous section.

A single bay FDF arrangement consists of a single LGX Frame Bay for use in smaller termination applications. Single bay installations usually require an ultimate capacity of at most several hundred fibers. In typical cross-connect applications, both outside plant and equipment cables will be terminated in the same bay. As shown in the figure below, the Fiber Optic Termination System (FOTS) is terminated on the FOTS termination shelves at the top of the bay. The facility or OSP fiber terminations are located on the lower portion of the bay. Equipment cable termination shelves and OSP cable splicing/termination shelves can be added from the top-down and from the bottom-up, respectively.



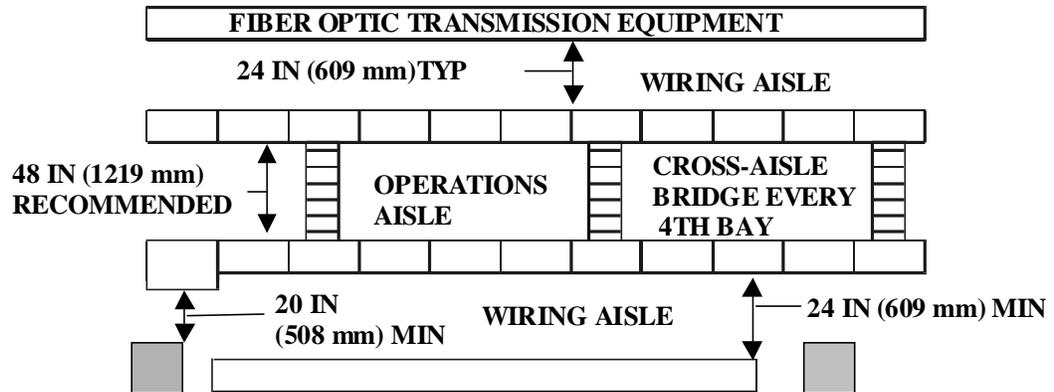
Typical Single Bay FDF

## Multiple Frame Lineups

A second lineup should be considered if the first lineup exceeds the maximum recommended length or if the number of bays required exceeds the available floor space. If a second lineup is specified, it is highly recommended that the second lineup be positioned immediately across the aisle facing the first lineup. The cross-aisle bridge should be specified to facilitate jumper routing between the two lineups.

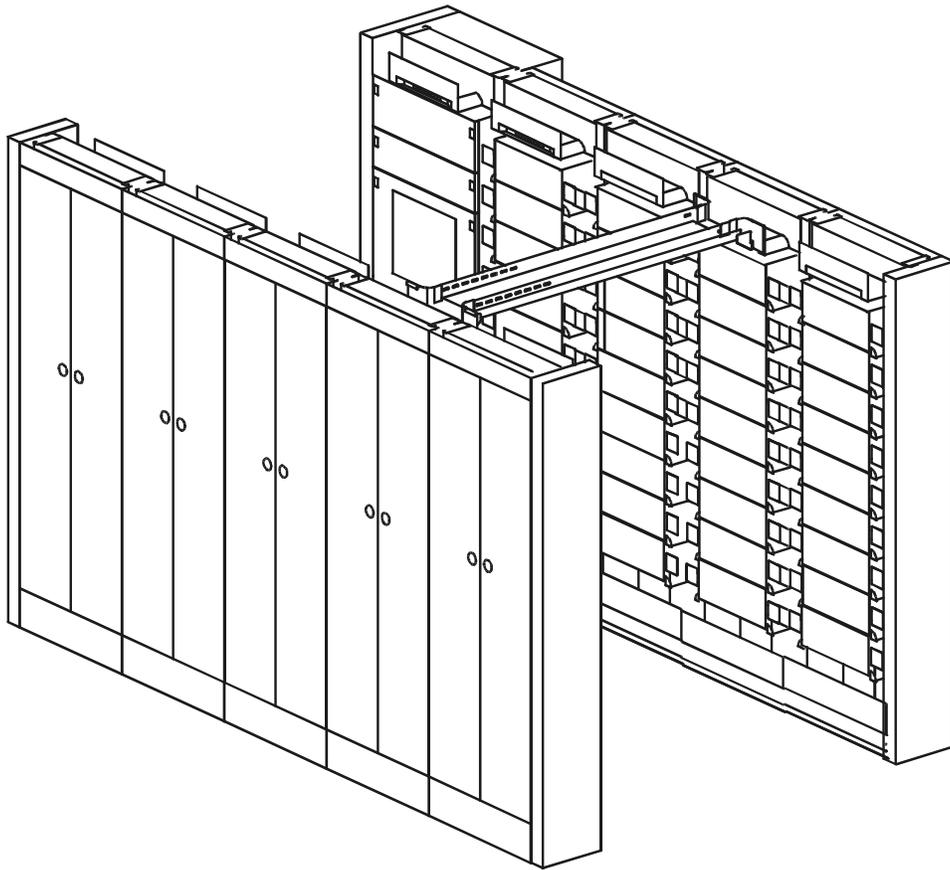
The engineer should be careful to specify the exact location of the second lineup and for the cross-aisle bridge. The cross-aisle bridge connects the upper raceways on two bays that face each other. The cross-aisle bridge consists of a cross-aisle jumper trough supported by a ladder-type rack firmly attached to two specially designed upper raceways. The cross-aisle bridge upper raceways replace a standard raceway where the cross-aisle bridge is to be connected. The cross-aisle bridge can span an aisle of 72 inches (1828 mm) maximum between frames. The cross-aisle bridge is located at a height of 80 inches (2032 mm) above the floor providing clearance to craft beneath the bridge. The cross-aisle jumper trough has a width of 10 in (254 mm).

In longer lineups, the cross-aisle bridge should be specified at more than one location along the length of the frame. This provides an even distribution of jumpers over the length of the frame and keeps any one bridge from being congested. A typical application is to install one cross-aisle bridge for every four FDF bays.



### LGX<sup>®</sup> Distributing Frame

#### Dual Lineup with Cross-Aisle Bridge Every 4<sup>th</sup> BAY



**LGX<sup>®</sup> Distributing Frame  
Dual Lineup with Cross-Aisle Bridge**

## Detailed Equipment Specification

---

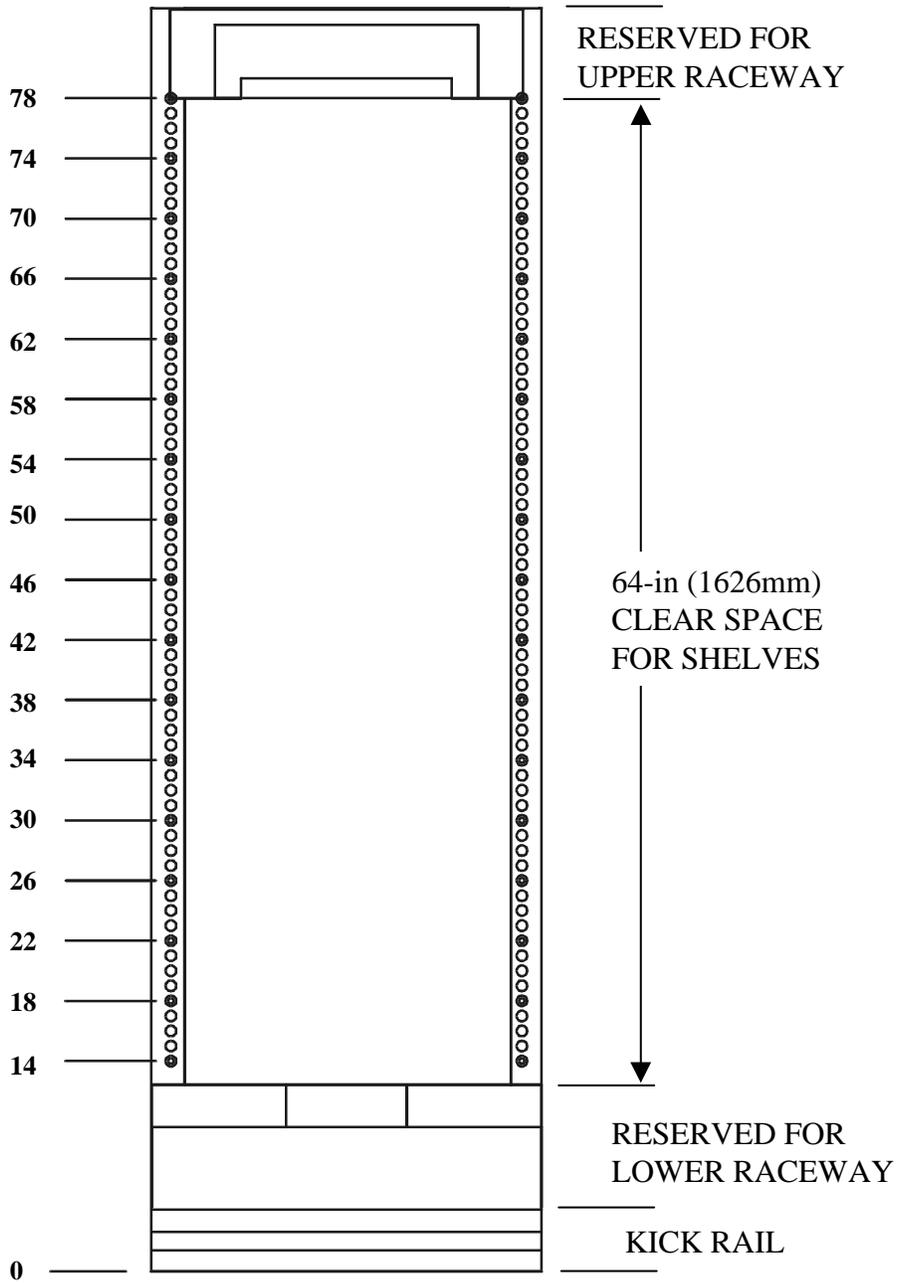
### FDF Equipment Specification

The exact **LGX** FDF layout and equipment arrangement is used to develop a detailed list of equipment that must be specified to construct an FDF. This will typically be a comprehensive listing of equipment and may include:

- **LGX** Frame (Preassembled) — specify desired number of bays to be installed for the project at hand. This should include space for termination as well as space for maintenance equipment, future growth, etc.
- **LGX** Duct Doors — One set of rear doors for each bay to be installed.
- **LGX** End Guards — Two per lineup – One on each end.
- **LST1U-072/7** Termination Shelf (Preterminated) — One for every 72-fiber complement **or one LST1U-144/9 Termination Shelf for every 144-fiber complement.**
- 2000A Communications Panel — One every Fourth Bay.

### Detailed FDF Bay Layout

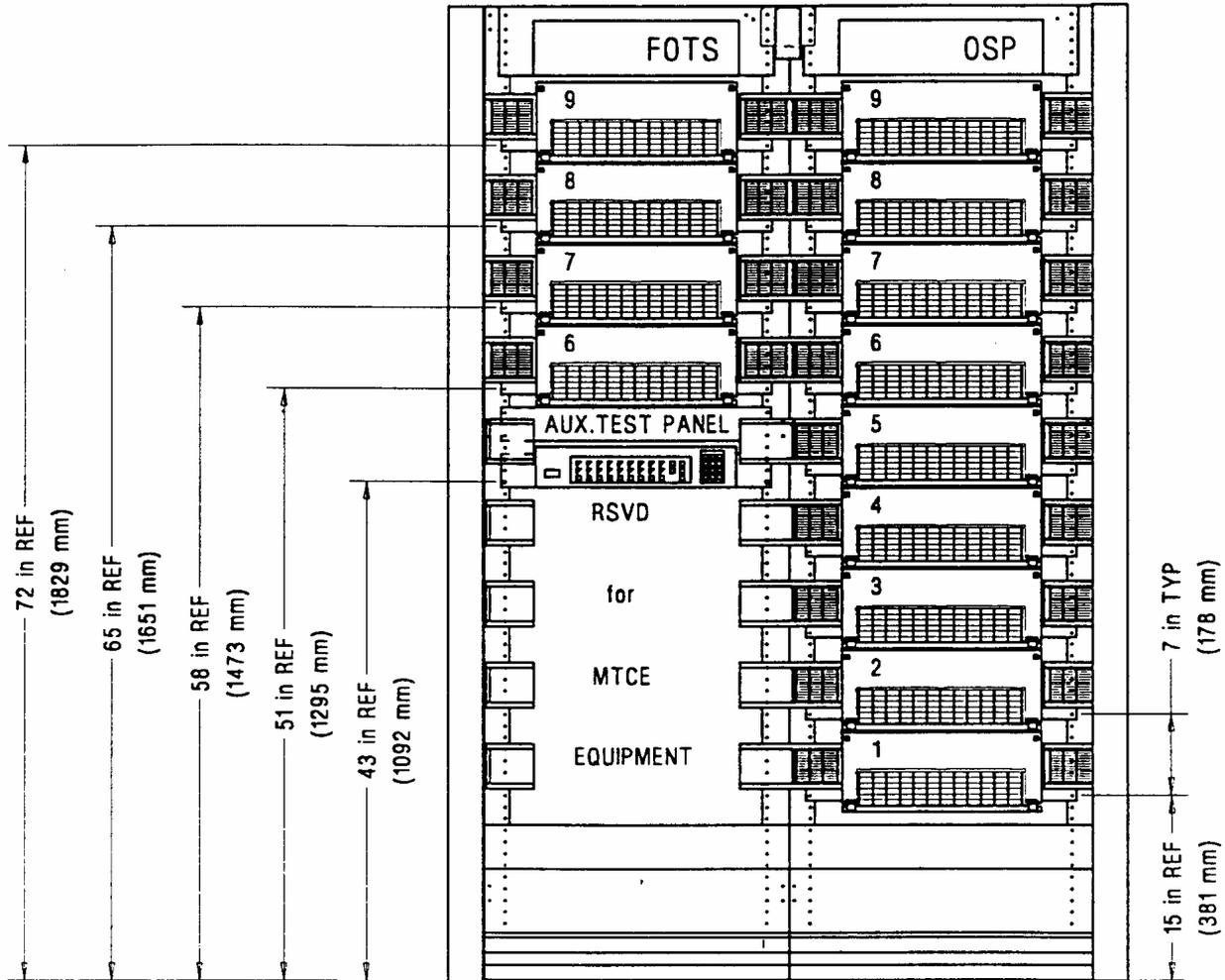
A detailed bay layout should be prepared for each bay in the FDF lineup. As shown on the following page, the standard **LGX** frame provide 64 inches (1626 mm) of vertical frame space available for mounting shelves in each bay. Each shelf on the FDF is located according to the predetermined equipment arrangement. A suggested shelf identification scheme designates the shelf location identifier as the distance from the frame base (in inches) to the lowest mounting hole on the shelf mounting bracket. The absolute shelf location coordinate system, shown in the figure on the next page, applies to the **LGX** system using either the Network Bay Frame or Seismic Network Bay Frame.



**Shelf Coordinate System**

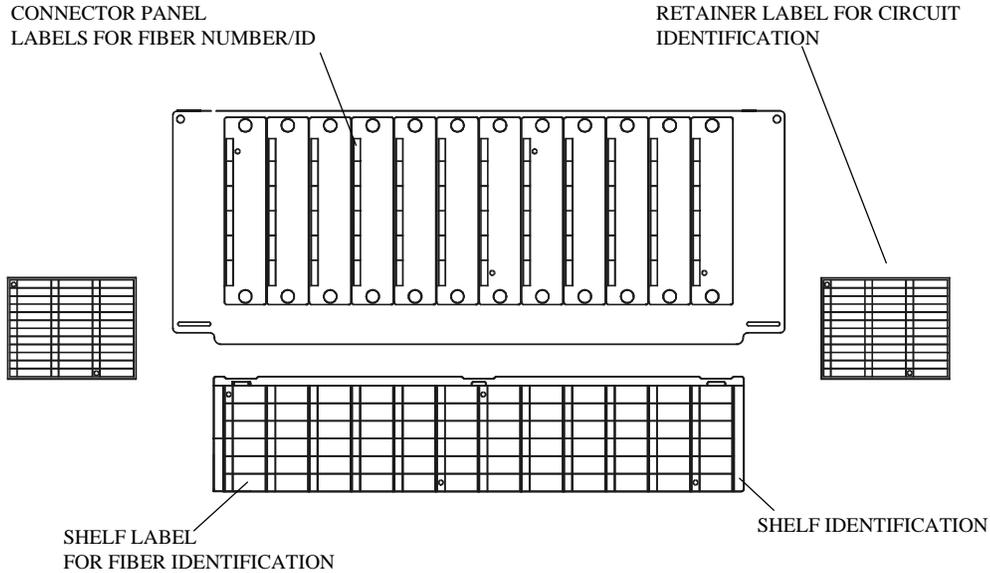
The following figure shows an example of shelf location numbering for a typical bay layout. As an alternate or quick reference system, each shelf may be designated with a numeric character. The lowest shelves would be given the lowest number with the designation scheme progressing from bottom to top; for example; 1,2,3...9.

Example of Shelf Numbering



## Termination Assignment and Labeling

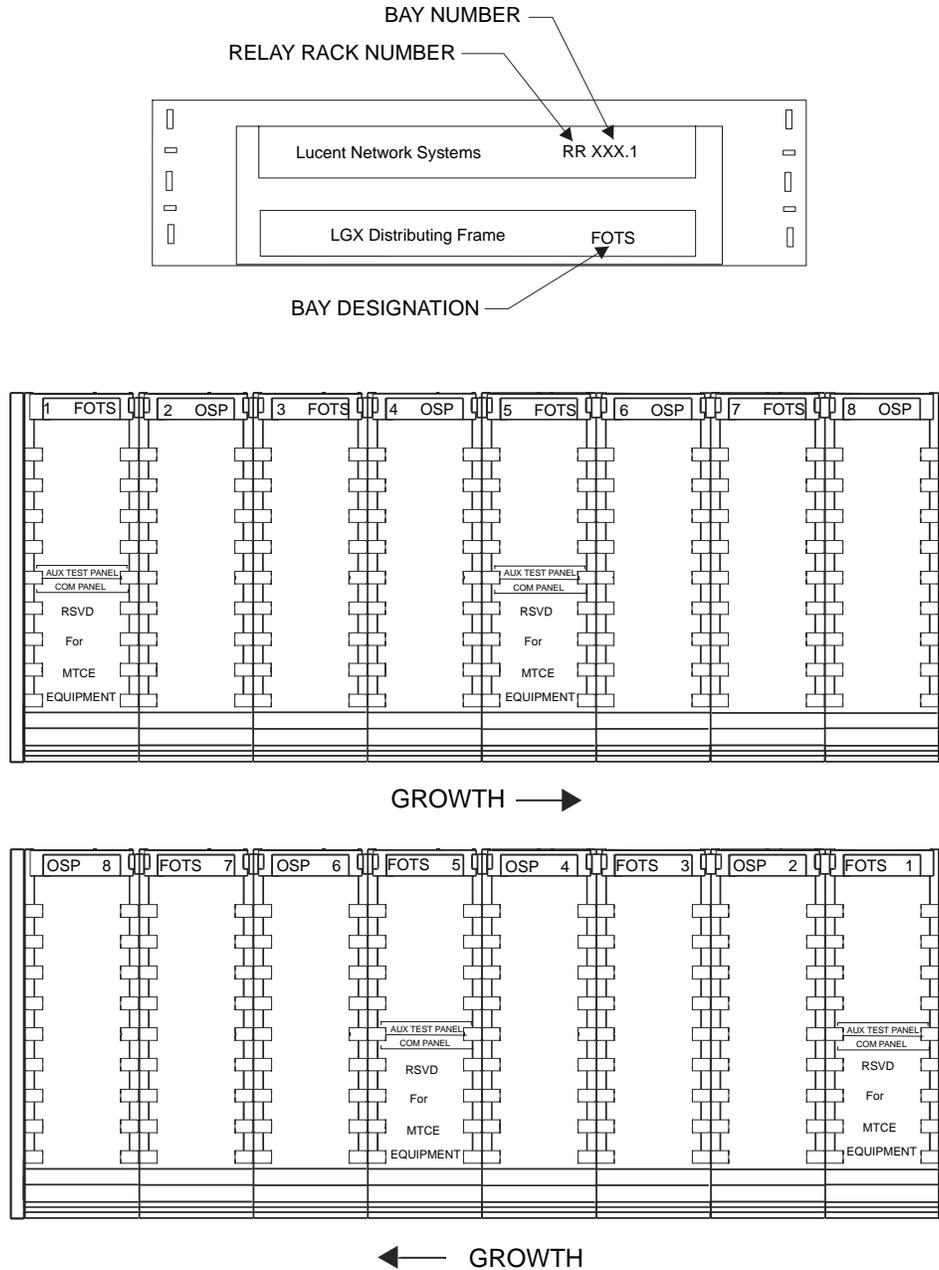
When terminating fibers on the distribution shelves a sequential layout strategy should be used. The connectors on a standard density shelf are numbered 1 through 72. See figure below. An alternate identification system may be used to number each connector position 1 through 6 and each connector panel A through M from left to right on a shelf. Termination identification is placed on the shelf label in the field. Circuit identification is placed on the side retainer labels when the circuit assignment is made.



## Typical Shelf Labeling

### Frame and Bay Numbering

Typical frames are designated by Relay Rack (RR) location as specified by a master drawing. Bays within an LGX FDF are typically numbered sequentially — either left to right or right to left numbering sequences is accepted. Generally, the bay numbering will proceed in the direction of growth of the frame as shown in the figure below. In alternating bay arrangements, it may also be desirable to clearly mark each bay as to OSP or FOTS termination.



### Bay Designation

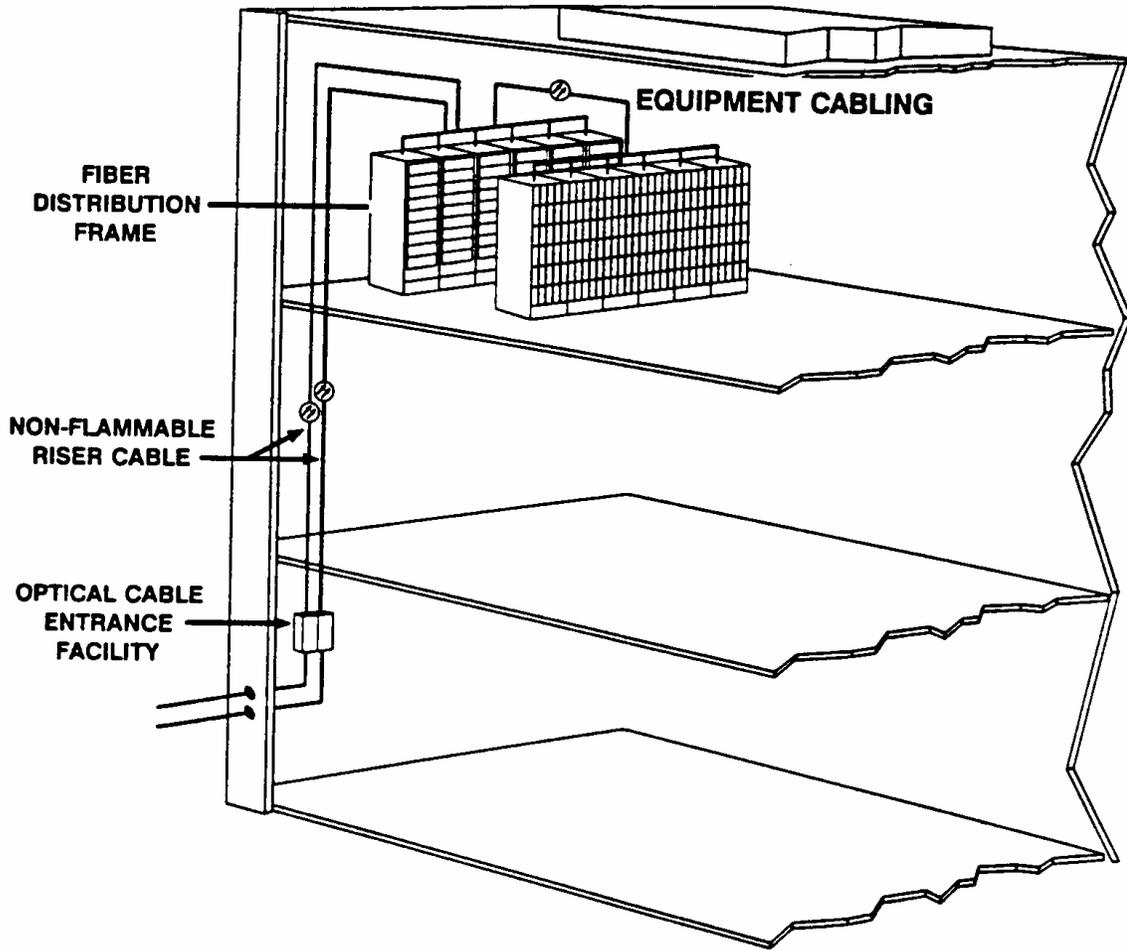
## **Structured Cabling Plan**

---

To facilitate a new LGX FDF or major addition to an existing LGX FDF installation, a structured cable access plan should be engineered. The cable access pathways should provide non-blocking access for fiber cables planned for the immediate addition and all future fiber growth. The structured cabling plan should encompass the following areas:

- **Cable Entrance Facility (CEF)** — The cable entrance facility has been primarily used in the past to isolate metallic members of OSP fiber cables. More and more fiber splicing is now done in the CEF. Planners today consider several options such as setting up a new CEF or Alternate Splice Area (ASA) just for fiber. An area separate from copper exchange cables often allows efficient splicing in a clean environment. Closures or splice cabinets can be located on the first floor above a cable vault if desired. An infrastructure for the future should allow for anticipated large volumes of fibers to be spliced far beyond the capacity of today's fiber splicing.
- **Backbone or Riser** — OSP cables have typically been routed directly into the equipment areas of central offices. Heightened awareness of the potential hazards of OSP cable has stimulated most service providers to issue recommendations against the continuing practice of bringing OSP cables into the equipment areas. Most service providers have adopted recommendations of the *National Electric Code (NEC)*, which states that OSP cables should not enter more than 50 feet into the building. To accomplish this objective, a new strategy has been adopted for splicing OSP cables to fire-retardant building cables. Thus, rigid building cables become the backbone in the fiber infrastructure carrying optical signals into the heart of the office.
- **Distribution Frame** — Recent trends to improve the cabling situation at the FDF include installation of a complete cable management system and Fiber Protection System. These cable pathway systems should be engineered in accordance with fundamental planning for the ultimate growth scenario.
- **Equipment Cable Distribution** — Mixing copper and fiber has sometimes resulted in congestion. New cable pathway systems and ducting systems are engineered for protecting and organizing fiber jumpers and cables. Now, multifiber building cables are usually routed between the distribution frames and equipment.

**OFS offers a total approach including services to support engineering and installation of the cable management system. Solutions are available for each area of the fiber distribution network. The figure on the next page illustrates the fiber distribution network elements typically required to implement a totally structured cable plan.**



Structured Cabling Plan

## Overhead Cable Access

---

To ensure future growth and flexibility, cable access pathways should be engineered with the ultimate capacity in mind. Overhead cable rack and pathway systems are most commonly specified for use with the FDF. OFS engineering services provide detailed consultation and design for fiber cable management systems. Complete engineering specifications for the cable access pathways are provided in:

- ED-8C120 Fiber Protection System (FPS)
- ED-8C612 Cable Management System (CMS)

Shown in the figure on the next page is a typical cable rack arrangement designed for a transmission equipment area. Shown on the left is the LGX Fiber Distribution Frame, and on the right is a lineup of FOTS or multiplexer equipment. This arrangement utilizes two levels of cable racking to allow separation of the different classes of cables. Any heavier riser fiber optic cables routed into the FDF will be placed on the cable racks adjacent to the FDF. Other fiber cables interconnecting the FDF to equipment are routed in the FPS below the lowest rack. The FPS fully encloses the fiber cables and maintains the minimum recommended bend radius. A key advantage of the FPS in this configuration is that the multiplexers or fiber terminals are added the FPS can easily be extended beneath the cable racks. This essentially forms a nonblocking arrangement, ensuring the ability to add fiber with future equipment additions.

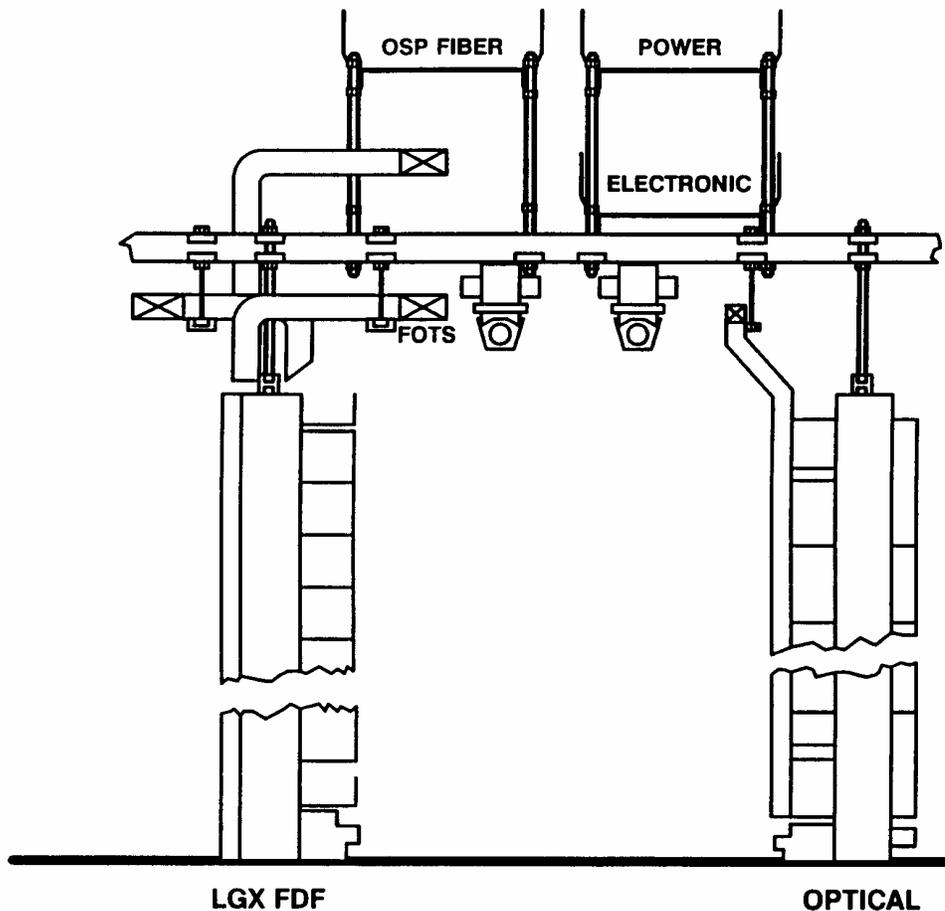
The FPS can also be engineered in different sizes. For instance, the LGX FDF will be a concentration point for fiber; therefore, larger size ducts and sometimes multiple ducts should be specified over the FDF. Smaller ducts can be used in cross-aisle pathways and to interface with FOTS equipment. In this way, the fiber is protected all the way from the FDF to the fiber transmission equipment. In typical multiplexer cabling configurations, power cables are placed in the upper level rack, while copper communication and maintenance circuits are placed in the lower level rack. The fiber entering or leaving a particular bay is enclosed in the FPS. Total segregation of cables is accomplished with this arrangement.

OFS cable management approach provides a way to supply AC auxiliary power for appliance outlets and lighting for the equipment area. The arrangement shown supplies AC power lines along the length of a lineup in an enclosed raceway below the lowest rack. This arrangement allows AC power to be dropped into any frame via a drop cord. These cords are secured into the raceway with twist-lock fittings. Because these fittings are removable, an equipment frame can be removed without disturbing AC power to other bays. As an alternative, it is always possible to run the AC power along the base of the FDF with outlets at the base of the frame.

Electrical fluorescent lights are also to be integrated into the CMS along with the AC raceway. These lighting fixtures are designed to provide the appropriate illumination for the immediate frame area. Lighting fixtures are secured beneath the raceway making circuit and switch leads easy to run through the raceway. The entire AC/lighting arrangement is in conformance with applicable codes.

The arrangement shown in the figure below is typical only — one of the many that OFS experienced engineers can design. The principal advantages of a carefully engineered fiber cable management system include:

- Segregation of different cable classes
- Protection for fiber cables
- Nonblocking growth — especially important for fiber
- Multitiered pathways
- AC in enclosed ducts
- Integrated lighting arrangement



## Bottom Cable Entry

---

The *LGX* FDF will easily accommodate bottom feed cabling through holes or slots cut through the floor. Holes or slots typically must be engineered and located in the floor prior to installing the FDF. A number of different options are available for bottom feed cable access to the *LGX* FDF, depending on solid concrete or raised floor installation.

### Concrete Floor Access

Bottom cabling access through a solid concrete floor is usually achieved through a series of core drilled holes — usually drilled prior to the placement of the FDF bays. Holes will typically be 4 inches (102 mm) or 5 inches (127 mm) in diameter. Options for locating the holes are shown in the figures that follow and described below.

#### Recommended Configuration [15 inch (381 mm) FDF Depth]

To provide cabling access through a concrete floor, it is recommended that two 5-inch (127 mm) holes be located at the base of each frame. The two holes are positioned immediately in the rear of the Network Bay Frame and offset to the sides as shown in Figure A on the next page. A 15-inch (381mm) deep *LGX* Frame should be used [or a 3-inch (76 mm) frame extension is attached to the rear of a 12-inch (305mm) *LGX* frame] to allow the cable access holes to be located within the footprint of the frame. Thus providing two cable access holes within the *LGX* FDF, the cabling capacity is increased to 40 square inches (25800 square mm) per bay. The recommended arrangement results in a 15-inch (381 mm) FDF footprint. This arrangement is easiest to drill, provides ample cabling capacity for most any situation, and is easily accessible. Furthermore, the round holes are easily plugged with fire-stopping material. A common application is to provide access for OSP cables for bottom entry through the floor and access for FOTS equipment cables from overhead — in this case, floor holes are only located beneath the OSP bays.

#### Alternate Configuration - [12 inch (305 mm) FDF Depth]

Where a 12-inch (305 mm) deep *LGX* frame must be installed, bottom access holes are drilled in the floor so that they align with the duct area of the Network Bay Frame. In a typical application, 5-inch (127 mm) holes are drilled in between each frame as shown in Figure B on the next page. Because each hole is shared between two bays, only a limited cabling capacity of 20 square inches (12900 square mm) is provided for cable access. This option may be used where a minimum cable capacity arrangement is required for large pair-count cables such as ribbon riser cables.

#### Alternate Configuration (Slots)

Another option shown in Figure C on the next page is to utilize slots instead of holes. The slots can be cut into a solid floor to provide even greater cabling access. The cable capacity with slots is approximately 50 square inches (32260 square mm). If slots are used, a 3-inch (76 mm) frame extension is recommended to enclose the slots within the footprint of the frame.

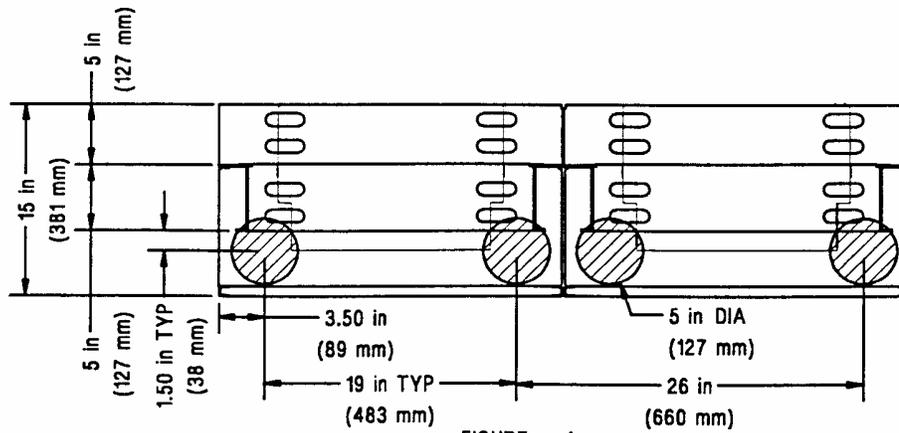


FIGURE A

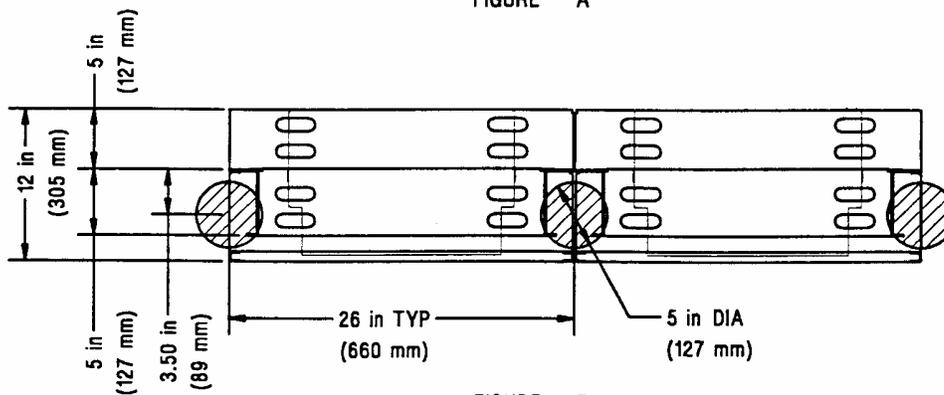


FIGURE B

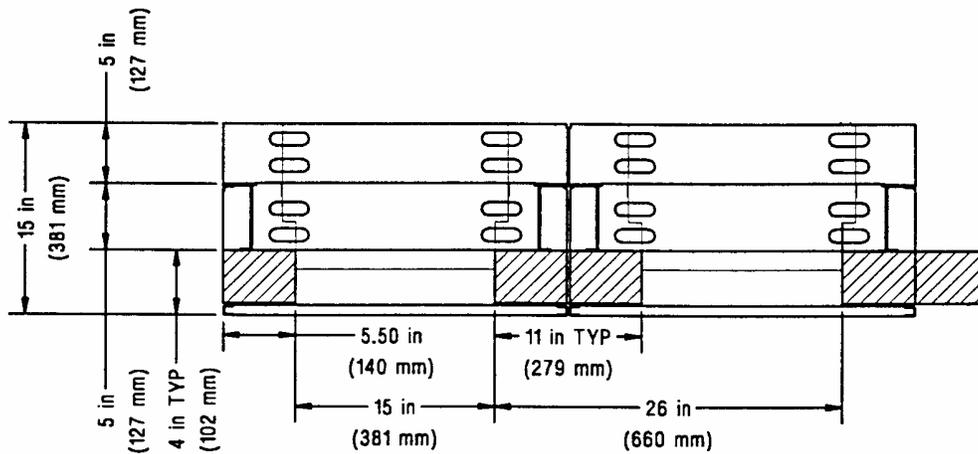


FIGURE C

### Bottom Access Through Solid Floor

### Raised Floor Access

Bottom cable access through a raised floor (or similar false floor) is considerably more simple than through a concrete floor. Raised floors are easily cut — often they can be removed and cut in a fixtured machine.

Furthermore, a raised floor usually requires no fire-stopping material — so slots can easily be chosen over holes.

#### **Recommended Configuration [15 inch (381 mm) FDF Depth]**

A 15-inch (381mm) FDF depth provides improved access and capacity for bottom feed cabling. A much larger slot can be cut and still fall within the footprint of the frame. For instance, a 5-inch (127 mm) deep by 21-inch (533 mm) wide slot can be provided as shown in Figure A on the next page resulting in a cabling capacity of 100 square inches (67700 square mm). The principle advantage of the 15 inch (381 mm) frame is that cables are easier to access as they are passed through the raised floor into the *LGX* bay frame. A 15-inch (381 mm) footprint with a large rectangular slot is therefore recommended for bottom feed through raised floors.

When placing the *LGX* frame on the raised floor, structural elements may interfere with a regular slot placement. Because the raised floor arrangement is so flexible, the slots may be placed to the center or the sides to avoid structural interference.

#### **Alternative Configuration [12 inch (305 mm) FDF depth]**

The 12-inch (305 mm) bay frame can easily be accessed from beneath a raised floor by cutting a slot between the Network Bay Frame base and the base of the *LGX* rear duct. This arrangement shown in Figure B on the next page provides a slot nearly 2 inches (508 mm) deep by more than 21 inches (533 mm) wide for a total cabling capacity of approximately 40 square inches (25800 square mm). The cables that pass through the slot are fanned to the sides of the *LGX* bay frame and secured to the shelves.

#### **Alternative Configuration (Slots Between Frames)**

An alternative with the 12-inch (305 mm) footprint is to locate the slots to the side of the duct area as shown in Figure C on the next page. In this case, cables are automatically fanned to the side cabling ducts of the frame.

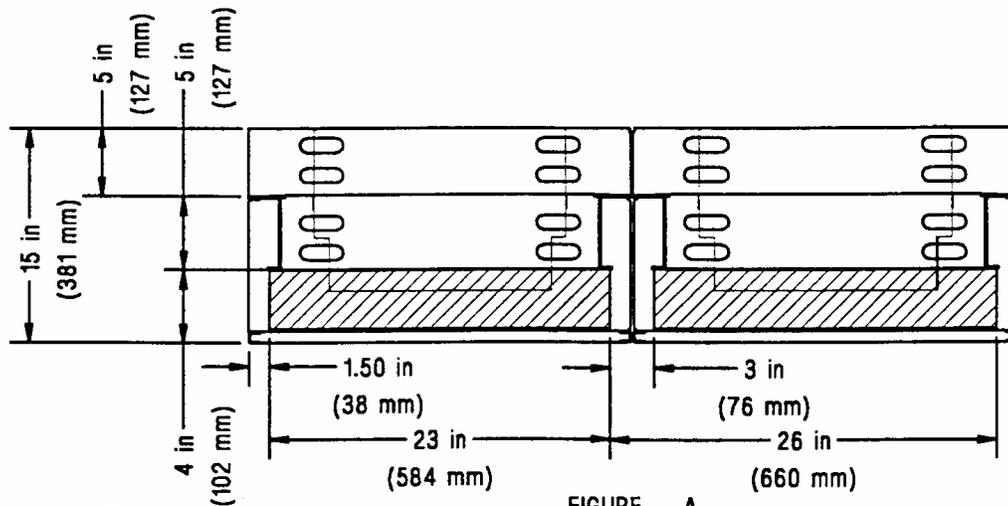


FIGURE A

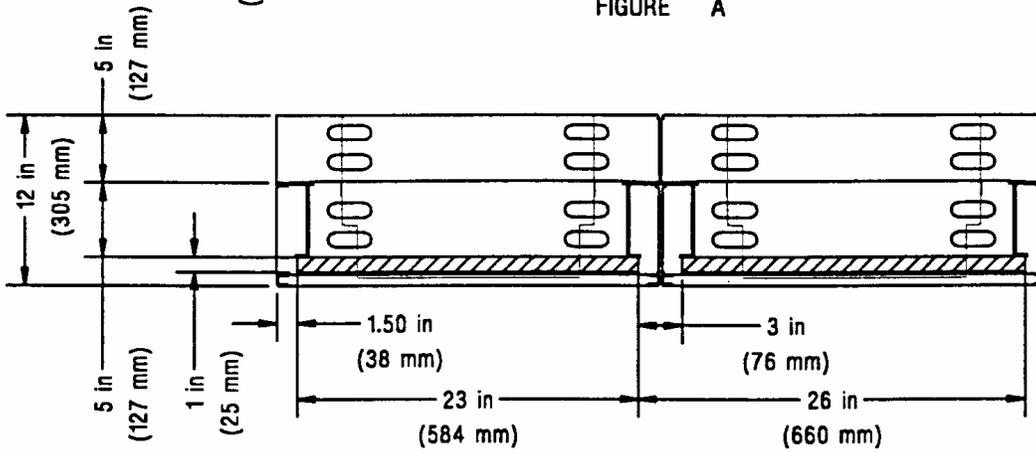


FIGURE B

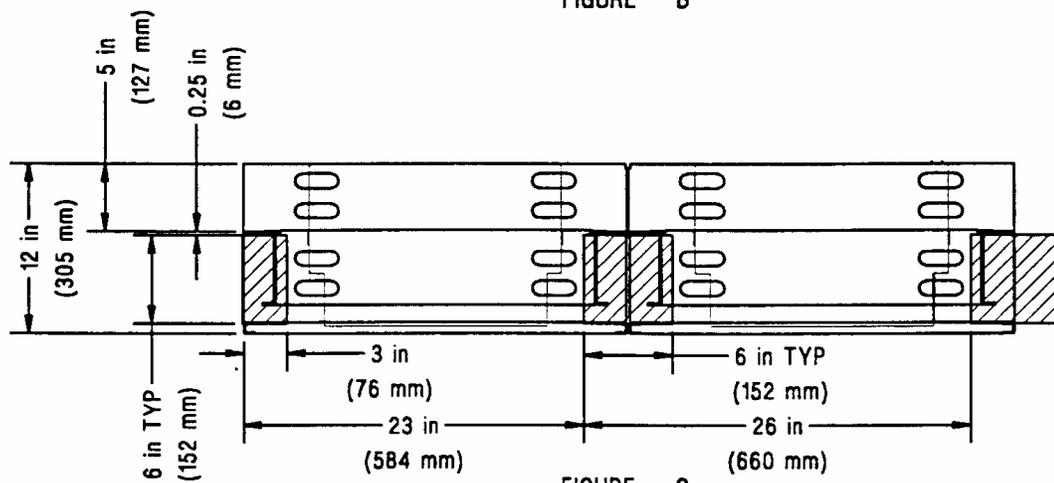


FIGURE C

Bottom Access Through Raised Floor

## AC Power

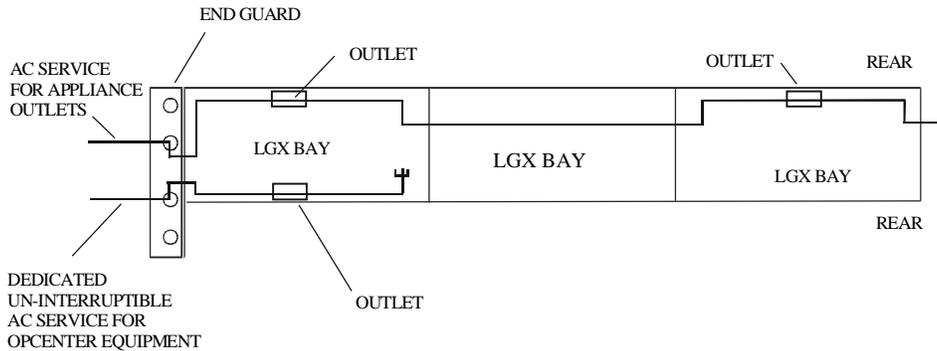
---

AC outlets are typically provided at the base of the frame for use in powering auxiliary test equipment. Outlets are typically only needed in the front of the frame. However, in an Operations Bay, AC Power may be supplied to appliance outlets in both the front and back of the frame.

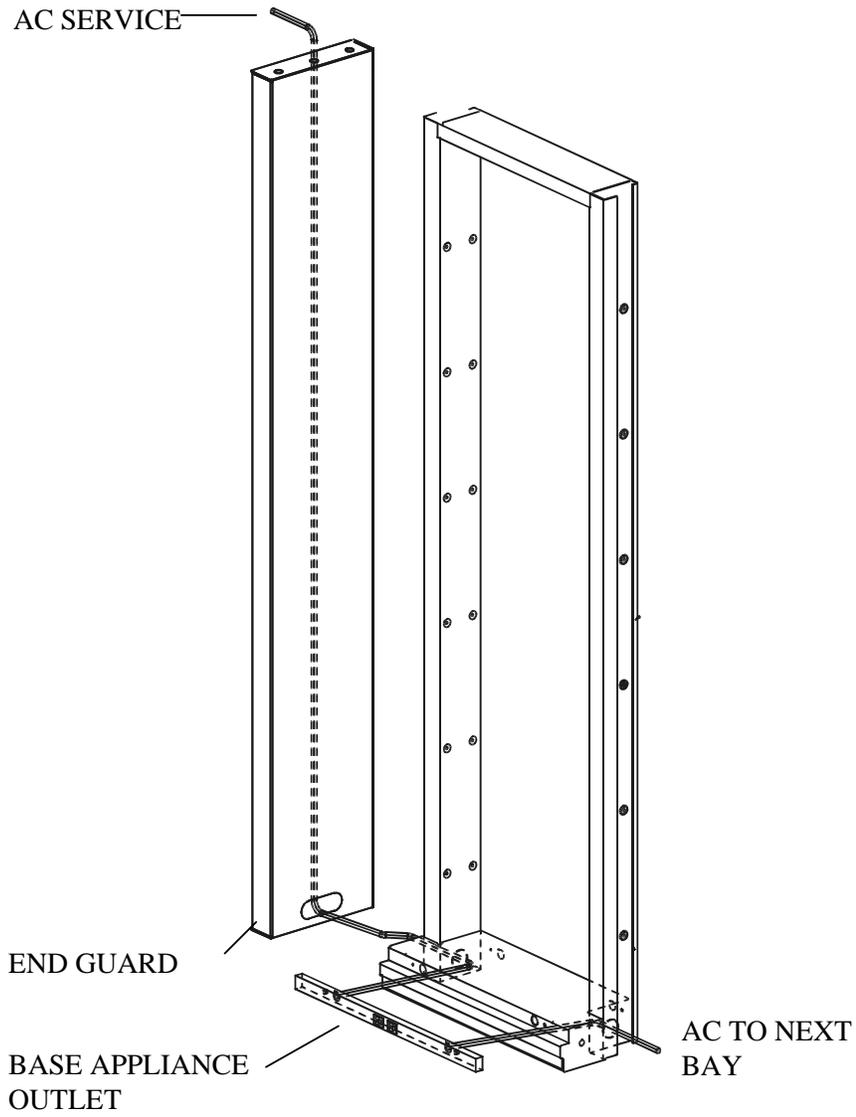
AC conduits (flexible or rigid) are typically routed into the end guard at the end of a lineup and then through the end guard to the base of the frame. The AC can then be routed along the base of the frame from one bay to the next. The AC power is used to connect appliance outlets in series as required. Appliance outlets are typically specified in every bay or at least every other bay.

Appliance outlets may be ordered separately from ED-8C509-50.

**Note:** All 110 VAC Power should be installed according to the National Electrical Code. Consult a licensed electrician where applicable.



### AC Service Into LGX Frame



**AC Service Provisioning via End Guard**

## Central Office / Wire Center Applications

10

### Section Contents

---

In Central Office (CO) applications, the LGX<sup>®</sup> Fiber Distributing Frame (FDF) serves as the primary interface between Outside Plant (OSP) fibers entering the building and the Fiber Optic Transmission System (FOTS) equipment optical terminations. In many cases, the FDF will be located in the transmission equipment area of the CO. The LGX FDF can be configured in standard or high density to serve even the largest central office fiber management needs. Central office applications should be implemented according to the Planning Guidelines and Engineering Guidelines outlined in this document. Special considerations for the central office application are included in this section.

- Central Office Application Overview 10-2
- Structured Cable Management 10-3
- Centralized FDF 10-5
- High Performance Fiber Termination 10-7
- Optical Cable Entrance Facility 10-9
- Fiber Protection System 10-10

### CO Application Overview

---

The fiber distribution network is a vital link in any Central Office (CO) or wire center application. In CO applications, the FDF serves as the primary interface between OSP fibers entering the building and the Fiber Optic Transmission Systems. In many cases, the FDF will be located in the transmission equipment area of the CO. The OSP cables entering the building are usually spliced to fire retardant building cables and then routed to the FDF. The LGX Fiber Distribution System becomes especially important in CO applications where multiple bays of fibers are terminated in a continuous lineup. The LGX FDF can be configured in standard or high density to serve even the largest fiber terminal application needs. The LGX FDF can be used in multiple lineup configurations as well. Also, in many offices the need exists to provide a fiber management system that can evolve as more flexible and higher capacity optical transmission equipment is deployed.

A plan for fiber growth should include all aspects of optical cable management in the wire center. Providing a well designed Fiber Distributing Frame is fundamental to the cabling strategy.

## **Best Central Office Practices**

Many existing wire centers have outdated fiber cable management systems. Other wire centers are evolving and growing over time and have several generations of fiber cable management practices and termination equipment. No matter what state the wire center is in, it can benefit from taking advantage of the current best practices for fiber cable management. The best practices for fiber cable management have been developed to handle the potentially large volume of fibers that may converge on the central office. Best practices include:

- **Centralized FDFs** — New **LGX** Fiber Distributing Frames are installed to centralize optical cable administration while providing a framework for future optical cable growth.
- **Preterminated Connections** — The Fiber Distributing Frames are deployed using preterminated shelves and cables. The preterminated facilities result in an efficient installation with the highest performance possible from the factory.
- **Fire-Resistant Cables** — Current best practices route only indoor fire-resistant cables throughout the wire center.
- **Fiber Segregation and Protection** — Optical cable management practices call for fiber cables to be segregated from other copper/electronic cables in the wire center through use of separate pathways and ducting systems, thus providing protection for the valued services carried on the fiber cables.
- **Flexibility and Speed** — The newer fiber cable management systems provide support systems to manage the flexibility and speed with which optical services are provisioned.

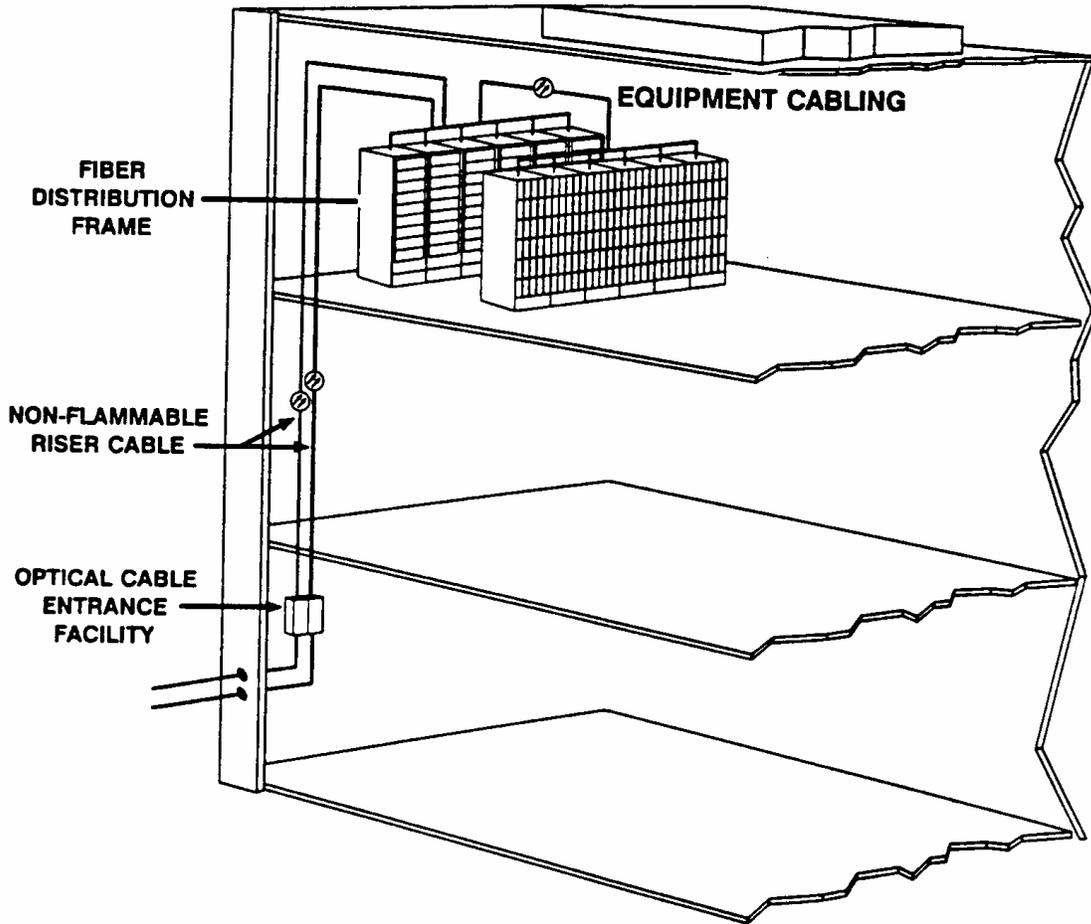
## Structured Cable Management

---

To position the wire center to accommodate future fiber growth, each area of the optical distribution network should be considered when planning adds and changes to the fiber cabling system. Using a structured approach to central office cabling can help to ensure that no part of the cabling system is neglected. The key components of the structured system to be considered include:

- **Optical Cable Entrance Facility (OCEF)** — In newer structured cabling systems, more and more fiber splicing is done near the copper Cable Entrance Facility (CEF). The structured approach typically recommends an Alternate Splice Area (ASA) be set up as a separate Optical Cable Entrance Facility (OCEF). The OCEF will be an area of the wire center close to the copper CEF yet separate from the copper cable splice area so that optical cables are not disturbed by exchange cable activity. Separating the OCEF also allows for efficient splicing in a clean environment. The OCEF is often a separate room, a separate lineup of racks, or a separate wall from other facilities in the wire center. The OCEF location is selected to provide easy access to OSP cables entering the building through ducts and to cable pathways for routing cables on to FDF and equipment areas. The OCEF should be designed to accommodate large growth in fiber cable splicing that may be expected in the future. The OCEF is usually equipped with robust splice cabinets that provide protection for fiber splices while allowing easy reentry should maintenance be required.
- **Backbone** — The backbone cables carry the optical path from the OCEF to the FDF. In multistory wire centers, this may be a high fiber count riser cable. With the structured cabling approach, the OSP cable sheath terminates at the OCEF. Most wire center applications adhere to recommendations such as the National Electrical Code which states that OSP cable should not enter more than 50 feet (15.2 m) into a building. The structured cabling system utilizes fire-resistant indoor cables throughout the backbone route.
- **FDF** — The Fiber Distributing Frame serves as the primary operational interface for administration, maintenance, and provisioning. FDFs provide a flexible interface for cross-connecting or interconnecting backbone cables to equipment cables. The FDF allows centralized organization and administration of fibers, and sets up a flexible platform for growth. The effectiveness of the FDF is determined by careful application of the planning and engineering guidelines. Once set-up, the FDF becomes the primary point of interface for connecting high-capacity services.

**Equipment Cable Distribution** — The equipment cabling is made up of cables, connectors, and support racking systems needed to interconnect equipment. This includes all of the cables routed from the FDF to equipment frames and all of the cables between equipment frames. New cable pathway systems and ducting systems are available for protecting and organizing fiber jumpers and cables.



Structured Cabling Plan

## **Centralized FDF**

---

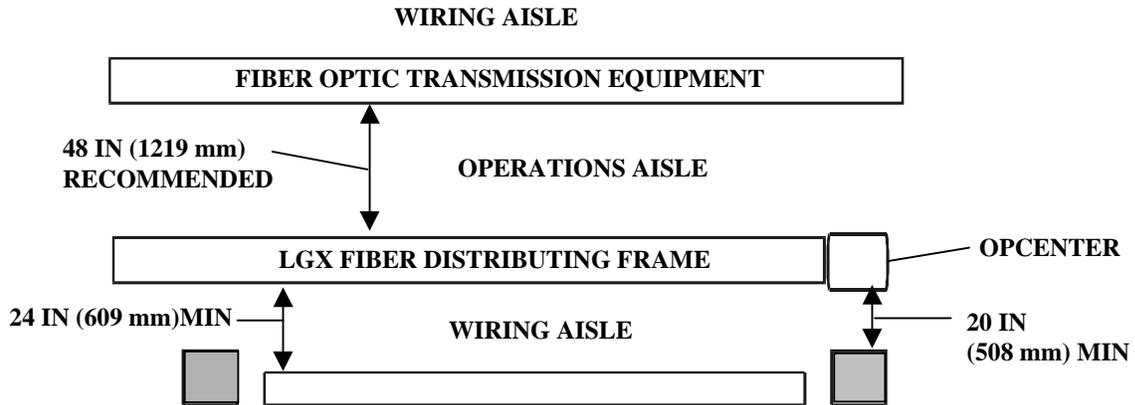
Customer demands for rapid turn up of high-bandwidth service makes it important to focus on fiber cable organization when planning and installing a central office fiber management system. The *LGX* FDF provides a system approach to organizing a large number of fibers and allowing connectivity between any and all fibers in the office. The *LGX* FDF is a complete set of modular hardware, with application guidelines and operating procedures for implementing any size fiber installation in a variety of operating environments. The modular approach to fiber distribution allows easy selection of a common set of hardware components and implementation procedures for fiber installations in various applications. The modular approach allows the user to install the *LGX* System in increments to match the growth needs of fiber installations.

### **Single Lineup**

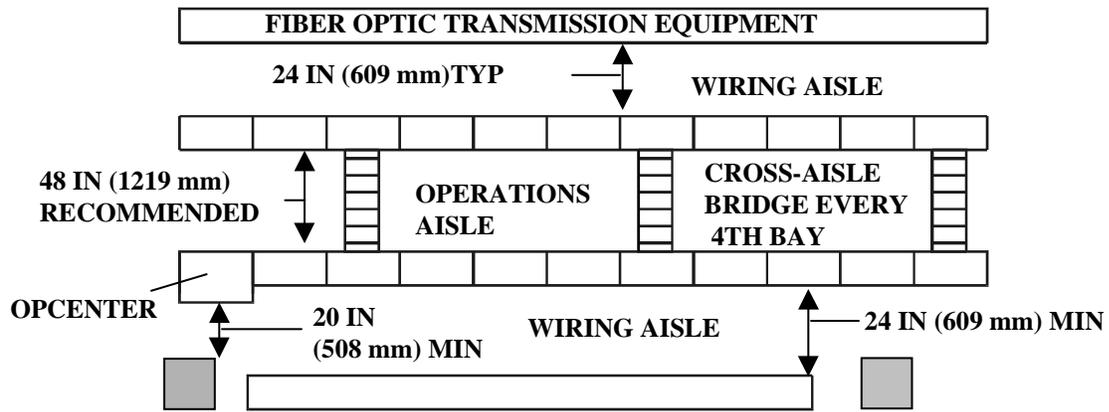
In most central office applications, a single FDF lineup will provide the capacity to satisfy the termination needs of the office. A single FDF lineup using standard density (648 fibers/bay) can accommodate up to 20 bays in a single lineup. A single high-density lineup (1,008 fibers/bay) can accommodate up to 12 bays in a lineup. With the single lineup configuration, it is recommended that as many bays as possible be installed initially even if they are not fully populated with shelves. By initially deploying the ultimate number of bays, the site will essentially be certain of having the space to grow as fiber shelves/terminations are added in the future. The single lineup arrangement should be carefully planned and engineered according to guidelines in the planning and engineering sections of this document.

### **Multiple Lineups**

In most central office applications, a single FDF lineup will provide the capacity to satisfy most termination needs of the office. If the single lineup exceeds the recommended maximum length, a second lineup should be considered. Special planning and engineering will usually be required to ensure full connectivity without congestion. A second lineup should be positioned immediately facing the first lineup across an aisle. The cross-aisle bridge may be used to facilitate jumper routing between the two lineups. A more careful study and analysis may be required as the termination requirements approach the limits of the frame. Also, some form of mechanized administrative system may be needed to manage such a large *LGX* distribution system. A plan should be developed to closely monitor the jumper pileup. The *LGX* system makes provisions for larger jumper raceways or adjustable raceways that can be retrofitted to the frame if warranted. OFS technical support can provide assistance in planning and implementing larger lineups or multiple lineups.



FDF Single Lineup



FDF Dual Lineup

## **High Performance Fiber Termination**

---

The central office FDF should be installed with the highest quality optical connections available. For this reason, it is recommended that preterminated products be specified for the central office application. The preterminated products have the advantage that they can be assembled in the factory where the environment is controlled and where performance can be guaranteed.

### **Preterminated Shelves**

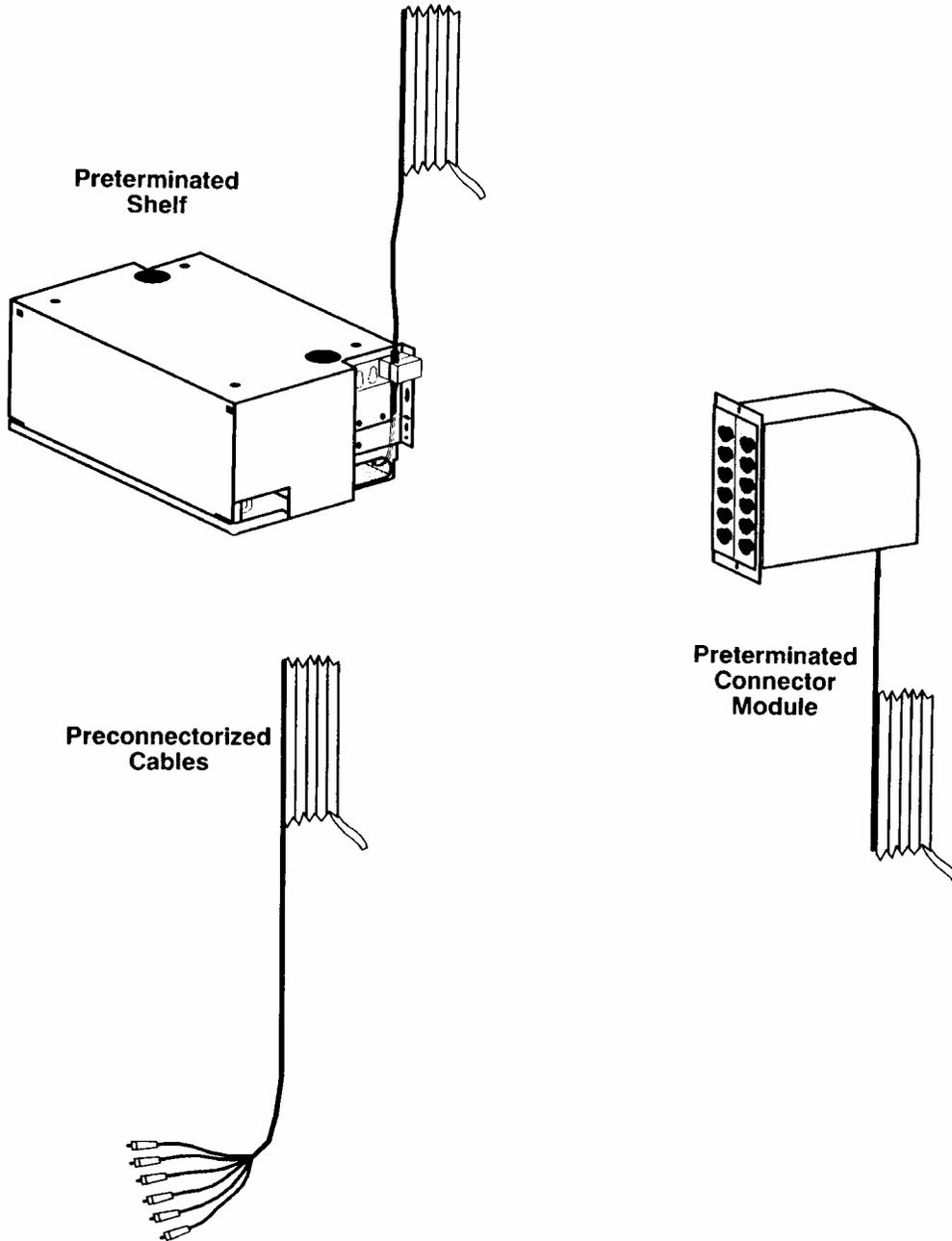
Preterminated shelves provide an easy way to implement a new cabling strategy that conforms to the structured cabling plan. Preterminated shelves are available in all connector options. These shelves are factory terminated, completely tested, and ready for field installation. Preterminated shelves are supplied with fire-resistant indoor fiber cable coiled in a packaging arrangement that allows easy running of cables. For instance, the preterminated shelf can be placed on a spindle in the central office at a location adjacent to the FDF position where it is to be installed. The spindle allows the cable to be reeled off as it is pulled towards the splice point. Once the unreeling is complete, the shelf can be removed from the reel and installed onto the FDF bay. The stub end of the cable is then spliced at the OCEF.

### **Preterminated Connector Modules**

Preterminated connector modules are also available for installing a partial complement of a shelf. These modules are available in 4, 6, 12, 24, and 36 fiber complements. Like preterminated shelves, these modules are also supplied with lengths of cable that are packaged on reels for easy handling and installation. The building cables are easily unreeled and pulled to the splice point for connection. The modules can easily be inserted into the shelf from the rear and snapped into place. The building cables neatly dress into place to finish the installation. The preterminated connector modules allow you to add partial shelf complements of fiber terminations as needed.

### **Preterminated Cables**

Preterminated cables are available with connectors terminated on one or both ends. The cables can be used for routing between the *LGX* FDF and the cable entrance facility, and between the *LGX* FDF and the FOTS equipment. An ideal application for small fiber count preterminated cables is to connect between the *LGX* FDF and the transmission equipment because these lengths are usually shorter and can be measured more precisely. As part of this application, a detailed site survey and measurement should be conducted to accurately determine the length of the cable so that excess slack is minimized.



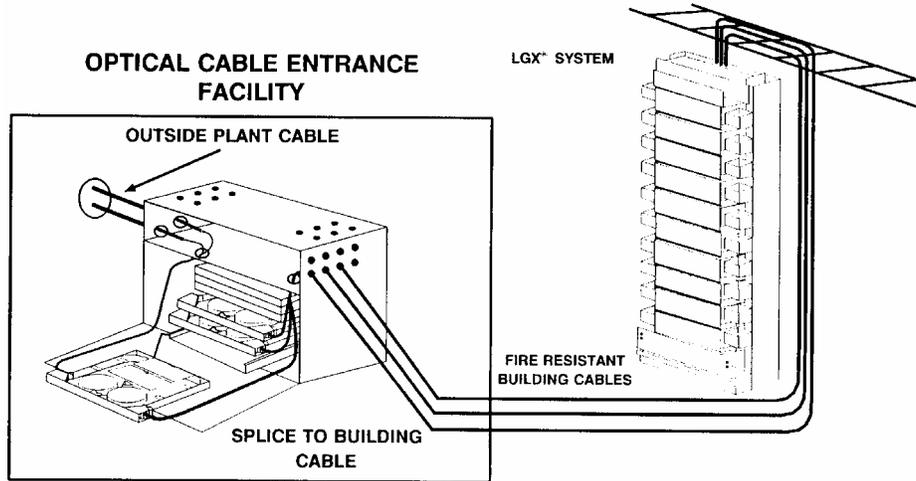
## Preterminated Products

### Optical Cable Entrance Facility

To prepare the cabling environment for future growth associated with high-capacity fiber termination, a structured plan should provide a complete solution for routing and protecting fiber cables. The plan should include provisions for one or more Optical Cable Entrance Facility enclosures as an interface between OSP cable sheaths and building riser cable sheaths. The high-capacity OCEF

enclosures can be used to transition from outside-to-indoor cable sheath while storing slack within the unit.

The OCEF provides a high-capacity splice cabinet that will accommodate multiple sheaths. This facility also provides a means for midspan splicing which is particularly useful in cutover applications. The OCEF accepts standard LT1A-type splice organizers.



## Fiber Protection System

An important ingredient of modern central office applications is to provide a cable management system that protects, segregates, and encloses fiber cables within the office.

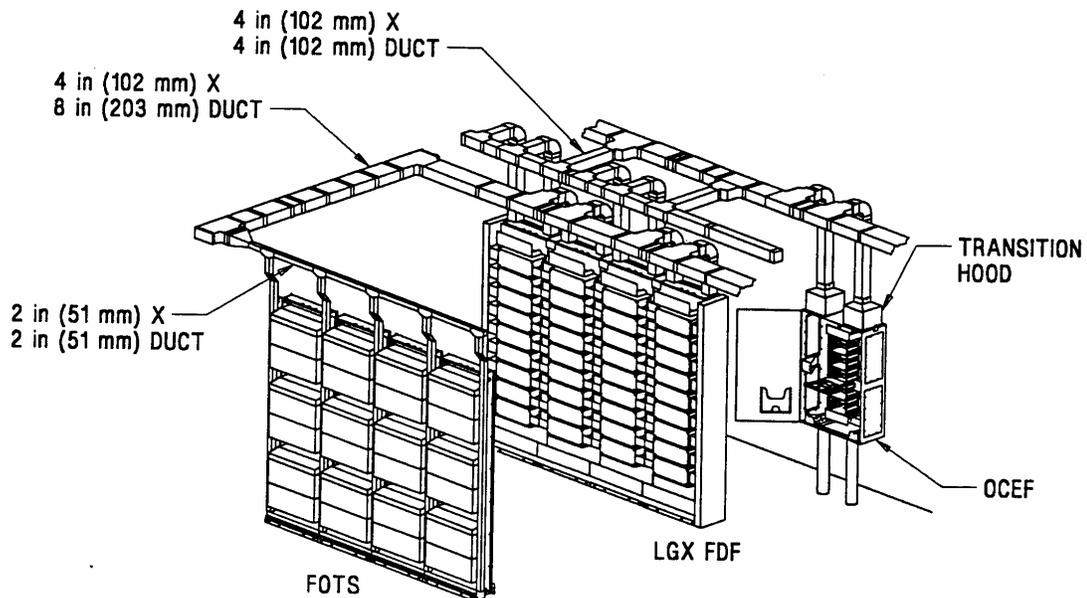
### Fiber Protection System

The Fiber Protection System is a fully enclosed system used to organize and protect fiber cables. The Fiber Protection System can be configured with a variety of duct sizes and shapes. The system is usually designed with the larger ducts in the vicinity of the FDF to support the larger number of cables that will be concentrated at the FD frame. The Fiber Protection System is designed so those minimum bend radius requirements are maintained throughout the system.

The Fiber Protection System can also be retrofitted into the equipment frame areas to organize and protect fibers routed into existing transmission and interconnect frames. For these applications, the Fiber Protection System can be installed to organize and protect existing fiber jumpers. Some of the excess fiber jumper slack can be taken up in storage areas that are designed right into the Fiber Protection System ducts.

### Fiber Protection Service

OFS can provide a wide range of Fiber Protection Services. This may include proposals on how to route fiber cables so that future growth will not be blocked. Transition plans can be developed to move existing fiber cables and jumpers into the ducting system. Complete engineering and installation services are available to support the initiative.



# CATV Head-End Applications

11

## Section Contents

---

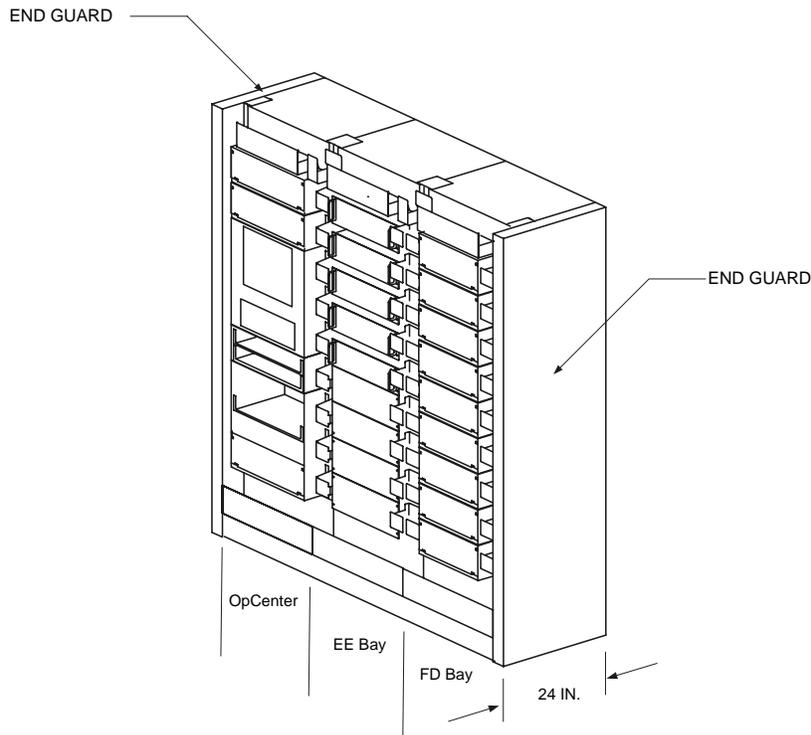
The LGX<sup>®</sup> Broadband Fiber Management System is available for use in Cable Television (CATV) head-end applications. This system is similar to other standard LGX Fiber Distributing Frame (FDF) applications and is largely planned and engineered using similar guidelines to central office applications. The primary difference in with the head-end application is the integration of optoelectronic equipment into the Fiber Distributing Frame lineup. The Broadband FDF application also requires additional floor space since the frames are 24 inches (609 mm) deep. This section covers the special aspects of planning the head-end application for the Broadband Fiber Distributing Frame.

- CATV Head-End Application 11-2
- Broadband Fiber Management System 11-3
- Broadband Frame Guidelines 11-5
- Bay Arrangement 11-8
- Floor Space Considerations 11-11
- Cable Access 11-12
- Frame Numbering 11-12

## CATV Head-End Application

As the number of fibers used for broadband amplitude modulated (AM) analog transmission increases, so does the need for improved fiber cable management and organization at the CATV head-end. Traditional practices used in CATV head-ends include splicing Outside Plant (OSP) fibers directly to pigtails on optoelectronic (OE) equipment, laser transmitters, and receivers. These practices have often restricted the CATV provider's flexibility in connecting or upgrading services. Also the traditional head-end practice of managing fiber in 19-inch wide frames and data cabinets may not accommodate a graceful growth to several thousands of fibers.

Many CATV Head-End (HE) Fiber Distributing Frame applications can be planned and implemented according to the central office application guidelines in the previous section. As an alternative, OFS also provides the *LGX* Broadband Fiber Management System for use in head-ends that require an integrated fiber cable management and OE equipment management approach. The *LGX* Broadband Fiber Management system includes modular frames that allow fiber terminations, optical splitters, laser transmitters, and all electronic and optic interconnection cables to be managed within the same lineup of frames. This system permits rapid and convenient optical connections between OE equipment, optical splitters and outside plant fibers. The modularity of the system allows *LGX* equipment to be installed incrementally as fiber growth demands.



### **LGX<sup>®</sup> Broadband Fiber Distribution Frame Broadband Fiber Management System**

The *LGX* Broadband Fiber Management System includes an entire system of components, including:

- **Fiber Distribution Bay** — The Fiber Distribution Bay is used to terminate all OSP cables on optical connectors. The Fiber Distribution Bay provides users with a point for test access and flexible rearrangement. All optical circuits are connected through this bay. The Fiber Distribution Bay is typically equipped with preterminated **LGX** shelves, which organize permanent cables in the rear and provide front access to optical ports. Usually, nine preterminated shelves are mounted on the bay.
- **Electronic Equipment Bay** — The Electronic Equipment Bay is used to mount optoelectronic equipment in a bay adjacent to the Fiber Distribution Bays. The optoelectronic equipment mounted in these bays is typically the equipment used to convert electrical video signals (coax) to optical video signal (fiber). The Electronic Equipment Bay is arranged so that coaxial cables are organized in the rear of the bay while the optical fiber cables are organized in the front. The fiber interconnect jumpers in the front of the bay can be routed in a contiguous trough system to the Fiber Distribution Bay or to a splitter shelf as required.
- **LGX Preterminated Shelves** — The **LGX** Fiber Distribution Bay is typically configured with preterminated **LGX** Shelves equipped with fire-retardant cable stubs. This allows the shelves to be easily installed and stub cables to be quickly routed to the splice location. The preterminated shelf option improves the overall quality of fiber connections by providing high-performance connections assembled in the controlled factory environment. These shelves are available with any type of connector with the SC connector usually being the connector of choice in broadband applications.
- **Optical Splitter Shelf/Modules** — A broadband system can easily be equipped with optical splitter shelves and modules to provide an integrated approach for access to optical splitters. Modular units are fully compatible with existing fiber distribution arrangements and allow convenient access to connectors. Modules are available to provide a wide variety of splitter functions in several different port and pigtail configurations. Modules may be equipped with any connector or buildout block system. Modules are available in various splitter input and output configurations; for example, 1X2, 1X3, 1X4, 1X5, 1X6, 1X7, 1X8, etc.
- **Optical Connectors and Jumpers** — A complete line of high-performance optical connectors and jumpers is provided as part of the system. The connector of choice for the broadband **LGX** Fiber Distribution Systems is the SC connector. SC connectors are inserted into the network to allow easy test access and rearrangement of fibers. These connectors/ jumpers offer extremely low insertion loss and low reflection.
- **Frame Accessories and Kits** — A complete series of frame accessories and kits are available to customize the frame for local requirements. These include floor mounting kits, AC adapters, end guards, rear doors, equipment mounting adapters etc.

- **Operations Bay** — The **LGX** OpCenter Bay provides a platform to house a computer and peripheral equipment in a standard equipment frame. The Operations Bay may be located directly in the LGX Fiber Distribution Frame (FDF) lineup to provide convenient access to FAS software. The bay is ideally arranged for convenient access to the keyboard, mouse, printer, and monitor. Keyboard and mouse slide out for easy access and slide in, when not in use, to form a flush profile with the front of the frame.
- **Optical Cable Entrance Facility (OCEF)** — The OCEF is used as a high-density optical splice cabinet. The cabinet is a water-resistant enclosure intended for storing a large number of splices and accommodates multiple cable sheaths through the top and bottom or the sides. Cable entry ports are sealed resulting in a National Electrical Manufacturers Association (NEMA) 4/12/13 rating, which provides protection against dust and water spray. The cabinets use standard 12A cable clamps for securing cables and are provided with a work shelf for splicing. A split grommet seal is available to allow insertion of mid-span cables in applications requiring cut-over to the new broadband **LGX** Fiber Distribution System.

The **LGX** Broadband Fiber Management System is largely planned and engineered using similar guidelines to central office applications. The Planning Guidelines and Engineering Guidelines in this document can be used to support the CATV head-end Applications. The primary difference in with the head-end application is the integration of optoelectronic equipment into the Fiber Distributing Frame lineup. The Broadband FDF application also requires additional floor space since the frames are 24 inches (609 mm) deep. The remainder of this section covers these special aspects of planning the head-end application for the Broadband Fiber Distributing Frame.

## **Broadband Frame Guidelines**

---

Proper planning and engineering of an *LGX* Broadband Fiber Management System can ensure trouble free service and graceful growth into the future. The basic elements needed for planning are maximum number of fiber terminations, mounting space requirements for Radio Frequency (RF) and the optoelectronic (OE) equipment, the number and type of splitters, a cable placement and termination method, and knowledge of any other physical space limitations. This information is critical for determining whether to use one bay or multiple bays, and whether to locate the bays in a single frame lineup or in multiple frame lineups.

### **Comprehensive Plan**

A long-range plan should be developed before a new *LGX* Broadband Fiber Management System is installed, and whenever a new frame is added to an existing installation. The plan should identify the *LGX* equipment needed to support initial service, together with the equipment that will be needed to support the expected future maximum capacity. A comprehensive plan will allow an *LGX* system to be engineered, and floor space reserved, to allow the graceful addition of frames without costly future rearrangements. The planning should determine the number of required bays, the bay layout arrangement, floor space requirements, cable entry into the frames, numbering of the frames, equipment and connectors, and a detailed equipment list.

### **Number of Bays**

#### **Determining the number of bays requires the following information:**

- The vertical mounting space requirements for the RF and OE equipment
- The number and type of optical splitters
- The number of fibers to be terminated
- The termination method—preterminated shelves, splicing, etc.

For orderly expansion, it is recommended that separate bays be used for different functions. For example, RF and OE equipment should be placed in Electronic Equipment Bays, optical fiber terminations in Fiber Distribution Bays, and optical splitter modules in separate dedicated Fiber Distribution Bays. These

three functionally distinct bays may then be grouped in various ways.

Recognizing that confining the three functions to separate bays may not be economical for small installations, the *LGX* Broadband Fiber Management System can mix the various functions in a single bay. The following sections describe a method for determining the number of required bays.

## Number of Electronic Equipment Bays

**The Electronic Equipment Bay accepts 19-inch wide RF (combiners, demodulators, amplifiers, etc.) and OE equipment (lasers, receivers, etc.).**

Because each bay has a 64-inch (1626 mm) vertical mounting space for equipment, the required number of Electronic Equipment Bays can be found by dividing the total equipment height by 64 inches (1.6 m) and rounding to the next whole number. For example, if the RF and OE equipment consists of 24 modulators [each 5 inches (127 mm) high], two combiners [each 3.5 inches (89 mm) high], and 5 Laser shelves [each 8.75 inches (222 mm) high], the total equipment height is 170.75 inches (4 m) . Dividing this by 64 inches (1.6 m) and rounding up gives three Electronic Equipment Bays. The same calculation can be made for metric conversions by adding up the total equipment height in millimeters (mm) and dividing the total by 1626 (mm) and rounding up to the next whole number.

## Number of Fiber Distribution Bays (for Fiber Terminations)

The number of Fiber Distribution Bays needed for terminating outside plant fibers depends on the method chosen to terminate the fibers in optical connectors. The three options are:

- Preterminated Shelves
- Field Installed Connectors
- Factory Connectorized Pigtails

### Preterminated Shelves

Lucent recommends that Preterminated Shelves be used for terminating outside plant fibers. Because these shelves relocate splices from the bay to the Optical

Cable Entrance Facility, they save frame space, and enable the use of fire

retardant building cables. Additionally, the quality of factory installed SC optical connectors are superior to that of field installed connectors.

Nine 72-fiber Preterminated Shelves can be installed in a Fiber Distribution Bay, giving a termination capacity of 648 fibers per bay.

or, Seven 144-fiber Preterminated Shelves can be installed in a Fiber Distribution Bay, giving a termination capacity of 1,008 fibers per bay.

As an example of how to compute the number of bays, assume that 200 fibers must be terminated. This requires  $200/72=3$  (rounded up) Preterminated Shelves. Because each shelf measures 7 inches ( 178 mm) high, this equates to a total height of 21 inches (533 mm). Dividing the 64-inch (1.6 m) total available height in a bay by 21 inches (533 mm) and rounding up gives one Fiber Distribution Bay.

### Field-Installed Connectors

Field technicians can directly install SC connectors (Chapter 5) on optical fibers.

The connectors then plug into the rear of SC couplings in the connector bulkhead panel of a Termination Shelf. The capacity of the Termination Shelf is identical to that of the Preterminated Shelf (72 connectors), and the space requirements are computed the same way.

Because optical performance is lower for field-installed connectors, and to reduce installation time, optical connectors should be field installed only to restore damaged connectors. Preterminated Shelves should be the standard method for terminating outside plant fibers.

### **Factory-Connectorized Pigtails**

Factory connectorized fiber pigtails (short lengths of fiber with a connector on one end) can be spliced to outside plant fibers, and the connectors plugged into the rear of SC couplings in the connector bulkhead panel of a Termination Shelf. The splices are stored in Splice Shelves. Because of the space occupied by Splice Shelves when mounted in a frame, this method reduces the capacity of a Fiber Distribution Bay to about 360 fibers. The impact is to increase the number of termination bays needed in large systems therefore this method is typically not recommended.

### **Number of Fiber Distribution Bays (for Optical Splitter Modules)**

To determine the number of Fiber Distribution Bays needed to hold Optical Splitter Modules, the number of Optical Splitter Modules must first be estimated. This number depends on the number of optical nodes being served by each laser.

Splitter Modules with 1 by 2, 1 by 3, and 1 by 4 splits occupy a single-width in the Termination Shelf. Because one shelf can hold 12 single-width modules, the number of splitter Termination Shelves can be found by dividing the total number of required Splitter Modules by 12. For example, an installation having eight 1 by 2, four 1 by 3, and two 1 by 4 splitters equates to a total of 14 single-width Optical Splitter Modules. Dividing 14 by 12 modules per shelf and rounding up gives two shelves.

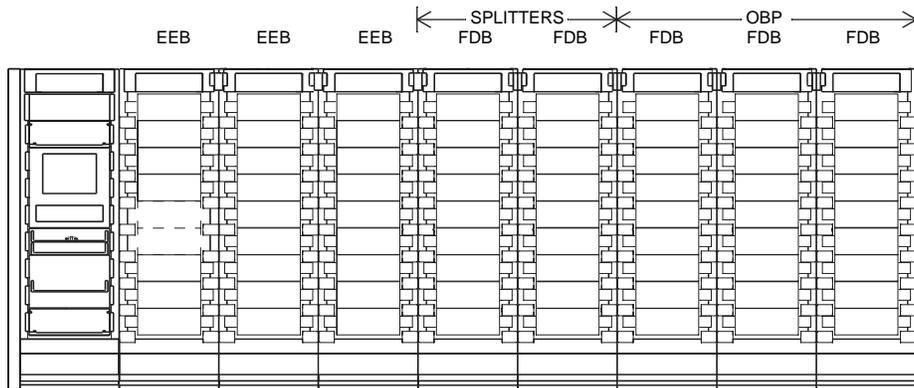
Each Termination Shelf requires 7 inches of vertical frame space. So, two shelves take 14 inches (356 mm), and dividing 64 inches by 14 inches (356 mm) rounds to one bay. One Fiber Distribution Bay is needed to hold two Termination Shelves populated with 14 Optical Splitter Modules. Additional modules and shelves can be added to the frame as needed.

## Bay Arrangement

Except for small installations requiring only one bay, multiple bays should be used for the three distinct functions: OE equipment, optical splitter modules, and optical fiber terminations. Bays should be located adjacent to one another in a frame lineup. The maximum number of bays in a lineup is limited by the capacity of the horizontal jumper raceways that carry jumper cables between bays. This maximum limit is typically about 20 bays. Special planning is needed for longer lineups or for a multiplicity of shorter lineups.

### Grouped

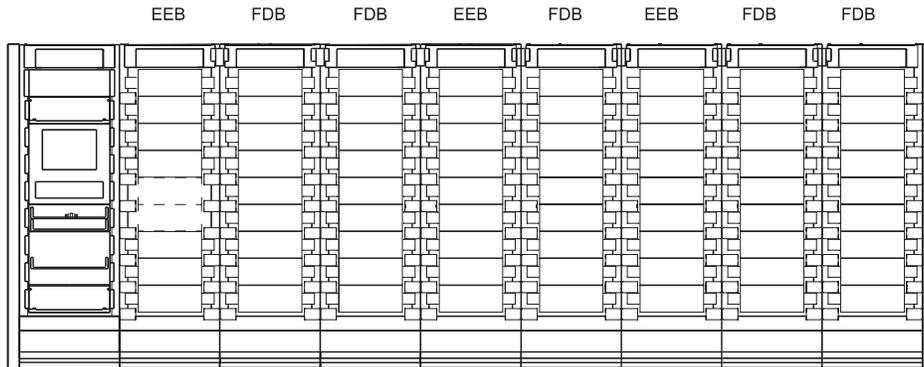
A grouped bay arrangement is one in which Electronic Equipment Bays, Fiber Distribution Bays for optical splitters, and Fiber Distribution Bays for terminating fibers are grouped separately. The grouped bay arrangement essentially separates and segregates the various functions. This allows each area of the frame to be administered without disturbing the other sections. The grouped arrangement is typically used on smaller installations where future growth will be limited.



Grouped Bay Arrangement

## Dispersed

A dispersed frame layout arrangement is one in which the various functional bays roughly alternate throughout a lineup. Positioning electronic equipment near the optical splitters and outside plant fibers to which they are connected allows the use of short optical jumper cables. This arrangement is generally recommended for most applications.



## Alternating Bay Arrangement

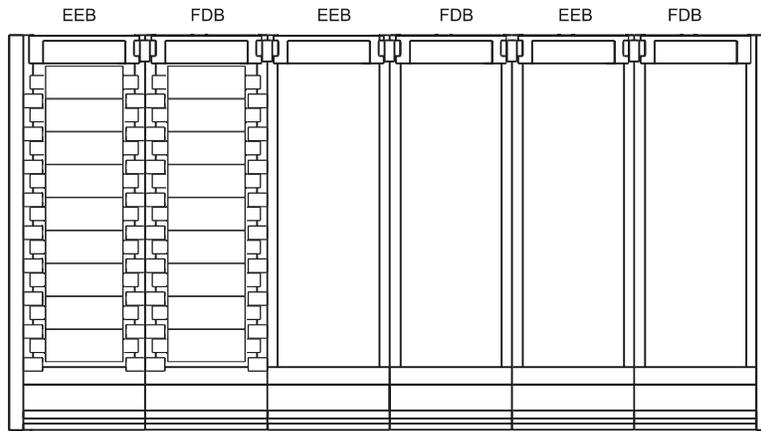
**Having chosen a bay arrangement, the next decision is how to populate the**

frames with equipment while allowing for growth. The two equipment layout options are blocked-in and spread.

### Blocked-In Layout

The blocked-in layout completely fills one functional bay with equipment before installing a new frame. This can be thought of as growing

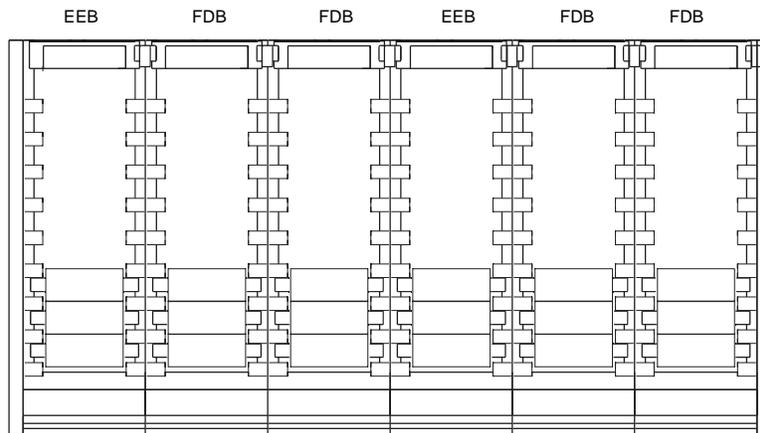
in a horizontal direction. While the blocked-in layout minimizes first cost, it creates potential growth problems. For example, growing to a long lineup could require that new equipment be physically distant from the old equipment it is replacing or to which it must be connected. This would require the use of long jumper cables. Additionally, difficulties could arise in large installations containing multiple frame lineups as discussed in the following section.



**Blocked-In Layout**

## Spread Layout

The recommended layout spreads a few shelves in each functional bay in a lineup, starting at the bottom for frames called from above (shown) or from the top for frames that are cabled from below. [Do not use the top 1 inch (25 mm) of space.] New shelves grow down.



### Spread Layout Bottom-Up Growth Shown

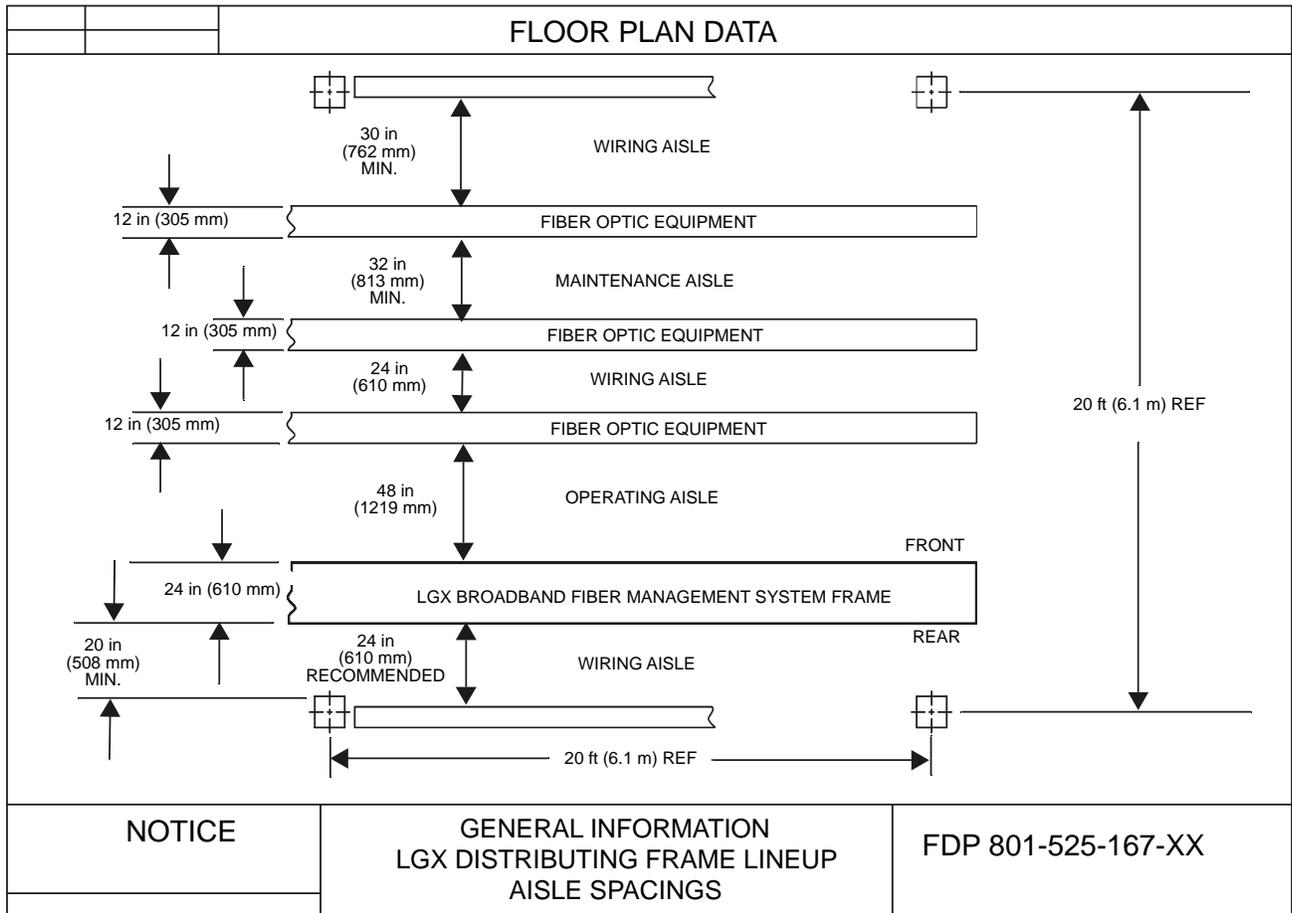
A spread layout is constructed by installing several functional bays initially and furnishing each with only a partial complement of equipment. Equipment is added to the frames, starting at the bottom or top (leave 1 inch unused) and growing, without ever filling the entire space. When a frame fills to within 14 inches of its total space, a new frame is added to the lineup. This process repeats until the lineup reaches its maximum length; for example, 20 bays.

After this, a decision must be made whether the ultimate capacity of the Head-end will require an additional frame lineup. If so, some of the remaining space in each bay can be used for tie terminations to the new lineup. If additional lineups are not needed, the remaining space in each bay can be filled with standard shelves and equipment. The main advantage of the spread layout is its flexibility for the retirement of old OE equipment. For example, if a 40-channel Laser Link transmitter is to be replaced with an 80-channel Laser Link II+ shelf, the new shelf can be located in the same bay as the old laser, and possibly connected to the same outside plant fibers using the same jumper cable. The old transmitter can then be removed.

Another benefit of the spread layout is that space is available on the Fiber Distribution Bay for the unforeseen. For example, if growth is so great that another frame lineup must be added, a termination shelf can be placed in a Fiber Distribution Bay to tie fiber terminations to the new lineup. These tie fibers allow patching to other lineups.

## Floor Space Considerations

Sufficient floor space should be available for both the initial and ultimate frame installation. Although initial installations may require only a few frames, sufficient floor space should be reserved to allow the frames to grow to their maximum capacity in a single continuous lineup. Floor space planning requires information on frame dimensions, floor loading, and aisle spacing. LGX Broadband Fiber Management System frames are 24 inches (609 mm) deep and 26 inches (660 mm) wide at the front. One End Guard adds 3 inches (76 mm) to the width.



### Typical Floor Plan

## Cable Access

The LGX Broadband Fiber Management System is designed for installation on either a raised floor or directly on a concrete floor. In either case, the system provides cabling access for both fiber optic cables and coaxial cables. The system is designed to allow cables to enter a frame lineup from the top or from the bottom. The Engineering Guidelines section in this document describes the equipment available for constructing overhead and underfloor cable pathways.

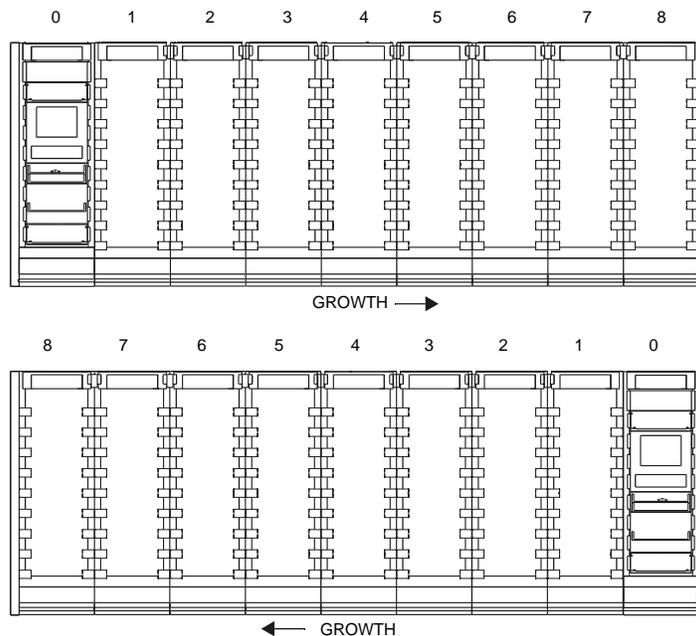
The Engineering Guidelines section also outlines guidelines and procedures for engineering bottom cable entry into the frames. Bottom cables enter a frame through holes or slots in the floor. These openings must be engineered to be within the footprint of the frame and located on the floor before installing the frame. Either circular holes or rectangular slots are used depending on the site conditions.

## Frame Numbering

Maintaining accurate records is essential for routine administration of the LGX Broadband Fiber Management System frame. Consequently, a scheme must be chosen for identifying each frame, the location of the equipment on the frame, and each fiber connector on the equipment. The following section describes numbering schemes for all the equipment on the frame. This information is also used with the Fiber Administration System.

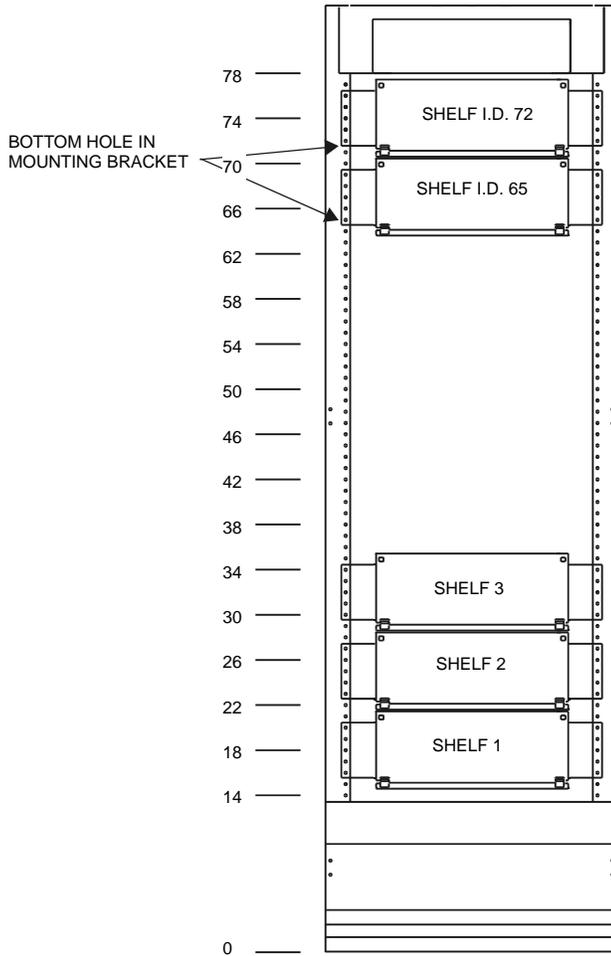
### Frame Numbering

Frames within a lineup are usually numbered sequentially—either left-to-right or right-to-left. Generally, the frame numbering will proceed in the direction of expected frame growth, and their numbers should be clearly marked at the top of each frame. It may also be desirable to clearly mark each bay as to Fiber Distribution Bay (fiber terminations), Fiber Distribution Bay (Optical Splitters), and Electronic Equipment Bay.



### Equipment Numbering

The equipment and shelves within each bay can be numbered using various schemes. One of the schemes uses the mounting hole number from the floor. This is the same as the distance (in inches) from the floor to the lowest mounting hole in the frame used to mount the shelf or equipment. The hole number begins at 14 at the bottom and increases to 78 at the top. A more frequently used method is to sequentially number each equipment shelf from top to bottom. Whatever method is chosen, each equipment and shelf should be clearly marked with its number.

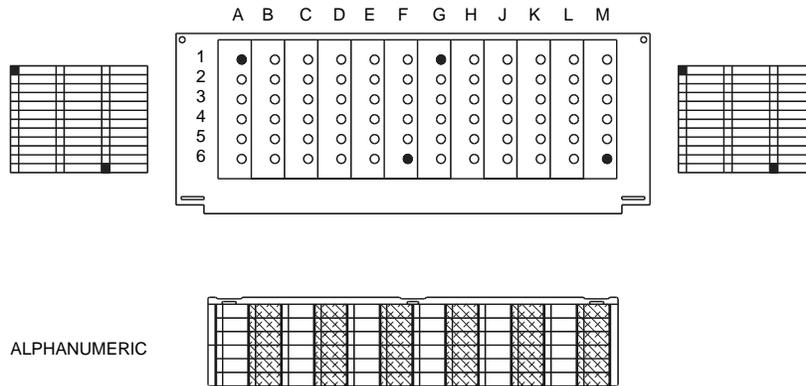


### Equipment Numbering

## Connector Numbering

### Fiber Terminations

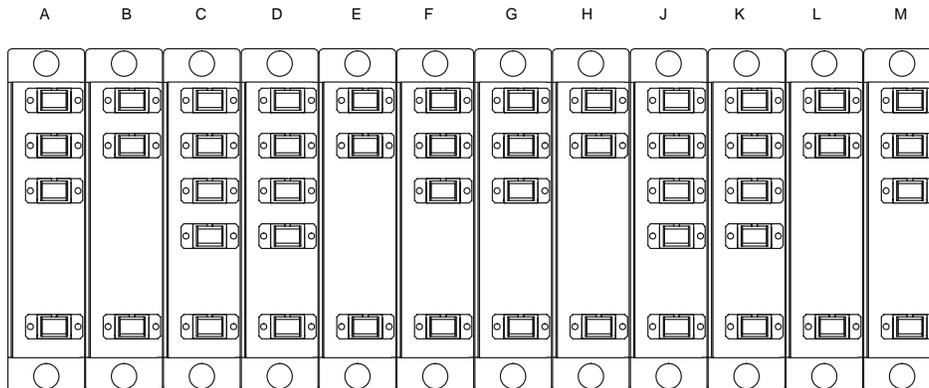
Fiber connectors on a Termination Shelf can be numbered sequentially 1 through 72. An alternate scheme is to label each vertical column of connectors A through M (omitting “ I “) from left to right and to number the connectors within each column 1 through 6 from top to bottom. The numbering method chosen is noted on a label attached to the shelf’s door. The destination of each connector can be noted on labels affixed to the side retainers adjacent to each shelf.



### Connector Numbering

### **Splitter Numbering**

An alphabetic scheme can be used to identify optical splitter modules in each single-width slot on the Termination Shelf, starting with A on the left and ending with M (omitting “ I ”) on the right. Within each slot, the lowest connector port will be the splitter input port, and this is labeled 1. The other ports, moving up, are sequentially labeled starting with 2. Using this scheme, the input port on a 1x4 Splitter Module mounted in the third slot from the left, would be C1, and the other ports on the same module would be C2, C3, C4, and C5 from bottom to top.



### **Optical Splitter Module Numbering**

## Outside Plant Applications

12

### Section Contents

---

The LGX<sup>®</sup> shelves are ideal for Outside Plant (OSP) Remote Terminal (RT) applications. The RT applications usually involve connecting OSP fibers to electronic equipment in electronic enclosures or Controlled Environmental Vaults (CEVs). In these applications, LGX shelves are installed on RT frames that are typically located up against a wall. Therefore, the front access termination shelves and combinations shelves are usually specified. Some RT frame applications may require a higher density than is normally provided. Higher density can be achieved with options provided by the high-density LGX shelves. Other applications for the LGX shelves include RT cabinet installations. This chapter covers the following areas:

- Overview of OSP Applications 12-2
- Service Configuration 12-3
- Termination Methods 12-3
- Sizing the RT Frame 12-4
- RT Frame Layout 12-4
- Cabling Plan 12-6
- High-Density RT Options 12-8
- RT Cabinet Applications 12-8

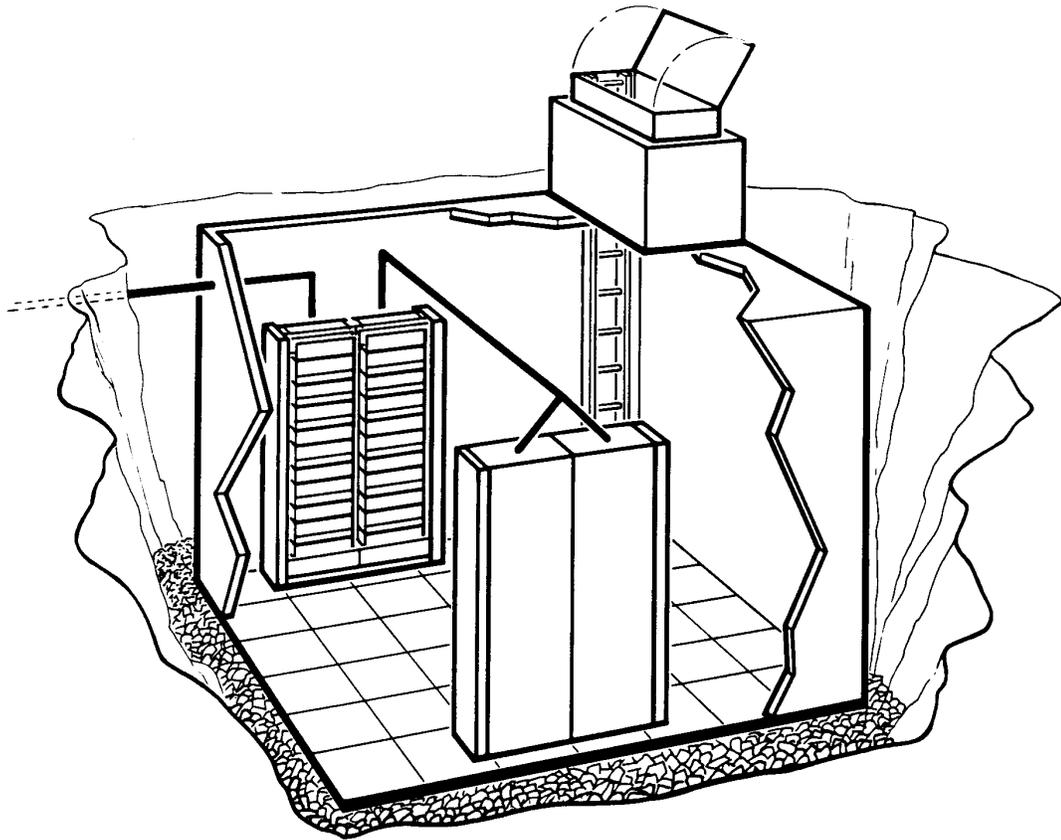
### Overview of OSP Applications

---

As shown in the figure below, a typical application for an LGX frame is in an RT frame. In this position, the LGX RT frame acts as an interface between OSP feeder cables and the serving electronics. Electronics positioned in the OSP are typically used for Digital Loop Carrier (DLC) Systems. The primary need at this location is to interconnect OSP fibers directly to the equipment and to provide for test access during cable construction or maintenance activities. In some instances, higher density shelves are used because of space limitations.

Other OSP applications include interfacing to electronics in RT cabinets. A similar need exists to connect OSP feeder cables to the electronics housed in the cabinets. These applications involve installing LGX shelves into 41-type, 50-type, 80-type, or 90-type cabinets.

**RT Frame Application**



## Service Configuration

---

An RT frame equipped with fiber termination shelves may be used in a variety of configurations to provide customer service. Usually, customer service is provided by using interconnect jumpers to connect OSP cables to Fiber Optic Transmission System (FOTS) equipment. A service configuration (either cross-connect or interconnect) should be determined as follows:

- **Cross-Connect** — This method of service connects an OSP fiber to servicing equipment with a short jumper cable. With this option, the lightguide equipment cables and OSP cables are permanently cabled and terminated at the RT frame. A short fiber optic jumper is routed from the OSP termination connector to the equipment termination connector. The cross-connect provides added flexibility while adding two connectors into the circuit.
- **Interconnect** — This method of service connects an OSP jumper cable directly to the equipment. The fiber optic jumper cable is then routed in the overhead rack to the equipment frame and terminated directly to the OSP cable connector. The interconnect method provides less flexibility but adds only one connector in the circuit. Interconnect provides economic advantages and is used in RT frame applications when the lowest loss is desired in a fiber circuit.

## Termination Methods

---

The distribution shelves handle a wide variety of fiber cable. All OFS fiber optic cable types, including Multimode (MM) and Single-Mode (SM) cable, may be terminated at the RT frame. Fiber cables are typically secured to the cable brackets on the sides of the shelves. In RT frame applications, OSP cables are only secured on one side of the shelves as opposed to both sides as in Central Office (CO) applications.

The fiber distribution shelf plan is to a large extent determined by the cable configuration selected. The cabling configuration is a key factor in determining the frame space required. In general, there are three ways to terminate cables at the RT frame.

- **Pretermination** — Preterminated shelves can be installed in OSP applications. The use of preterminated options allows splicing to be removed from the RT frame, thus resulting in higher termination capacity.
- **Direct Termination** — Allows individual fibers to be terminated directly to fiber connectors on the shelf. Usually, the LST1U-072/7 termination shelf is used for direct termination of either OSP or building fibers. The termination shelf handles 72 fibers in 7 inches (178 mm) of vertical space.
- **Individual Splice and Termination** — Uses a splice shelf such as the LSS1U-072/5 or LSS1U-144/7 in combination with one or two LST1U-072/7 termination shelves. These shelves will splice/terminate 72 fibers in 12 inches (305 mm) of vertical space or 144 fibers in 21 inches (533 mm) of vertical frame space.
- **Mass Splice and Fanout Termination** — Uses the LSS1U-216/5 splice shelf in combination with the termination shelf. This arrangement will handle mass fusion or array splice/fanout terminations in complements of 72 fibers

in 12 inches (305 mm) of vertical frame space or 144 fibers in 19 inches (483 mm) of vertical height.

## **Sizing the RT Frame**

---

The initial RT is sized according to the number of fibers to be terminated. During the engineering phase, the distribution shelves are matched and arranged in the RT. The RT frame can be equipped with shelves and associated apparatus in any desired configuration. The typical equipment layout described in the following paragraphs is recommended to optimize the use of frame space and set up the frame for easier installation and operation.

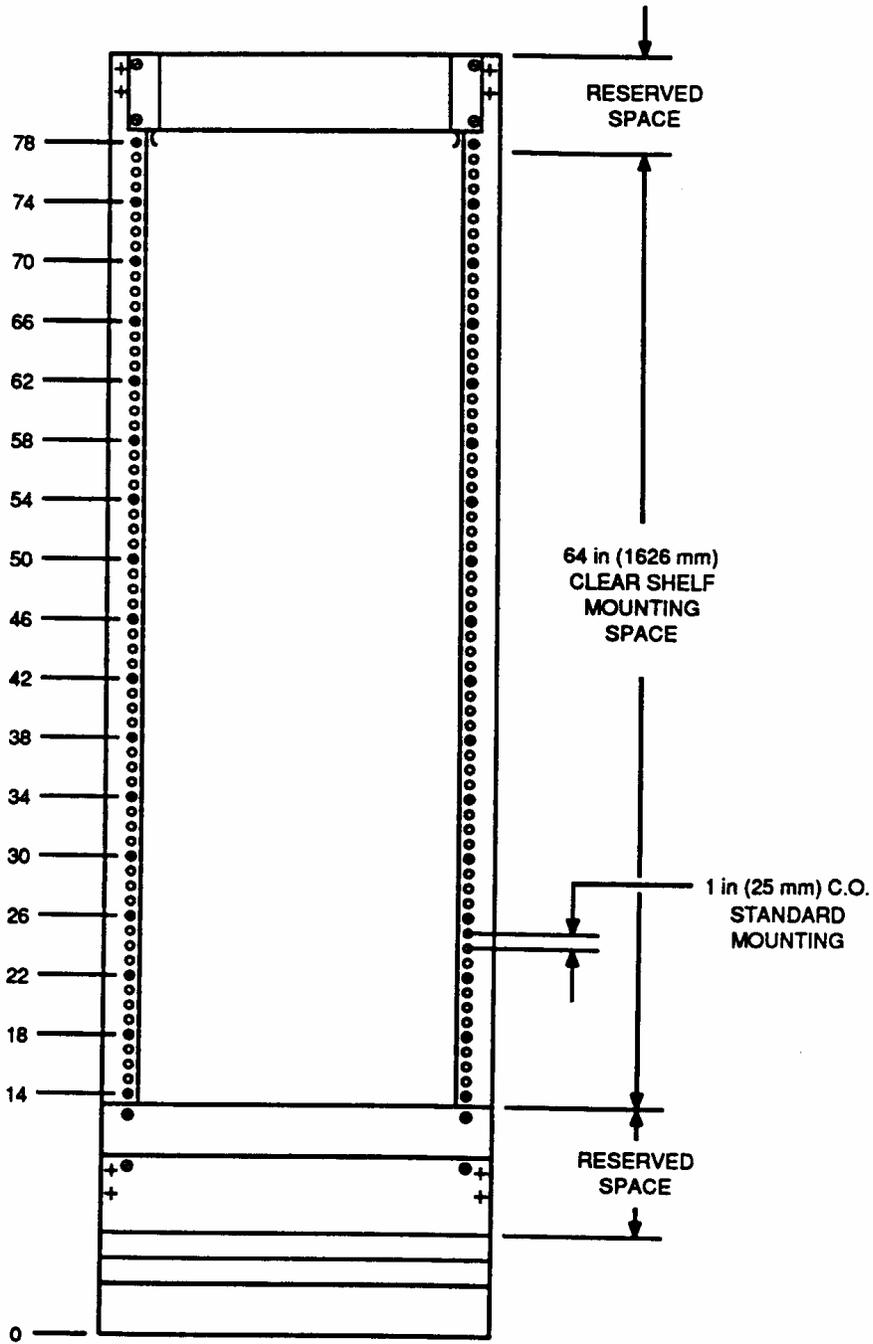
The fiber distribution shelves are used in RT frame applications where standard density of up to 648 fibers in one bay is required. For even higher densities, refer to the high density options later in this section.

## **RT Frame Layout**

---

An equipment layout on the RT frame may be similar to other single bay Fiber Distributing Frame (FDF) layouts (See Single Bay Layout in Engineering Section). In this case, splicing/termination shelves are added from the bottom up. RT frame designs typically do not require the upper and lower raceways. However, the space should be reserved if a future cross-connect arrangement is anticipated.

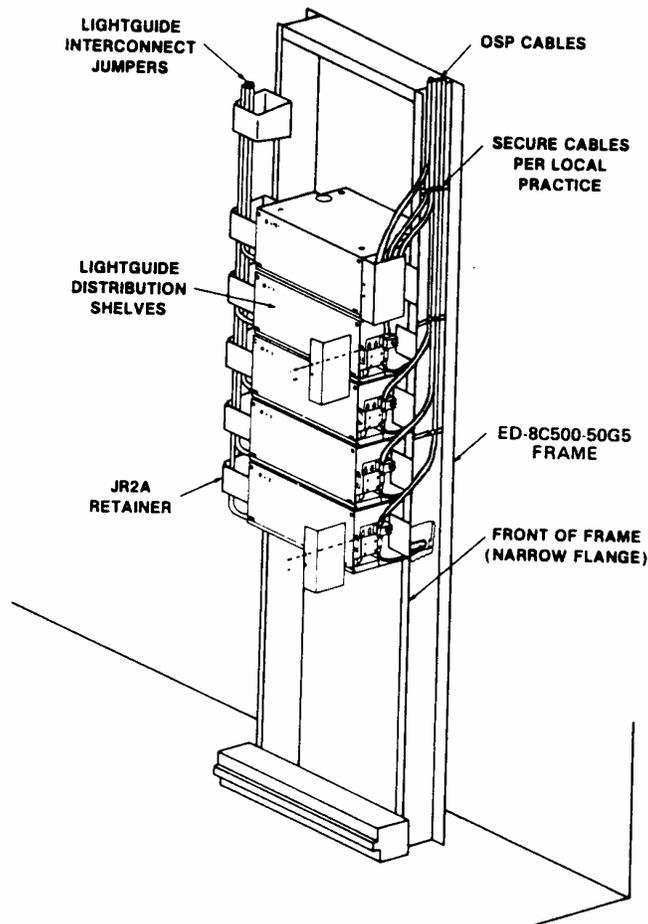
Each shelf on the frame is located using the predetermined equipment arrangement. A suggested shelf identification scheme is to use the distance from the frame base (in inches) to the lowest mounting hole on the shelf mounting bracket as the shelf location identifier. The shelf location coordinate system depicted on the next page applies to the ED-8C500-50, G5 Network Bay Frame. The figure shows an example of shelf location numbering on a typical shelf layout. As an alternate or quick reference system, each shelf may be designated with a numeric character. The lowest shelves would be given the lowest number with the designation scheme progressing from bottom to top; for example, 1,2,3...9.



RT Frame Coordinate System

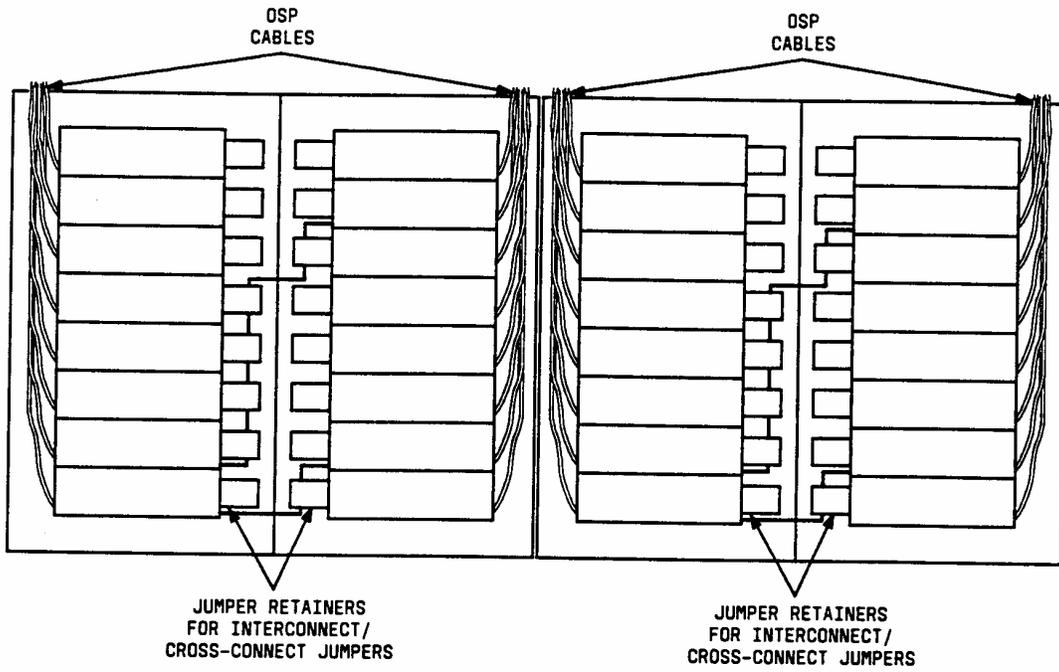
## Cabling Plan

All fiber optic cable types are usually terminated on one side of the frame only. A typical cabling configuration for the RT frame is shown in the figure below. The OSP cables are routed into one side of the frame while interconnect cables are routed into the other side. A limit of two OSP cables may be terminated on each individual shelf. The frame has an OSP cable capacity of 18 cables. When more than one bay is required, the cabling should be arranged as shown in the figure on the next page. When a large number of interconnect cables are to be installed, it may be desirable to equip the frame with JR2A jumper retainers to protect and organize the jumper cables. When more than one bay is required, the cabling should be arranged as shown in the figure on the next page. If several bays of shelves are used and cross-connecting is required between bays, the upper and lower raceways may be used to provide a convenient cross-connect path between the bays.



RT Frame Cabling Plan

Multiple RT Frames

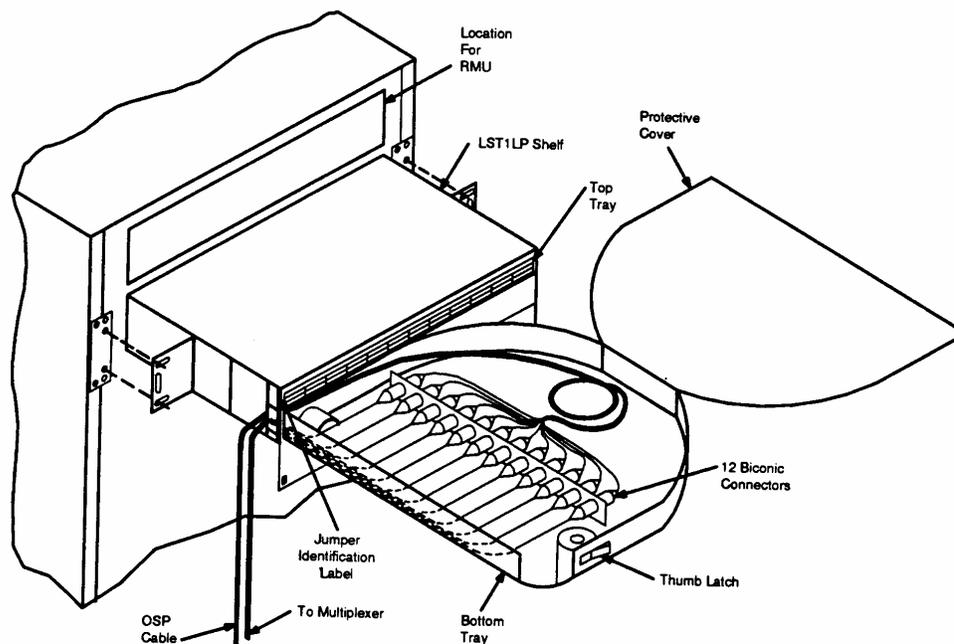


## High Density Options

Due to tight space constraints often encountered in RT applications, it may be necessary to implement high-density options for terminating fibers. Higher than normal density can be achieved through the use of the *LGX* shelves. The 7-inch (178 mm) LST1U-072/7 Shelf provides termination that allows up to 72 fiber terminations when a full complement of six-pack panels is installed. If a higher number of terminations are needed, eight-packs can be installed in the same shelves. Also, the high-density LST1U-072//9 Termination Shelf may be used for direct termination of buffered building cables or Outside Plant (OSP) cables. This high-density shelf accommodates up to twelve 1200-type panels. Since each 1200-type panel accommodates 12 adapters, the nominal shelf termination capacity of the shelf is 144 fibers. The shelf can also be equipped with 1200-type panels (LC duplex only) to achieve a maximum density of 216-fibers. However the 216-fiber 9-inch shelf is recommended for use only in special applications

## RT Cabinet Applications

In RT cabinet applications, *LGX* shelves and LST1LP shelves may be used for termination and splicing of fibers in the 41-, 51-, 80-, and 90-type cabinets. Both types of shelves, *LGX* and LST1LP shelves, may be used in the 41-, 80-, and 90-type cabinets. The 51-type cabinet only uses the LST1LP shelf for termination or splicing. See figure below.



## Premises (LAN) Applications

13

### Section Contents

---

The *LGX*<sup>®</sup> frame and shelves are ideally suited for any premises (LAN) application. The modular design provides an orderly, flexible, interconnect or cross-connect system with simplified installation and cabling. The shelves optimize the use of frame space and easily blend with existing distribution systems that mount in 19-inch (483 mm), 23-inch (584 mm), or in data cabinet arrangements. The shelves can also be wall mounted with front access only cabling procedures. This chapter covers the following topics:

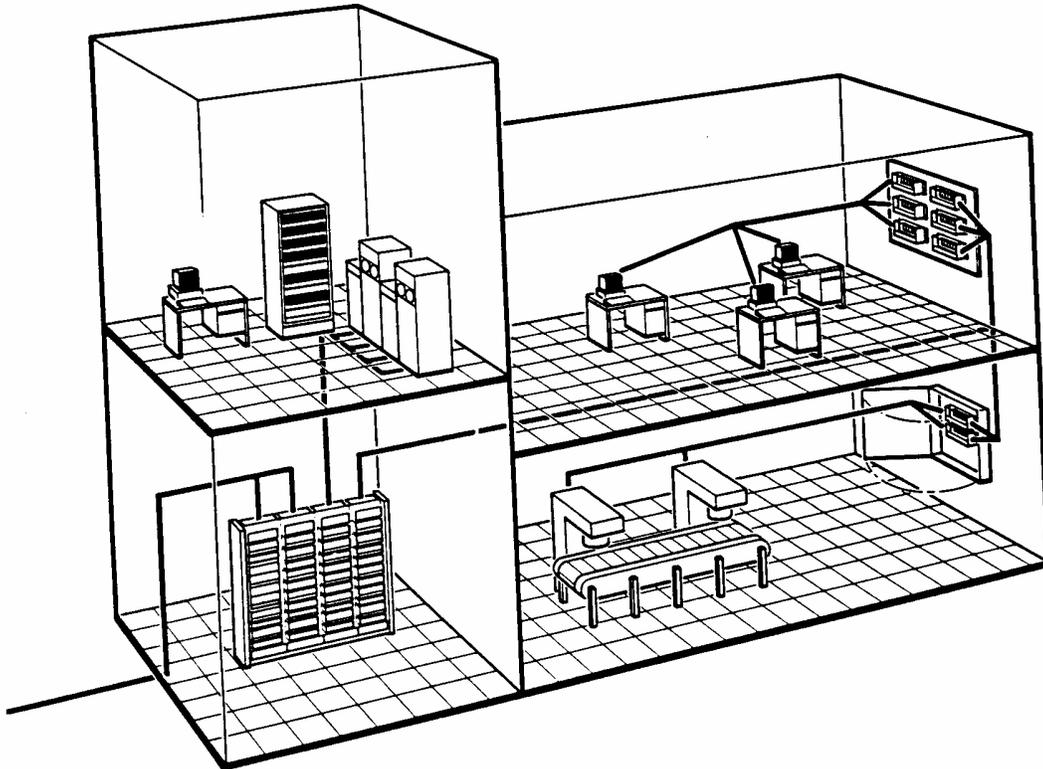
- PDS Planning 13-2
- Building Entrance Terminal Requirements 13-3
- Typical Equipment Room Installations 13-5
- 19-inch Electronic Industries Association (EIA) Frame 13-5
- Raised Floor Applications 13-5
- *LGX* Data Cabinet 13-7
- Wall Mount Applications 13-11

## PDS Planning

---

The *LGX* frame and shelves are well suited for connecting fibers in a PDS application. The *LGX* frame is usually located at the cable entrance area of the building or in the equipment room. At the frame, Outside Plant (OSP) feeder cables are connected to building cables. The building cable fibers may be connected to *LGX* equipment or distributed throughout the building in a network configuration. The *LGX* frame and shelves may be used in Local Area Networks (LANs) as fiber nodes or hubs. The *LGX* distribution shelves can be used in applications such as Manufacturing Automated Protocol (MAP) interconnection or Total Office Protocol (TOP) interconnection to connect fibers in factory or office environments. This section provides further information on applications in:

- Building entrance terminals.
- Equipment rooms.
- Raised floor data centers.
- Apparatus or satellite closets.



**LGX<sup>®</sup> System Premises Network Applications**

**Building Entrance Terminal Requirements**

---

The location of the equipment room is of primary importance in determining the treatment of an OSP cable as it enters the customer premises. If the equipment room is located at the OSP cable point of entrance, the cable may be directly grounded and terminated at the termination or splice shelf. This is the simplest type of OSP cable termination.

When the equipment room is located away from the point of OSP cable entrance, certain requirements must be met. The OSP cable does not contain any fire-retardant capabilities; therefore, it does not meet fire-regulation codes for exposed cabling. Also, metallic strength members in OSP cables may be exposed to electrical hazards and require grounding at the point of premises (building) entrance. One method of overcoming these problems is to run the OSP cable in conduit or metallic-covered raceways; however, the strength members in OSP cable make the cable more rigid and difficult to bend than fiber optic building cables. Because of this, it is difficult, and in some cases impossible, to run the OSP cables in conduit or raceways containing bends. An easier method uses the universal fiber optic closure or the Optical Cable Entrance Facility (OCEF) at the point of entrance as shown in the figure on the next page. Inside wiring cable is then run to the *LGX* frames. This meets all fire and electrical codes and allows easy feeder cable placement to the *LGX* frame.

**BUFFERED LIGHTGUIDE  
INTERCONNECT CABLE TO  
LIGHTWAVE EQUIPMENT**

**LIGHTWAVE EQUIPMENT  
& LIGHTGUIDE FACILITIES  
TERMINATIONS**

**EQUIPMENT  
ROOM**

**CEF**

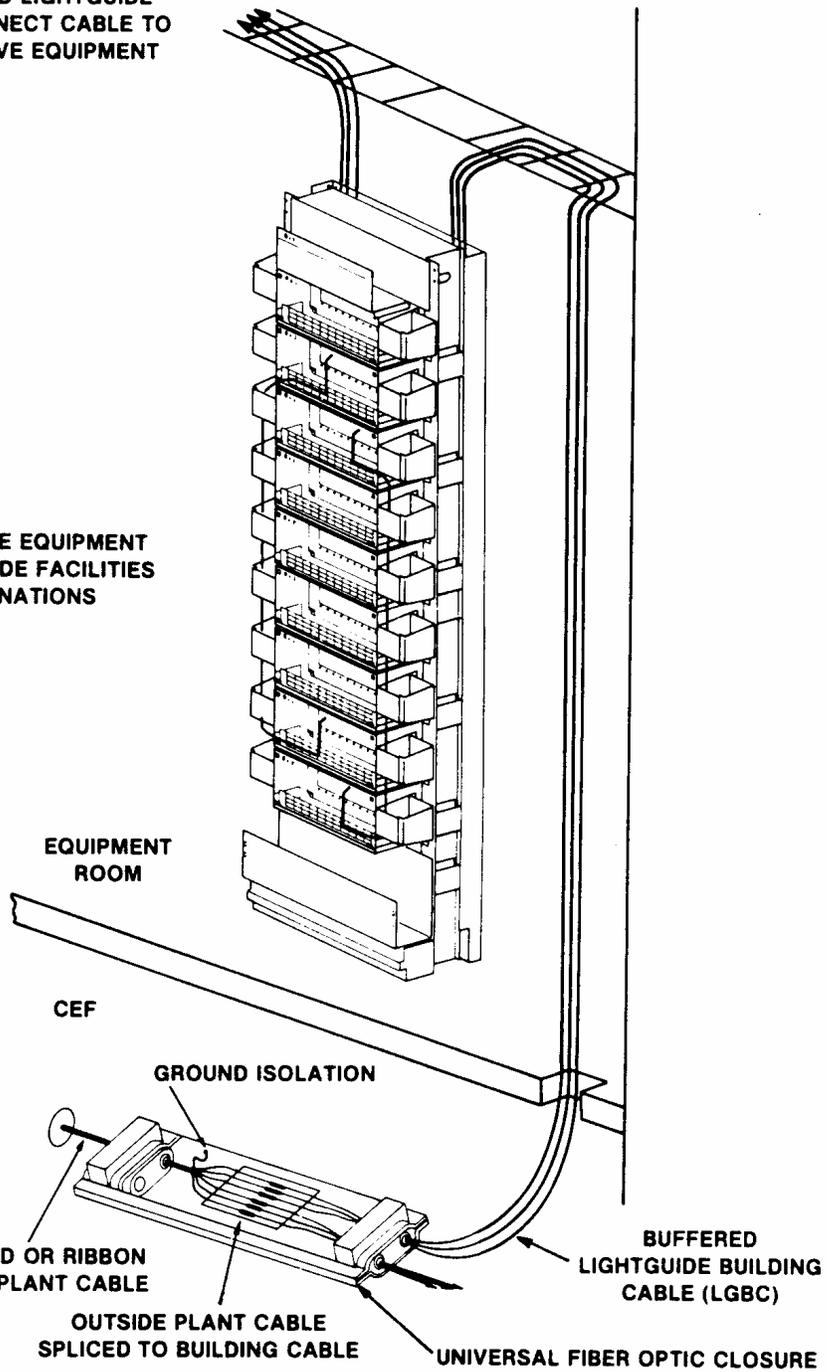
**GROUND ISOLATION**

**STRANDED OR RIBBON  
OUTSIDE PLANT CABLE**

**OUTSIDE PLANT CABLE  
SPLICED TO BUILDING CABLE**

**UNIVERSAL FIBER OPTIC CLOSURE**

**BUFFERED  
LIGHTGUIDE BUILDING  
CABLE (LGBC)**



## Conversion to Building Cables

### **Typical Equipment Room Installations**

---

This part covers the use of the *LGX* system in PDS applications and other applications requiring lineups of one or more frames. The *LGX* system forms a centralized location for terminating fiber cables. Cable and circuit administration is conveniently located at the frame, thus allowing efficient usage of all fiber facilities.

The *LGX* system may be installed to handle the termination requirements of any PDS. An initial application may involve a single *LGX* frame or perhaps several frames. It is usually desirable to allow sufficient floor space to grow the *LGX* system in a continuous lineup. The lineup should ideally be located adjacent to the Fiber Optic Transmission System (FOTS).

The planning, frame, and fiber installation and cabling procedures found in the Planning and Engineering sections of this document often apply to PDS equipment rooms. It is recommended that the fundamental long-range plan for the FDF System be reviewed when a new frame is installed or whenever additions are made to the system. The plan should include forecasts of the number of fibers that will ultimately be terminated at the frames. The forecast is needed to determine the system size and floor space that will ultimately be required to avoid costly rearrangements in the future.

### **19 Inch (483 mm) Electronic Industries Association (EIA) Frame Mounting**

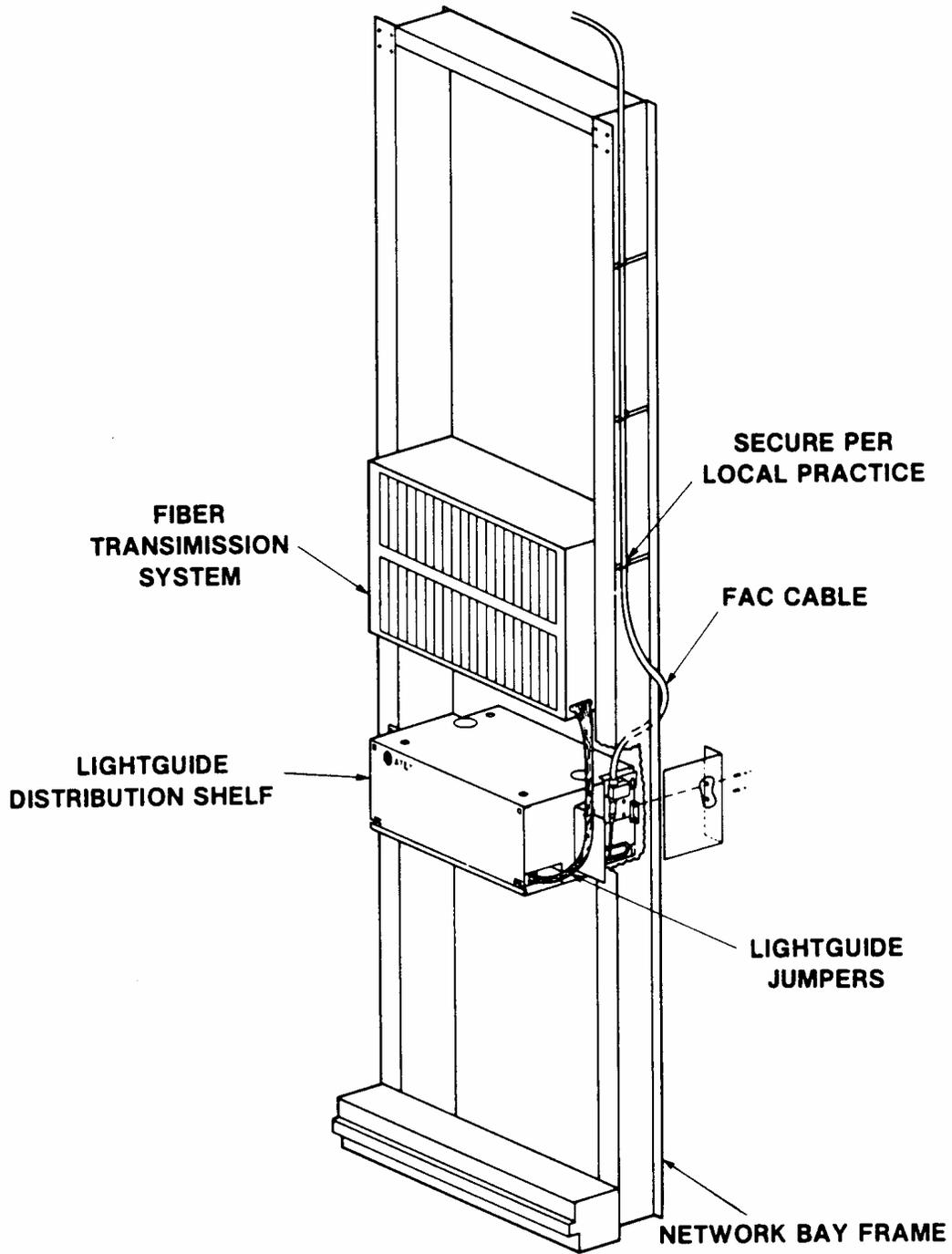
---

The *LGX* Fiber Distribution Shelves can be mounted in any 19-inch (483 mm) EIA standard frame as well as any 23-inch (584 mm) frame. The 19-inch (483 mm) frames include OFS as well as any commercially available 19-inch (483 mm) equipment frame or relay rack see figure on next page. The OFS Frame Adapters frame can be used for 19-inch (483 mm) mountings. The JR1A retainers can be mounted on the 19-inch (483 mm) frame.

### **Raised Floor Applications**

---

Many data networking applications generate a large number of fibers that converge on a computer data center. Fibers routed in these LAN applications have various requirements for splicing, interconnection, and cross-connection. Typical data centers are constructed on raised floors with computers and auxiliary data widely used due to the wide base that provides stability without additional anchoring. The data cabinet also provides protection on all sides for cables and equipment and is easily accessed through front or rear doors. The interior of a data cabinet is outfitted with vertical mounting channels for mounting shelves and securing cables.



19- inch (483 mm) Frame Application

## **LGX System Data Cabinet**

---

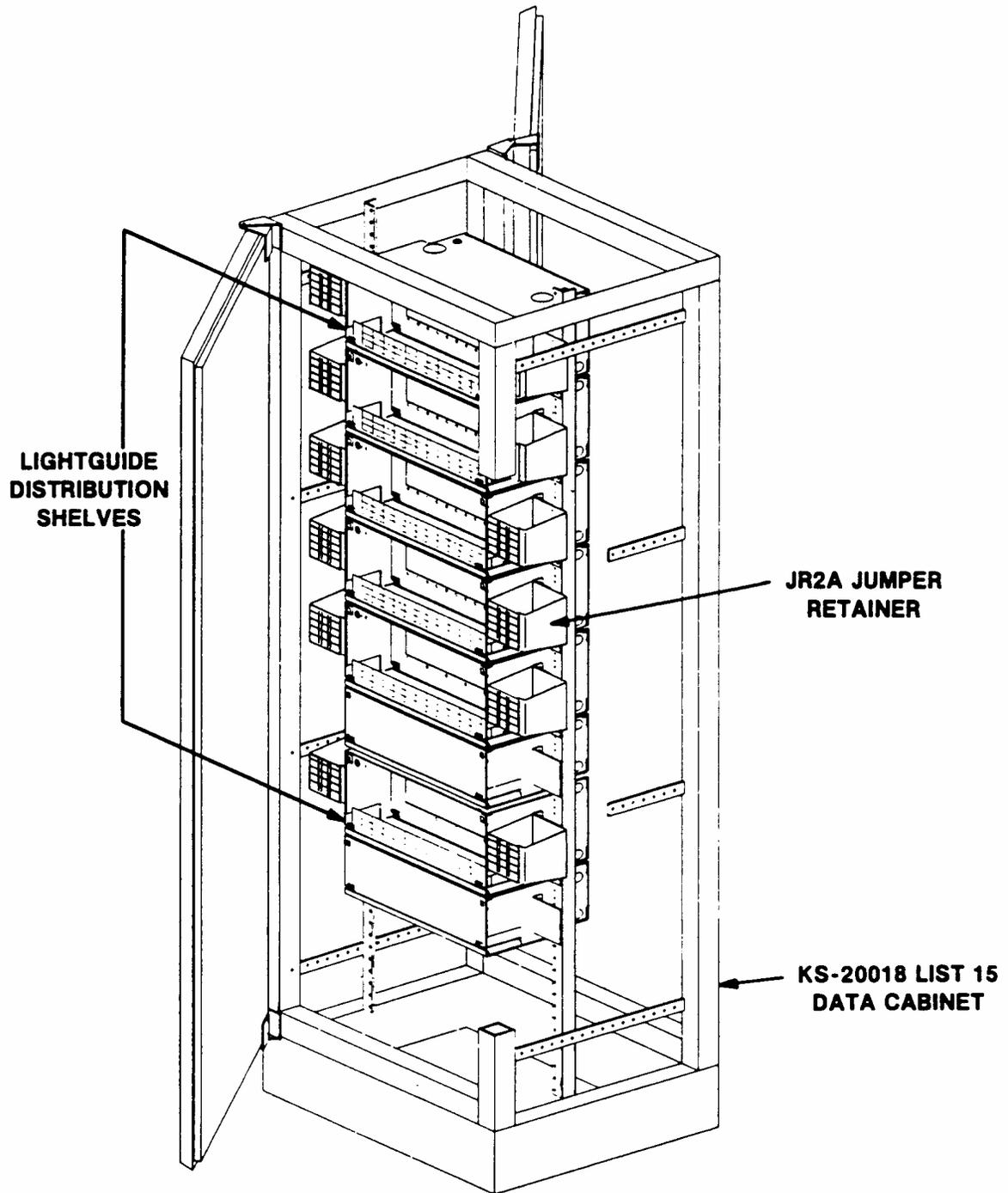
The distribution shelves mount in most data cabinets, including any 19-inch (483 mm) EIA compatible cabinet and the OFS 23-inch (584 mm) *DATAPHONE*<sup>®</sup> data cabinet. The data cabinet is typically placed on a raised floor in a data center where fiber cables enter the cabinet from below. The modular *LGX* shelves can be added as needed to equip the data cabinet for fiber optic cable splicing, termination, and interconnection. The data cabinet may be dedicated as a fiber optic cross-connect data cabinet or as a flexible interface in a data network; or the cabinet may be shared with other data communication equipment.

The distribution shelves are compatible with the OFS 19-inch (483 mm) EIA cabinet or any commercially available 19-inch (483 mm) EIA cabinet. The KS-20018, List 21 Data Cabinet is shown in the figure on the next page filled with distribution shelves. The distribution shelves are installed with the shelf mounting brackets oriented for the 19-inch (483 mm) mounting. The OFS data cabinet allows 64 inches (1626 mm) of clear vertical mounting space, which is the same as the available mounting space in the *LGX* frame. Because of this, the same planning guidelines used for determining the *LGX* shelf layout for the *LGX* frame can be used for the data cabinet. The JR1A Jumper Retainers shown in the figure on the next page are used in the 19-inch (483 mm) data cabinet application.

A typical *LGX* distribution system can be designed around the OFS KS-20018, List 15 Data Cabinet. The KS-20018, List 15 Data Cabinet is the original OFS *DATAPHONE* data cabinet. The List 15 data cabinet provides uprights for 23-inch (584 mm) mounting arrangements. The distribution shelves may be installed in the 23-inch (584 mm) *DATAPHONE* data cabinet just as easily as in the 19-inch (483 mm) cabinet. The JR2A retainers can be used in 23-inch (584 mm) cabinets.

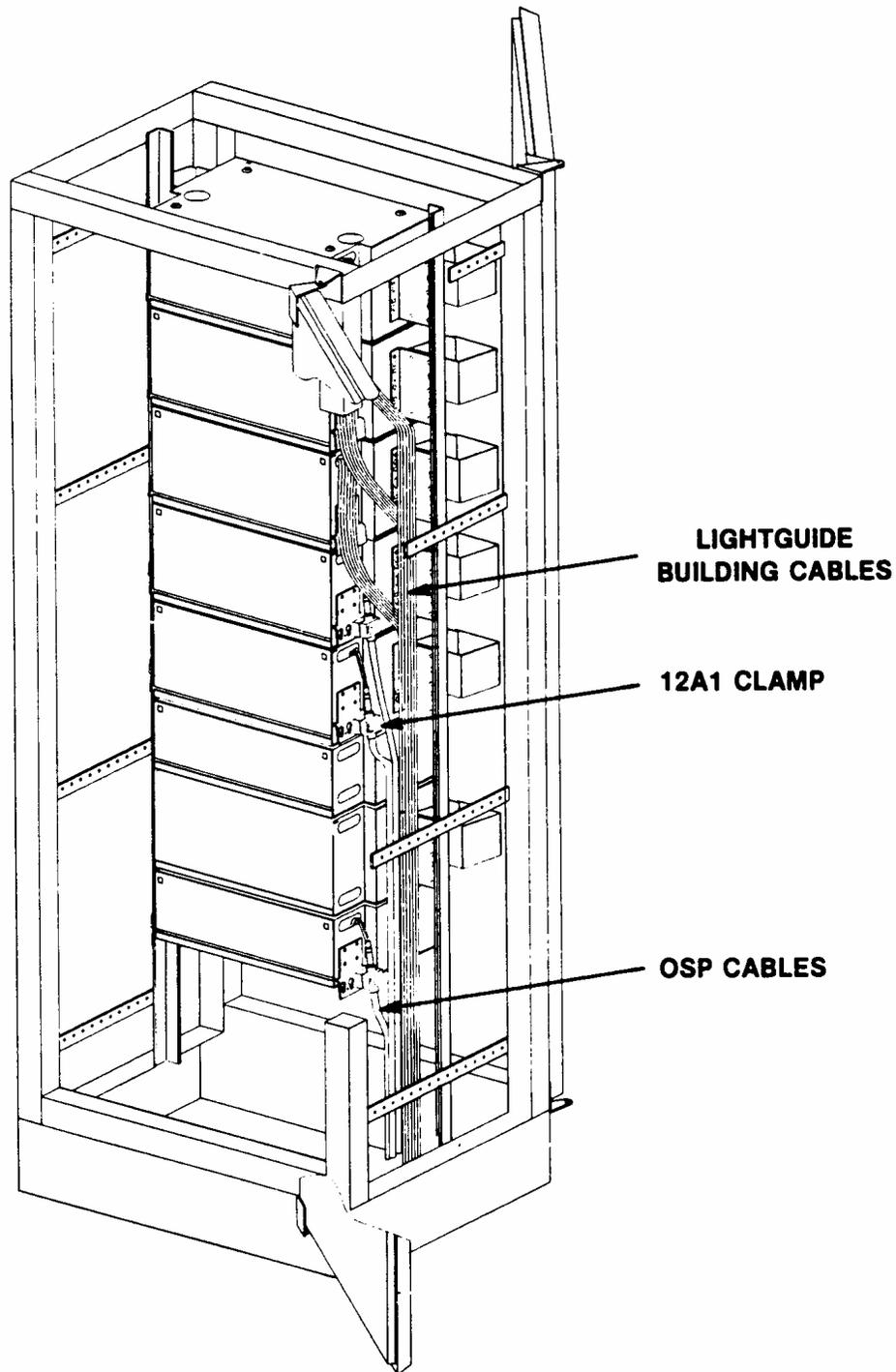
The shelf can be used for either bottom feed or top feed of cables. In a typical cabling arrangement the OSP cables are routed beneath the floor and routed up through the bottom of the cabinet. As the cables enter, they are secured to the side of the data cabinet. The OSP cables are typically routed up the sides of the cabinet to their shelf destination. They are attached using 12A1 cable clamps to the cable clamp brackets on the side of the shelf.

Buffered building cables can also be routed in the data cabinet through the entrance in the base of the cabinet. The building cables are secured as they enter the cabinet and then supported periodically over the height of the cabinet. The building cables may also be secured (tie wrapped) to the cable clamp brackets supplied with the shelf.



Data Cabinet — 19 inch (483 mm)

Data Cabinet — 23 inch (584 mm)



**Data Cabinet — Typical Cabling**

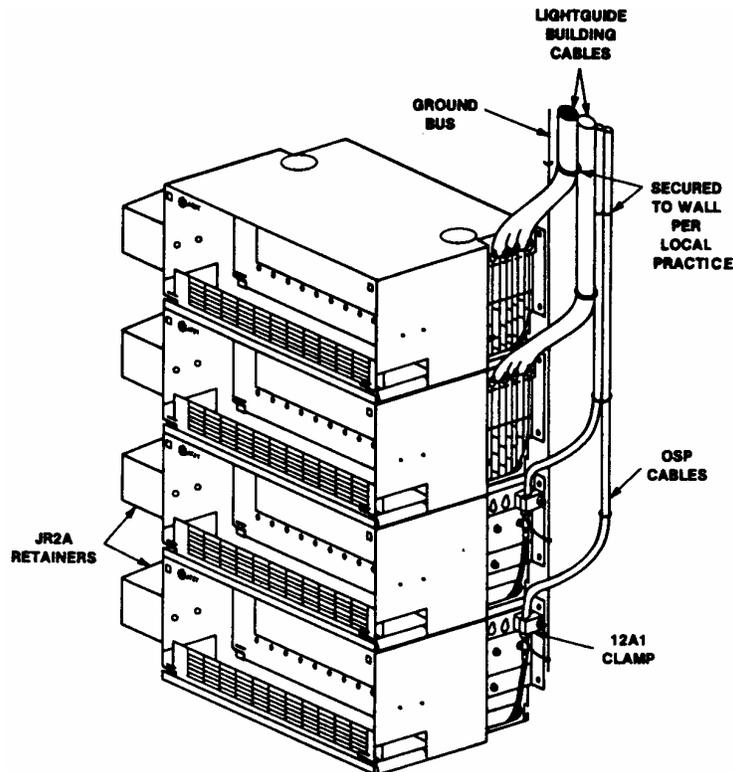
## Wall Mount Applications

### LGX Fiber Distribution Shelves

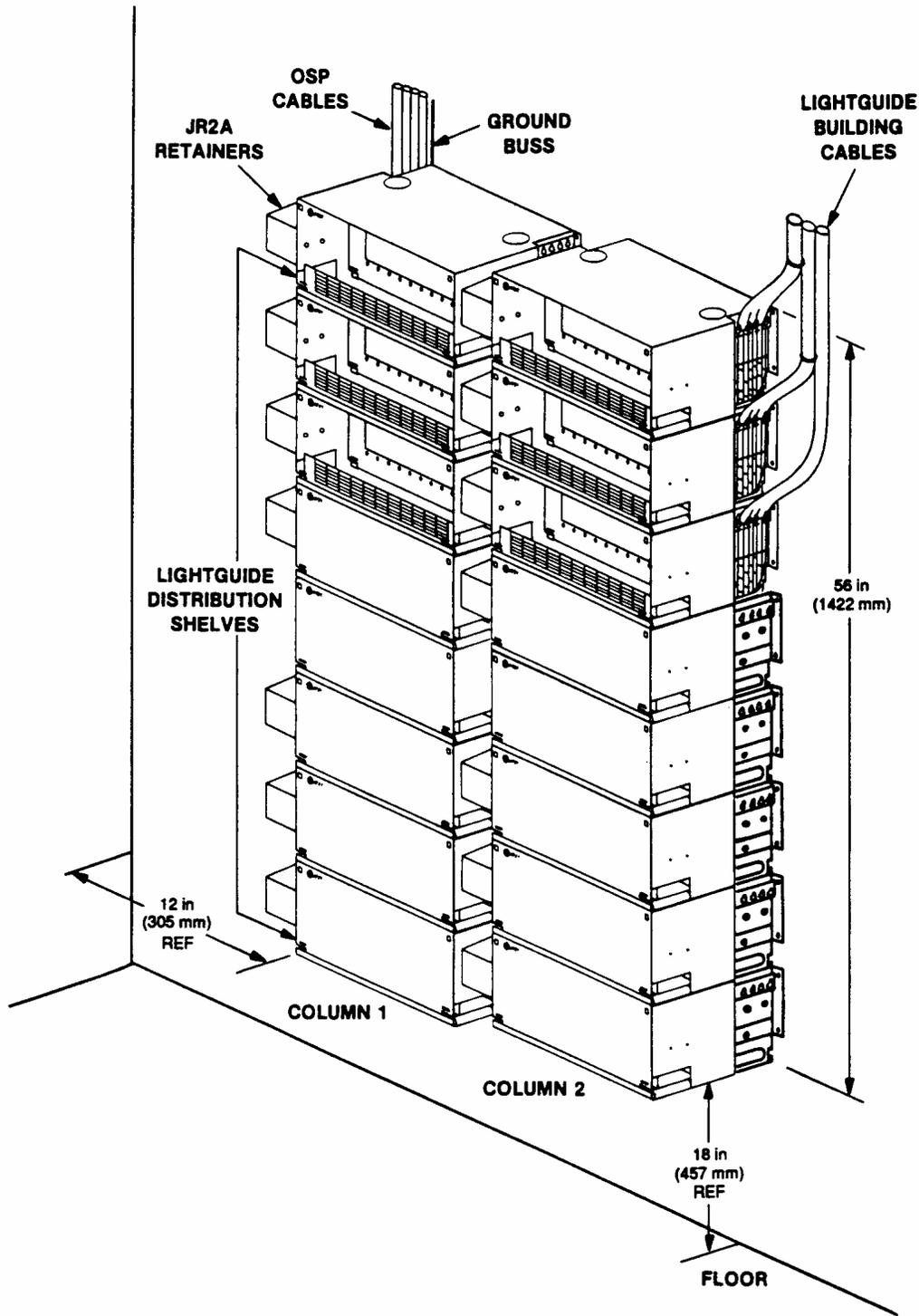
The *LGX* Fiber Distribution Shelves may also be mounted to a wall with the shelf mounting brackets supplied with the shelf. In PDS applications, shelves are often mounted to walls in equipment rooms or in apparatus closets. In these applications, the front access *LGX* shelves are recommended. The two front access shelves most commonly used in these applications are as follows:

- LST1F-072/7 Front Access Termination Shelf
- LSC2U-024/5 Combination Shelf

The shelves are usually secured to the wall and cabled as shown in the figure below. The shelves may be arranged for interconnection or cross-connection. As shown in the figure on the following page, the distribution shelves may be added to the wall in columns to form a very large cross-connect field. If a large number of jumpers must be accommodated, one or two columns of JR2A retainers may be installed between shelf columns to retain jumpers.



Wall Mount Application



Wall Layout — Multiple Columns

## Retrofit Applications

14

### Section Contents

---

Many fiber interconnection applications use fiber patch panels or interconnection cabinets for terminating fibers. Often these individual patch panels or cabinets are installed in positions that are not convenient as central distribution hubs. To efficiently utilize fiber facilities it may be desirable to relocate fibers to a centralized location. This allows easy interconnection or cross-connection of facilities and equipment.

The *LGX*<sup>®</sup> Fiber Distribution System is recommended for replacement of older interconnection equipment where centralized termination is desired. The *LGX* Fiber Distribution Frame (FDF) can be used in many applications to provide a new fiber hub for administering fiber optic circuits. This chapter covers the following areas:

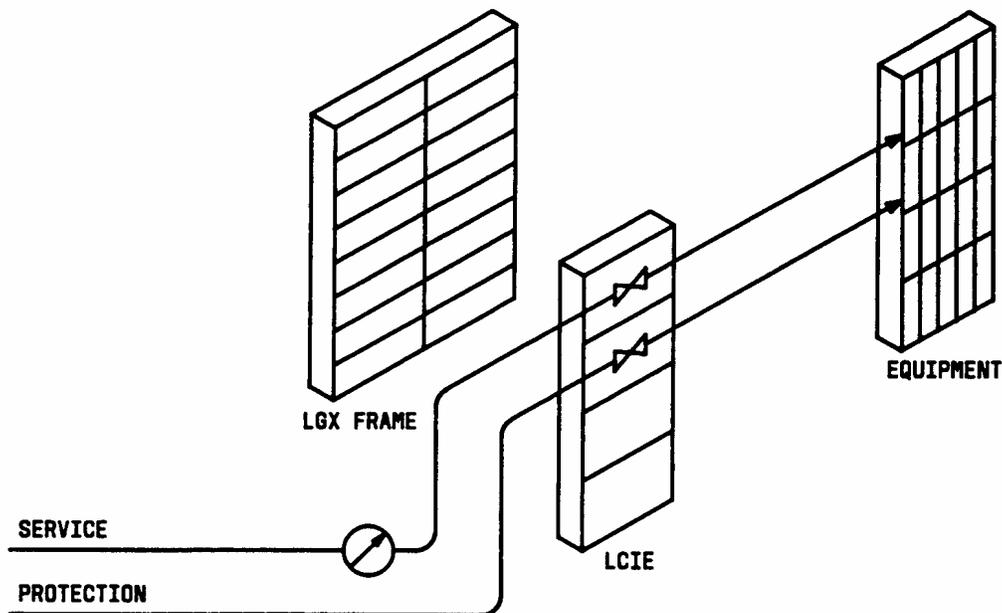
- Installing the *LGX* FDF 14-2
- Install Retrofit Cabling 14-3
- Moving Service Line to *LGX* Frame 14-5
- Complete Retrofit 14-6

## Installing the LGX FDF

---

In planning for the retrofit, the user should gather data on working systems, protection line capabilities, and spare fibers. A plan should be developed to economically utilize existing facilities. The number of fibers to be reterminated should be determined. The best time for retrofit is during the upgrade of facilities or equipment to the latest technology. The ultimate plan will relocate all fiber terminations to a convenient location.

A plan for cutting over working circuits while maintaining service may also be required. The plan should involve the use of transmission system protection lines. Alternatively, an entire facility cable or transmission system could be cleared of service prior to retrofit. Once the number of fibers is determined, the LGX frame can be planned and engineered according to the guidelines in the Planning and Engineering sections of this document. The LGX frame location should be planned so that additional frames can be added in a continuous bay lineup as required for future growth. The LGX frame is then installed in this new location..



Install LGX Frame in Retrofit Location

## Install Retrofit Cabling

---

In preparation for retrofitting a new LGX frame, a splice location should be selected and new cables should be routed to the splice location.

1. **Install Optical Cable Entrance Facility (OCEF)** — In typical retrofit applications, an Outside Plant (OSP) fiber cable is recabled to the new LGX frame. It is usually impractical to clear an entire cable of service prior to relocation; therefore, it will be necessary to splice the

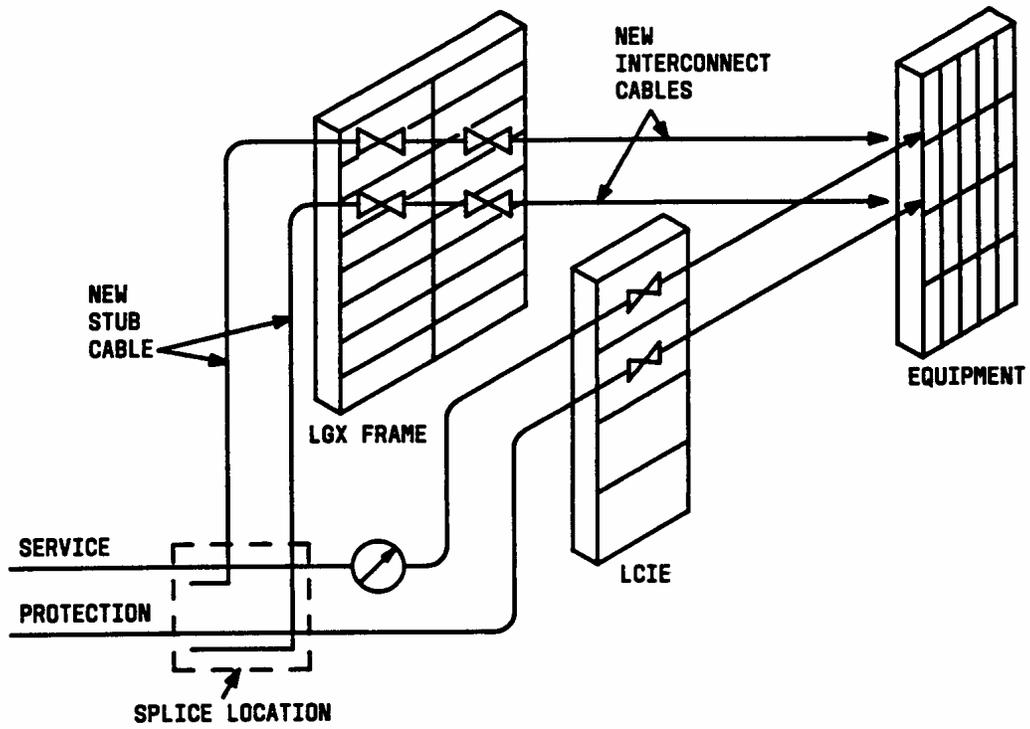
cable at an intermediate position. To relocate the cable will require splicing of a new length of cable at an intermediate splice location and then terminating it at the **LGX** frame. A typical splice location may be in a cable entrance facility or in an alternate splice area arranged specifically to organize fiber splices. The OCEF cabinet will typically be used in this location or alternatively a closure may be used.

2. **Route New Stub Cable** — A new stub cable is routed between the splice location and the **LGX** frame. A fiber optic building cable is recommended for stub cables routed within a building. In-building fiber cables are typically routed throughout the wire center to connect facilities and equipment. Cable designs conform to requirements of the **National Electric Code** and are listed by **UL\*** for general purpose (OFN), riser (OFNR), or plenum (OFNP) applications. OFS in-building cables include a variety of designs:

- **AccuRibbon<sup>®</sup> Riser Cable** — Heavy crossply sheath containing from 1 to 18 twelve-fiber ribbons used in riser or backbone applications.
- **Ribbon Building Cable** — Heavy-duty solid polyvinyl chloride (PVC) sheath containing up to three 12-fiber ribbons used in riser applications.
- **AccuMax<sup>®</sup> Buffered Cable** — Heavy-duty PVC sheath containing from 1 to 36 individually buffered fibers used in riser or equipment cabling applications.
- **Breakout Cable** — Contains from 1 to 72 individually jacketed fibers in a heavy-duty breakout sheath.  
In-building fibers may be preterminated or field terminated at the **LGX** frame.

3. **Route Interconnect/Cross-Connect Cables** —To move cables carrying service may require alternating service between service and protection lines. In these cases, new fiber optic jumpers must be prerouted from the fiber optic transmission equipment to the **LGX** frame. When using a cross-connect arrangement at the **LGX** frame, the interconnect cables will be terminated on the rear of connector panels and short jumpers routed to the new facility termination point. Another method is for the interconnect cables to be routed directly to the facility termination on the **LGX** frame. This provides a direct interconnect to the new stub cable.

- Registered trademark of Underwriters Laboratories, Inc.



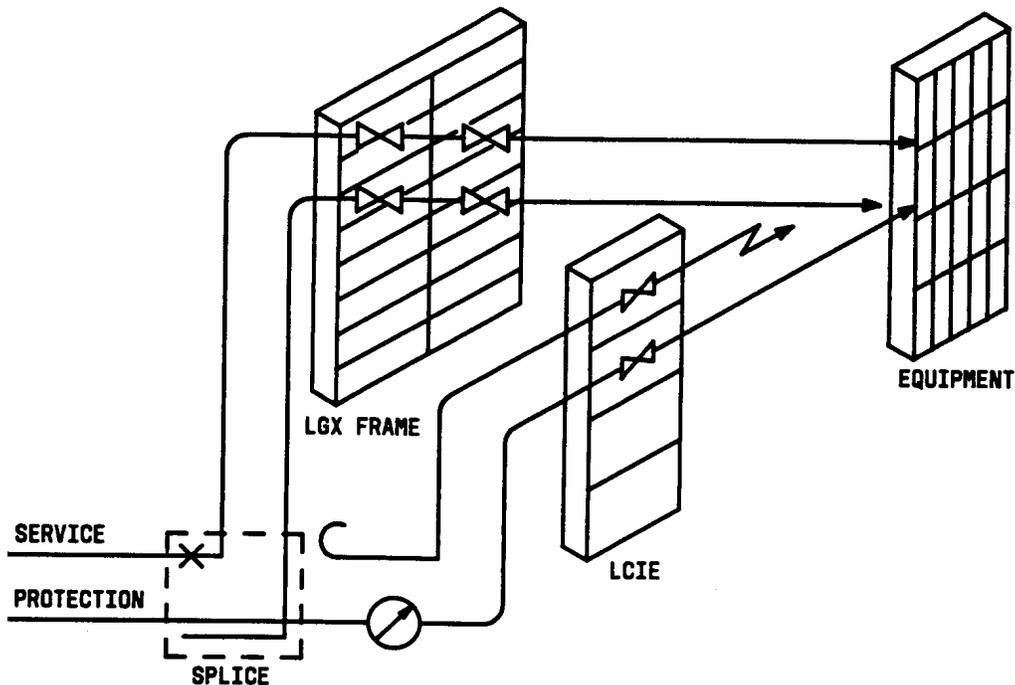
Install OCEF and Retrofit Cabling

## Moving Service Line to LGX Frame

The first step in moving the service line to the LGX frame is to transfer the working circuit to the protection line. The retrofit cabling is then used to splice the service line to the LGX frame.

1. **Clear Service Line** — Special precautions are required when handling optic circuits. Working circuits should be moved to protection lines prior to reterminating the service line to the LGX frame.
2. **Break and Splice** — The fiber facility cable to be rerouted should be opened and the fibers separated for easy access. Each fiber should be identified and tagged. After verifying there is no service on the particular fiber, the fiber is disconnected (or cut) and joined to the new cable terminated at the LGX frame. The fiber facility cable can now be tested at the LGX frame for continuity, reflection, and attenuation.
3. **Exchange Interconnect Cables** — The fiber interconnect cable or cross-connect jumper is connected to the equipment to replace the original interconnect cable. The service line is now connected through the LGX frame and ready to carry the working circuit.

### Move Service Line to LGX Frame

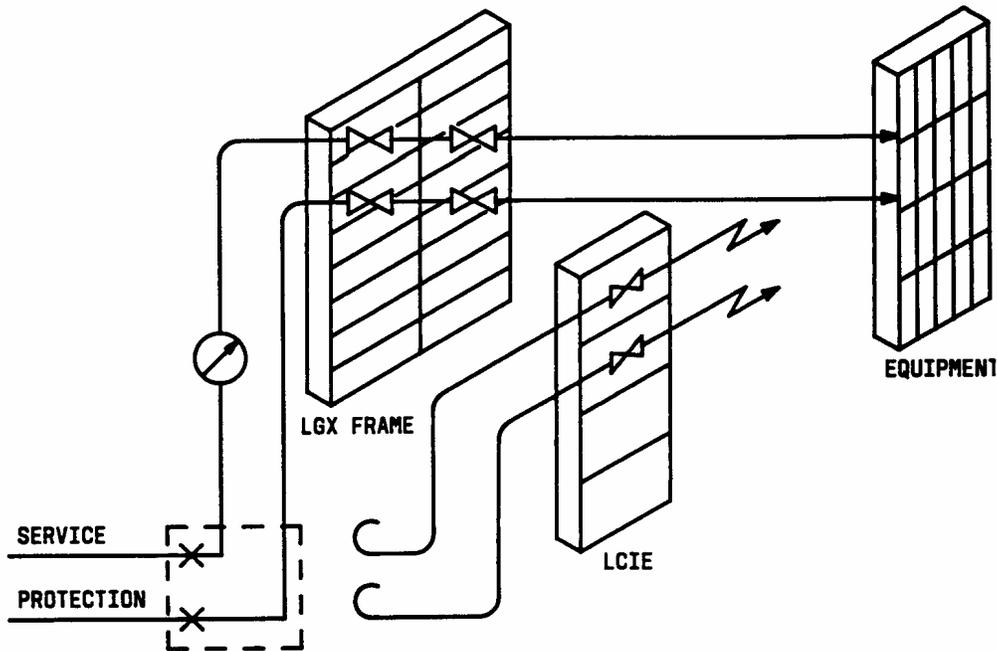


## Complete Retrofit

---

The retrofit is completed by turning up service, moving the protection lines to the *LGX* frame, and then closing and/or removing the old splice closure. The old interconnection equipment is then removed from the site as well. The *LGX* frame will serve as a convenient facility for providing optical connections.

1. **Turn Up Service** — The service line, connected through the *LGX* frame, is put into service by switching the optical circuit from the protection line to the service line at the equipment. The protection lines can be used to move one or several of the service lines in sequence.
2. **Move Protection Lines** — The protection lines are moved in the same manner as the service lines. All the lines of the fiber system will then be routed through the *LGX* frame.
3. **Close Splice** — The intermediate splice is sealed inside of the OCEF cabinet or optical closure in a permanent position.
4. **Remove Old Interconnection Equipment** — Once the old interconnect equipment is completely disconnected, it can be removed from the site.



Retrofit Completion

# Installation and Cabling

15

## Section Contents

---

The LGX<sup>®</sup> frame and shelf installation is done in accordance with instruction sheets provided with each product. The installation instructions in this guide contain supplementary information for reference only — they are not a replacement for the instruction sheets provided with the product. (and which are also available on-line). The information summarized in this section provides additional insight into making installation go efficiently and trouble-free. This section covers the following:

- Frame Mounting 15-2
- Labeling 15-7
- Cable Types 15-8
- Overhead Cabling Plan 15-10
- Bottom Cable Entry 15-14
- Shelf Cabling 15-15
- Splicing 15-18

## Frame Mounting

The Network Bay Frame or Seismic Network Bay Frame is easily installed in accordance with instructions for floor attachment. Typical mounting arrangements provide for securing the frame to the floor and to the overhead superstructure. Floor attachment may vary depending on:

- Type of floor; solid or raised.
- Type of ground; integrated or isolated
- Earthquake environment
  - Zone 1, 2 Minor Earthquake Region
  - Zone 3 Moderate Earthquake Region
  - Zone 4 Major Earthquake Region

### Floor Mounting Hardware

The following mounting kits are used for securing the Network Bay Frame or Seismic Network Bay Frame to the floor.

Product Code	Description
<b>Floor Mounting Kit 107 264 707</b>	Provides all the necessary equipment to secure the Network Bay Frame or Seismic Network Bay Frame to a concrete or raised floor. The kit is used for securing frames to concrete floors (all Earthquake Zones) and raised floors (Earthquake Zones 0 & 1).
<b>Floor Mounting Kit 107 264 715</b>	Provides all the necessary equipment to secure the Network Bay Frame or Seismic Network Bay Frame to a raised floor over concrete. The kit is used for securing frames to raised floors (Earthquake Zones 2, 3 & 4).

### Fastening to a Concrete Floor

The Network Bay Frame or Seismic Network Bay Frame is secured in accordance with instructions provided with the floor mounting kit (this is also consistent with installation methods described in ED-8C505-50 — Method of Installation). Framework installation methods are specified for use in either integrated or isolated ground systems and for the three earthquake regions. Frames are attached to the floor with 0.5-inch (12.7 mm) drop-in anchors, threaded rods, washers, and nuts. An example of the floor attachment technique is shown for an integrated ground in the top Figure A. If the frame is to be mounted in earthquake Zones 1 or 2, it should be fastened to the floor at two points in diagonally opposite corners. If the frame is to be installed in earthquake Zones 3 or 4, it should be attached to the floor at four points. The primary attachment pattern is shown in the middle Figure B — this corresponds to hole “1” in the bottom Figure C. If interference with floor reinforcing bar is encountered during installation at hole “1”, then alternate locations as depicted in the bottom of Figure C shall be selected in the following order of preference: 2, 3, 4. Where an isolated ground is called for, the frame is attached to the floor following a

similar procedure except insulators are placed between the floor and the

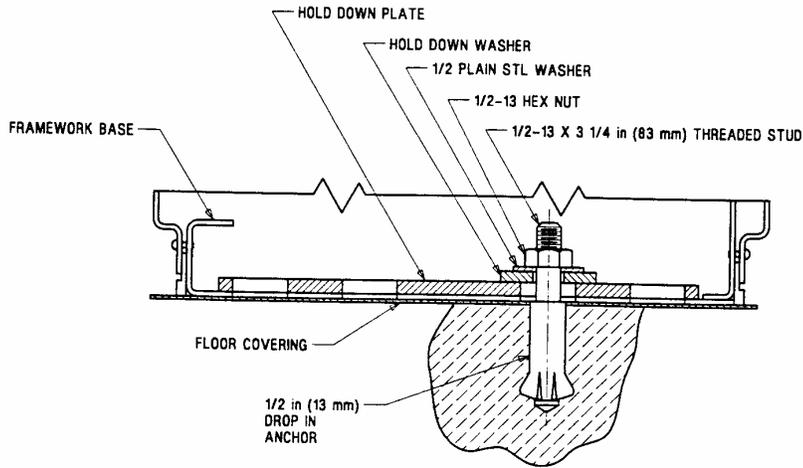


FIGURE A  
INTEGRATED GROUND ATTACHMENT  
FLOOR ATTACHMENT FOR ALL EARTHQUAKE ZONES

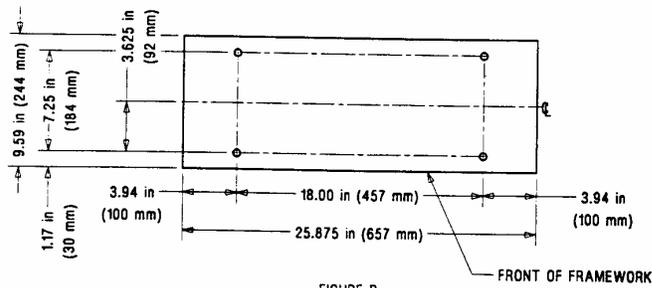


FIGURE B

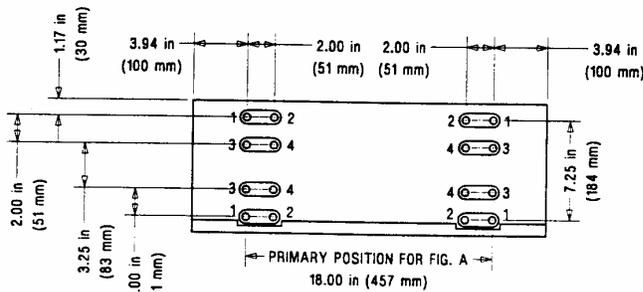


FIGURE C  
ALTERNATE ATTACHING LOCATIONS

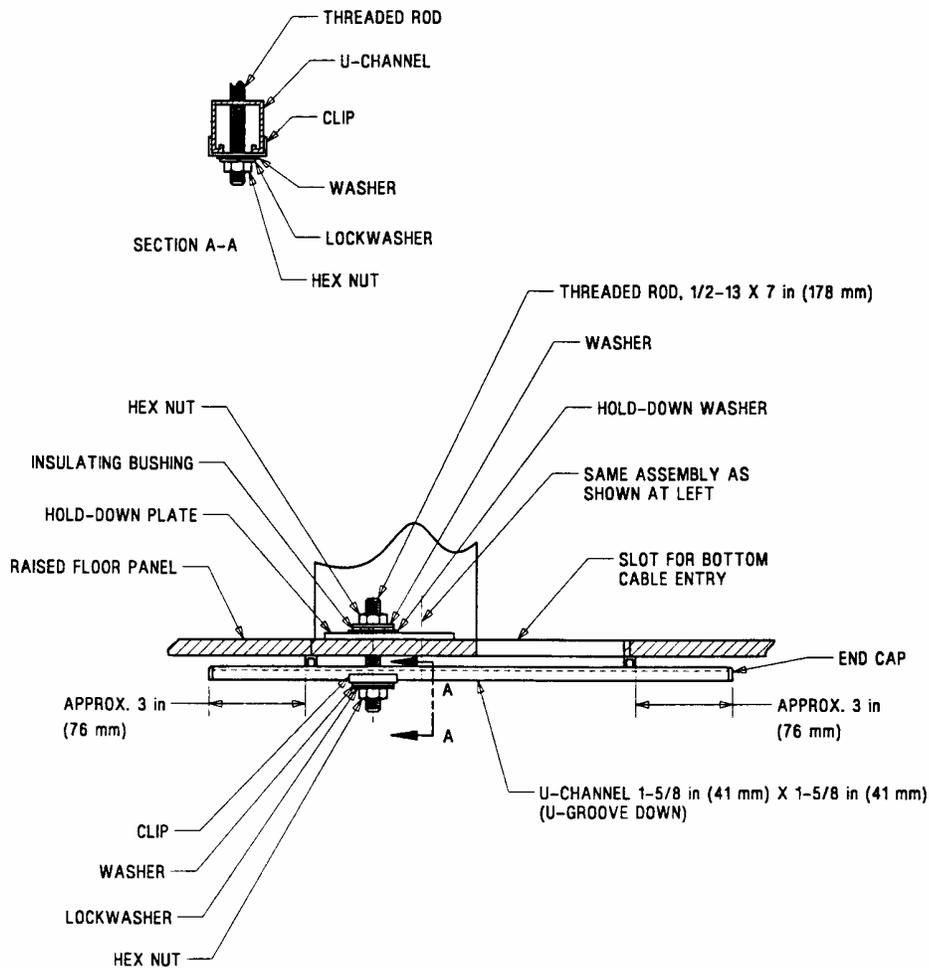
frame.

### Frame Mounting — Concrete Floor

### Fastening to Raised Floor

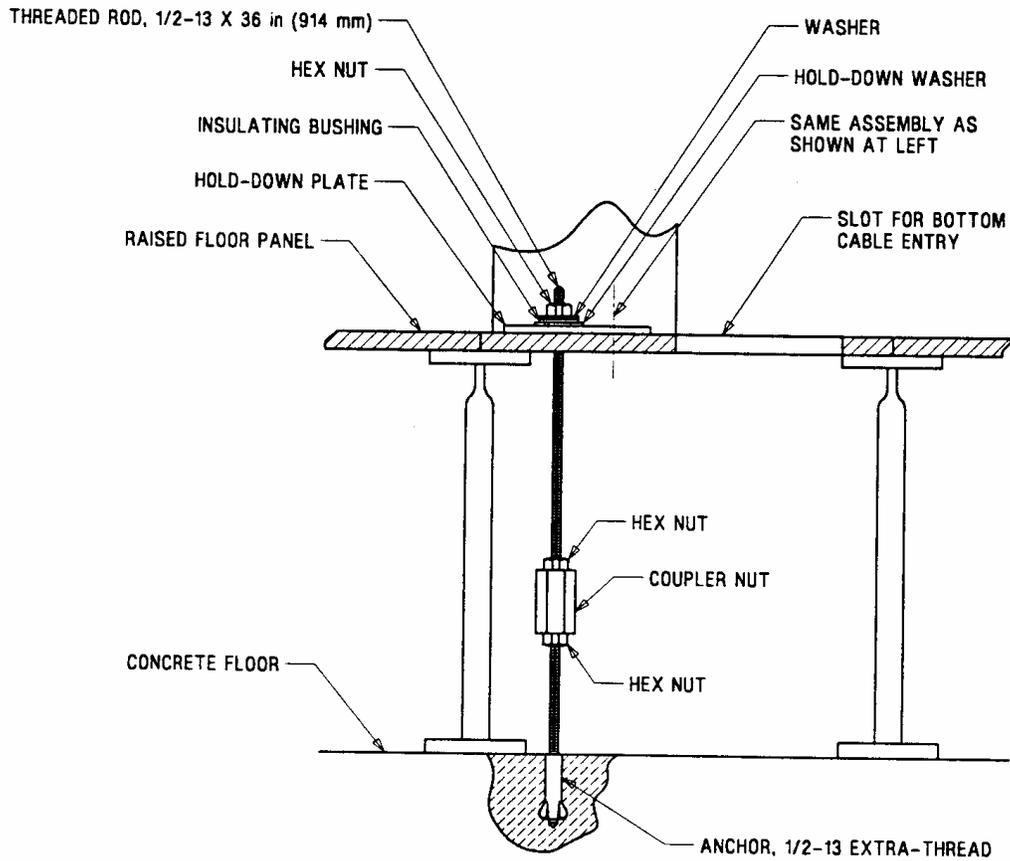
When the Network Bay Frame or Seismic Network Bay Frame is installed on a raised floor, two techniques are generally used for securing the frame.

- The first technique involves securing the frame to the raised floor structure at a level just beneath the floor tiles. This arrangement shown below is often used in low seismic areas such as Zone 0 or 1.
- In Zone 2, 3, or 4, it is typically recommended to provide a means of securing a frame to the concrete floor beneath the raised floor. This is shown on the following page.



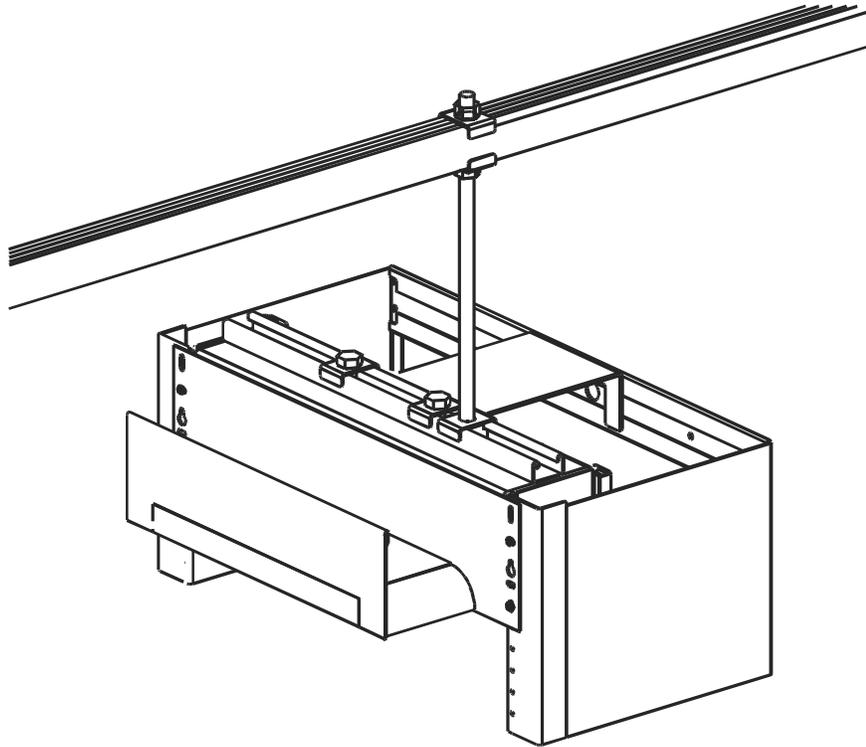
### Frame Mounting — Raised Floor Zone 1

Frame Mounting — Raised Floor Zone 2, 3, and 4



Fastening to Overhead Superstructure

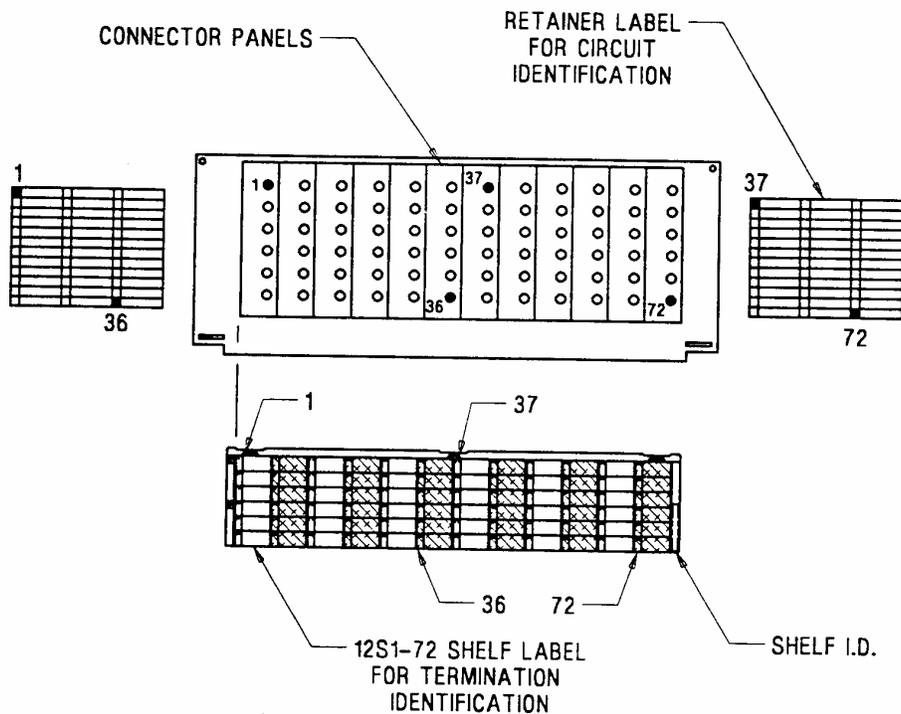
The Network Bay Frame or Seismic Network Bay Frame is typically secured to the overhead superstructure. This is accomplished by first applying a U-channel to the top of the frame for stability and then securing threaded rod through the channel into holes in the top of the frame. The threaded rod is in turn secured to the overhead superstructure.



## Labeling

An identification label is supplied with each shelf. The blank shelf labels shown in the figure below are formatted to provide a space corresponding to each connector position. These labels are used to identify cables terminated at a particular connector location. The retainer labels are also used to identify circuit or system information in cross-connect applications. The labels are stenciled in the field per local practice.

### Labeling



## Cable Types

A cabling plan is recommended for all applications of the LGX distribution system. The plan should consider the splicing technology, cable types, and optical connector types. The two main cable types, building cables and Outside Plant (OSP) cables, are explained in the following paragraphs.

### Building Cable

The LGX frame handles a wide variety of fiber cable constructions. All OFS fiber optic cable including Multimode (MM) and Single Mode (SM) cables can be terminated at the LGX frame. Vendor fiber cables of similar

construction may also be terminated at the *LGX* frame. Cables are usually either buffered fiber cables (building cables) or nonbuffered cables (usually coated fibers in an outside plant sheath). Buffered building cables include single unit, duplex, quad jumper or interconnect cables, and the new series of fiber optic building cable currently available with 4, 6, and 12 fibers to a sheath. These building cables consist of buffered fibers in a fire-retardant polyvinyl chloride (PVC) outer sheath. All building cables are relatively flexible although they must be handled with a minimum bending radius to avoid microbending loss. These cables do not contain any metallic covering or strength members and, therefore, require no grounding. All of the buffered building cables may be terminated at the *LGX* frame. In-building fiber cables are typically routed throughout the wire center to connect facilities and equipment. Cable designs conform to requirements of the *National Electric Code* and are listed by *UL*\* for general purpose (OFN), riser (OFNR) or plenum (OFNP) applications. OFS in-building cables include a variety of designs:

- **AccuRibbon® Riser Cable** — Heavy crossply sheath containing from 1 to 18 twelve fiber ribbons used in riser or backbone applications.
- **Ribbon Building Cable** — Heavy-duty solid PVC sheath containing up to three 12-fiber ribbons used in riser applications.
- **Accumax® Buffered Cable** — Heavy-duty PVC sheath containing from 1 to 36 individually buffered fibers used in riser or equipment cabling applications.
- **Breakout Cable** — Contains from 1 to 72 individually jacketed fibers in a heavy duty breakout sheath.

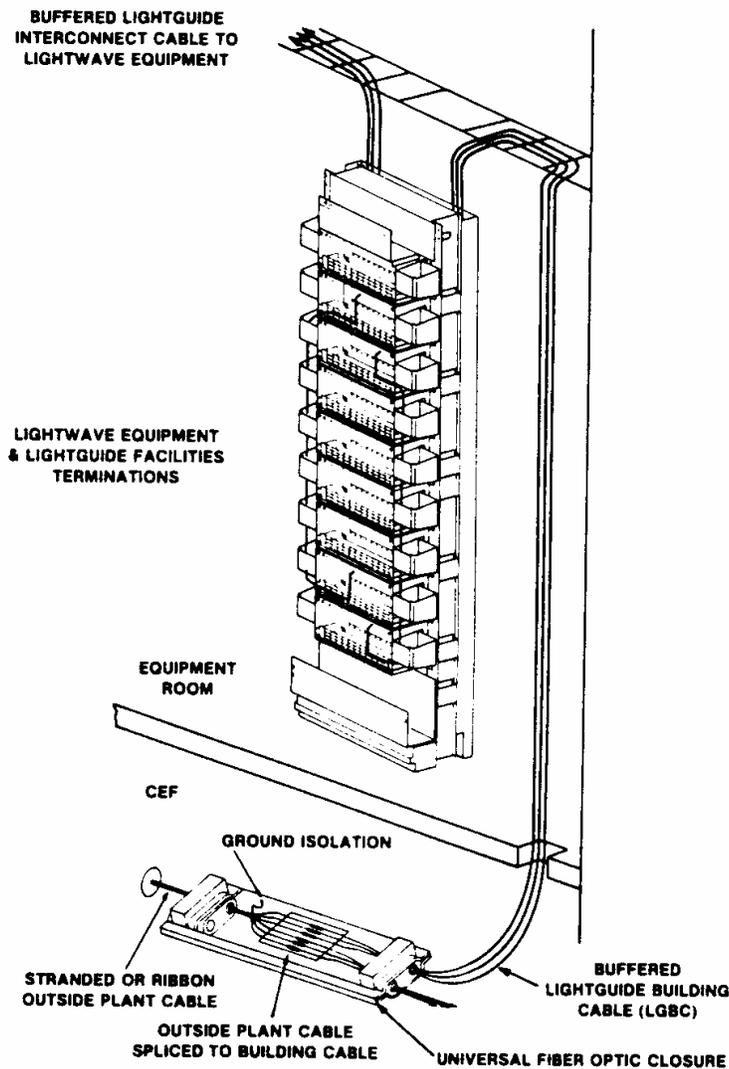
### Outside Plant Cables

Nonbuffered OSP cables can be run directly to the *LGX* frame, thus bypassing an intermediate splice. The OSP cables are reinforced, often with metallic strength members, which make them more rigid and difficult to bend than building cables. The metallic strength members may also be exposed to electrical hazards and, therefore, require grounding. The individual fibers which make up the construction of an OSP cable are coated (nonbuffered) and, therefore, must terminate with a splicing/fanout operation or be buffered prior to installing field-mounted connectors.

- Registered trademark of Underwriters Laboratories, Inc.

## Conversion of Cable Types

It may be desirable to convert OSP cables to buffered building cables before bringing them to the LGX frame. This may be done to limit the length of non-fire-retardant OSP cable that is placed in the building. This conversion involves a splice from the OSP cable to a building cable in a separate facility such as an Optical Cable Entrance Facility (OCEF) or a Universal Fiber Optic Closure (UFOC). The building cable can then be routed from the OCEF or UFOC to the LGX frame and treated in the same manner as other buffered cables. A common procedure is to convert from an OSP cable sheath to a building cable sheath prior to placement on the LGX frame. This can easily be accomplished through a splice closure as depicted in the figure below or through the use of an OCEF.



## Conversion of OSP Cables to Building Cables

### **Overhead Cabling Plan**

---

#### **Cable Management System**

The cabling plan is developed according to the Planning and Engineering sections of this document. The responsible engineer develops detailed specifications for the Cable Management System (CMS) per job site requirements. The CMS specification and installation instructions should be in conformance with ED-8C612. The CMS can be installed by supporting auxiliary framing from the LGX FDF, although the auxiliary framing is often also securely fastened to the walls and ceiling.

For most applications, the specification will call for the auxiliary framing to be installed at the 8-foot (2.44 m) level. Since the typical frame is 7 feet (2.1 m) tall, there is 1 foot (0.305 m) remaining between the top of the frame and the auxiliary framing. This space is generally used for routing fiber ducts associated with the Fiber Protection System (FPS). Other arrangements in taller equipment frame areas are also possible — and are tailored by the engineer to provide efficient use of cable pathways.

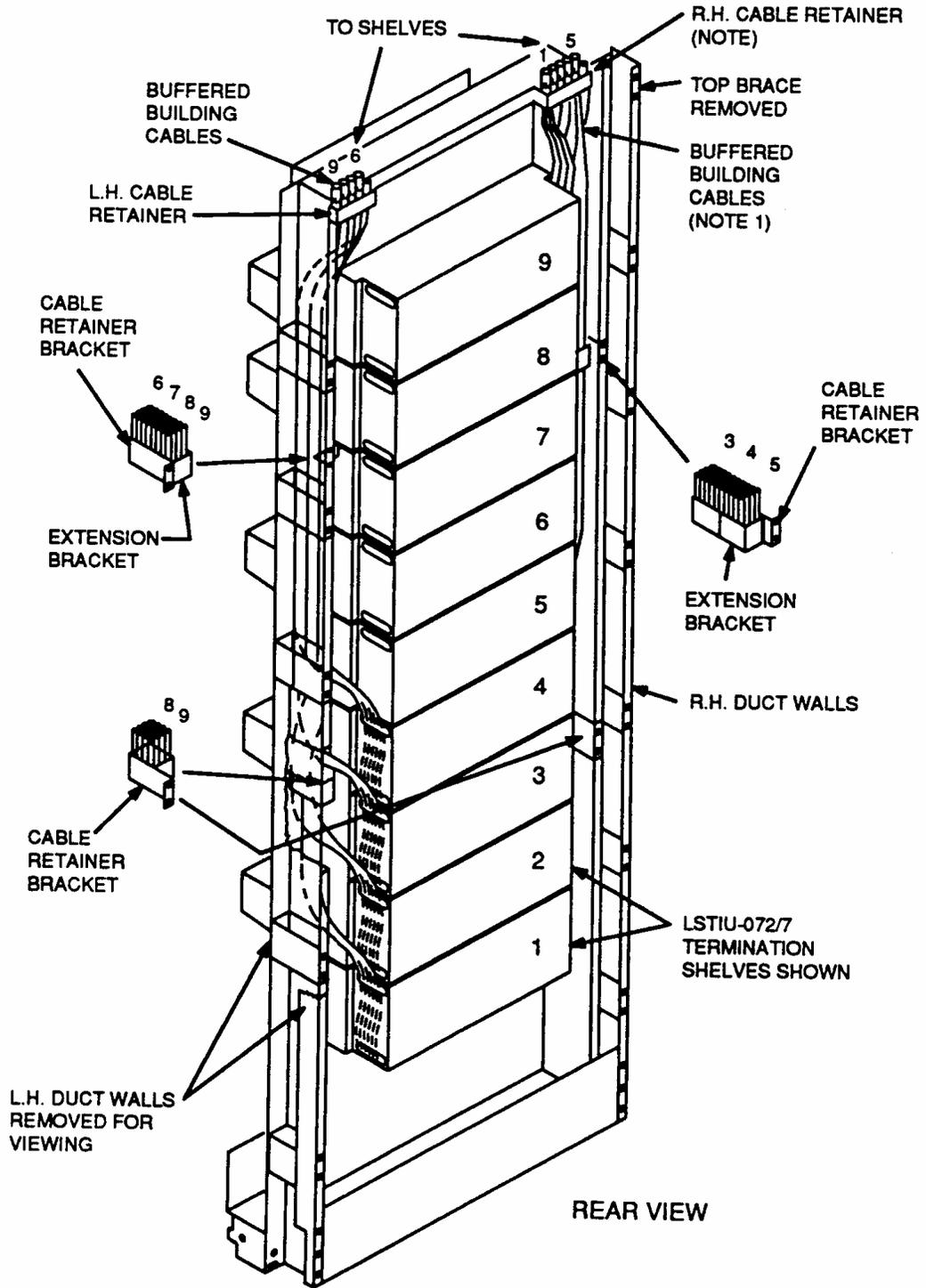
#### **Fiber Protection System**

A Fiber Protection System (FPS) should be installed per the specification provided by the responsible engineer. The FPS ducts are easily cut in the field and are therefore customized to each application. The FPS should be specified and installed in accordance with ED-8C120.

#### **Building Cable Placement**

Buffered fiber optic cables are usually placed in the overhead rack and run down into the two cable retainers at the top rear corners of the frame. The cables are secured to the retainers with tie-wraps. The cables are then routed down the sides of the frame to the appropriate shelf (see figure on next page). All cables designated for a particular shelf are secured (tie-wrapped) to the cable clamp brackets on the side of the shelf.

The permanent cables from the lightwave equipment are terminated on the rear of the LST1U-072/7 termination shelf panel. Cables that are field connectorized are stripped of their outer jacket after the last tie down possible (shelf cable bracket). Cables to be connectorized require about 48 inches (1.22 m) of slack. Individual buffered fibers can be connectorized from the front or rear of the frame. Standard connectorization instructions should be followed for placing connectors on buffered fiber ends. Connectorized fibers are then terminated on the termination shelf panel. Extra buffered fiber slack is coiled in the base of the shelf. Connectorized jumper or interconnect cables may also be terminated on the appropriate connector panels. A limited amount of jumper slack may be stored in the bottom of the termination shelf or in the jumper storage shelf LSJ1U-072/5.



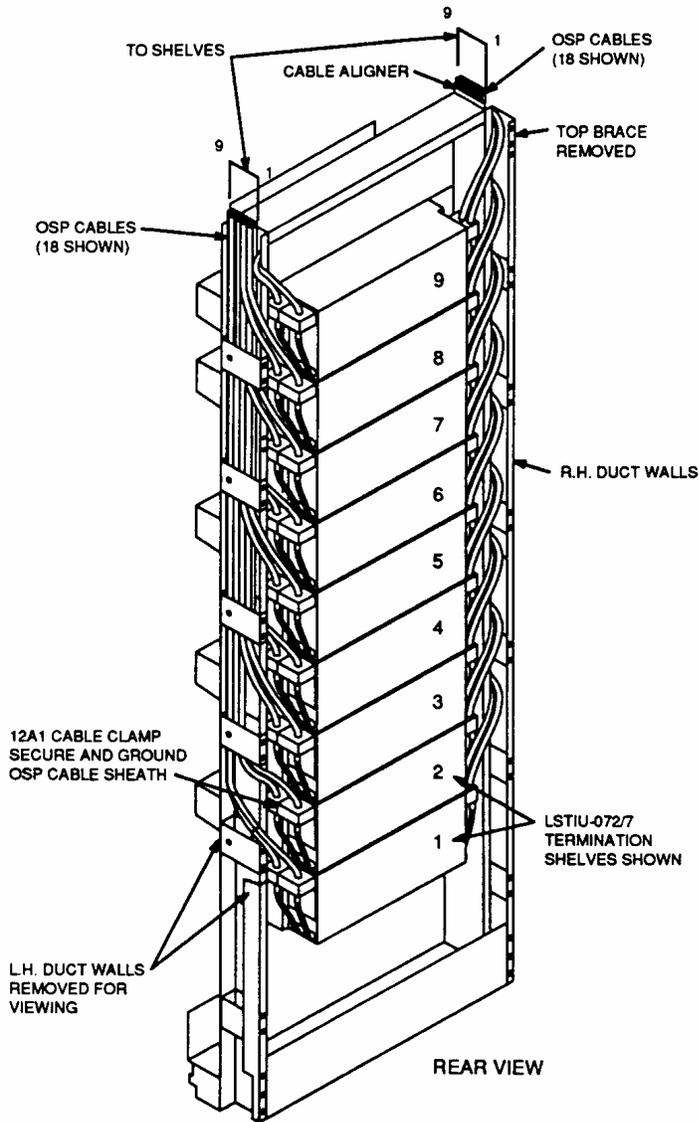
**Building Cable Placement**

**Outside Plant Cable Placement**

The OSP cables are usually routed to the LGX frame via ducts or conduit. An OSP cable can also be run in an overhead rack. These cables are

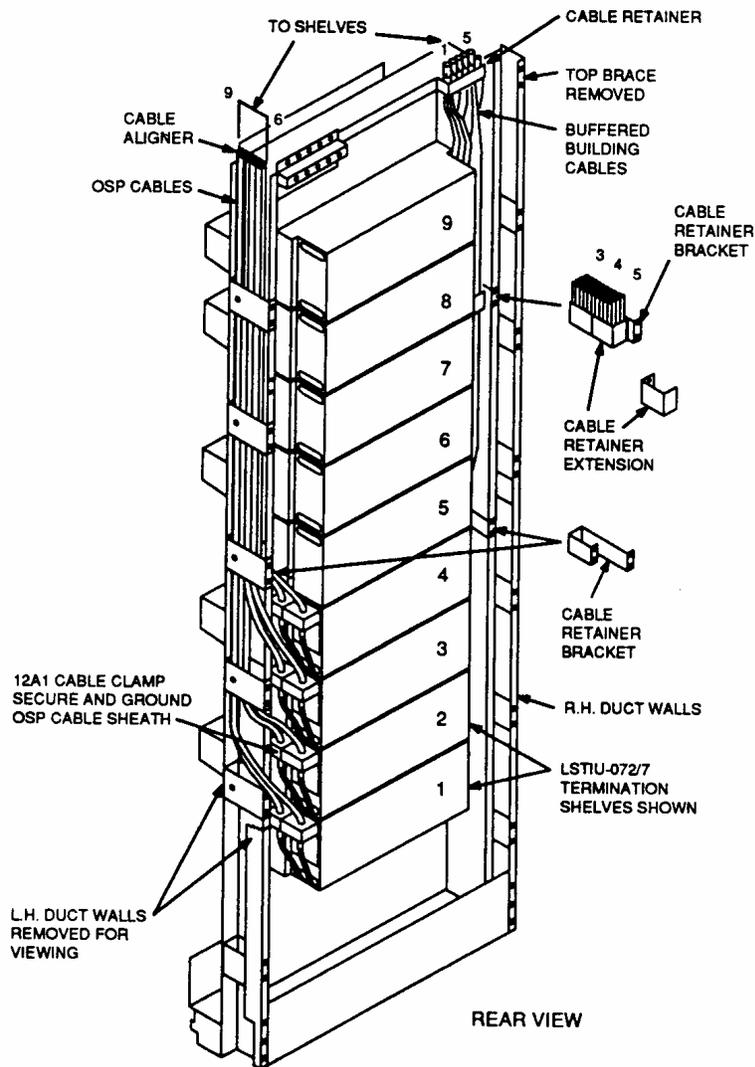
dropped into the frame through the open cable duct on the side of the frame as shown in the figure below. Cable placement is easier from the rear of the frame. Cables exit the frame duct and are routed to the shelves in an S-curve shape. At the shelves the cable ends are secured and grounded. The cable fibers then enter the splice shelf.

### OSP Cable Placement



### Mixed Bay Cabling

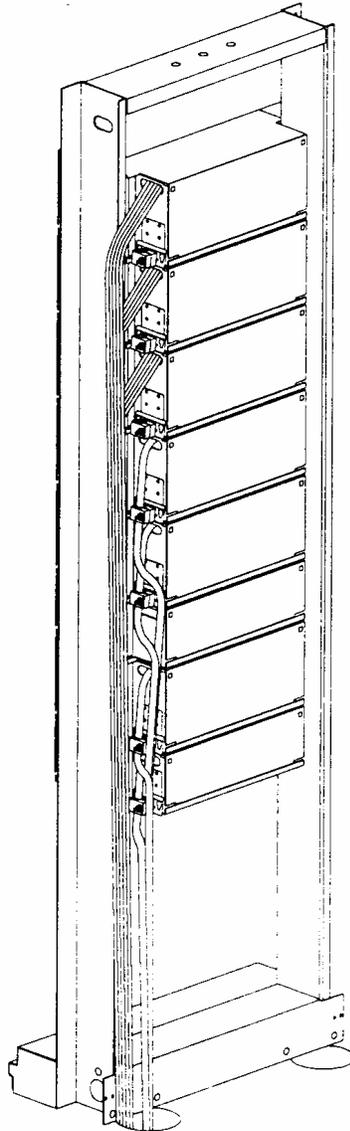
The LGX frame can accommodate any OFS SM or MM cables including stranded, ribbon, or *LIGHTPACK*<sup>®</sup> design. The type of cable end operation and splice procedure depends on the cable type. The OSP cables can be terminated by direct termination, array connectors, or individual fiber splice. Up to 18 outside plant cables [based on 0.5 inch (12.7 mm) outside diameter] can be placed on each side of the LGX frame cable duct for a total LGX frame capacity of 36 OSP cables. If the cable diameters are larger than 0.5 inches (12.7 mm), half the number or about 20 cables can be accommodated. A mixed cabling arrangement, as shown in the figure below, is typical where several OSP and building cables enter the same bay.



### Mixed Bay Cabling

### Bottom Cable Entry

The mounting surface (raised floor or concrete) of the *LGX* frame will determine how cables will be routed to the frame for bottom entry cabling. The *LGX* frame is attached to the floor and access holes are specified for concrete floor or raised floor per the Engineering Section of this document. Cables should be routed up through the holes or slots and then formed to the sides of the frame. Shelves may be cabled from top-to-bottom or bottom-to-top; however, the top-to-bottom is preferable. Standard cable routing procedures can be used to route the cables up the side of the frame and into the shelf. In some cases, cables may be tied to the frame uprights to provide strain relief. An example of bottom-entry cabling is shown in the figure below.



## Bottom-Entry Cabling

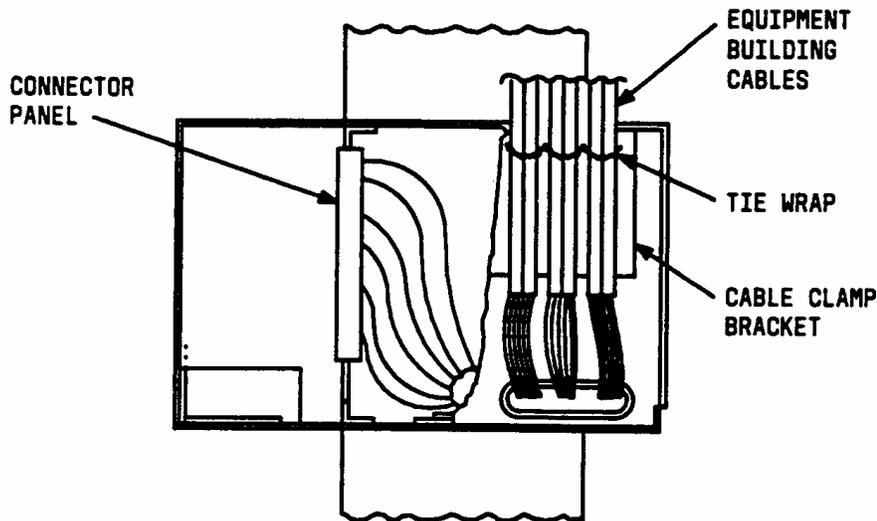
### Shelf Cabling

---

The LGX Fiber Distribution Shelves were designed to handle a wide variety of fiber cables. All OFS fiber optic cable types, including MM and SM cables, may be terminated on the shelves. The shelves also accommodate a wide range of termination and splicing technologies. The termination or splicing method selected will depend on the cable type, loss budget, and craft training. The most significant factor is the type of cable, OSP or building cable.

#### Termination of Building Cables

The LST1U-072/7 Lightguide Termination Shelf is ideal for terminating any type of buffered building cable. The building cables are usually secured to the shelf cable clamp bracket and then routed into the shelf as shown in the figure below. Spiral wrap is often recommended to provide strain relief — the spiral wrap is usually tied to the shelf bracket supplied with the shelf. Multifiber cables are stripped of their outer sheaths in preparation for termination. Connectors may be easily field mounted from the front or rear of the shelf. The LST1U-072/7 shelf is designed to store the excess buffered fiber in the rear of the shelf. The slack is coiled into fiber rings to maintain



a bend radius of 1.5 inches (38 mm).

#### Building Cables Secured to Shelf

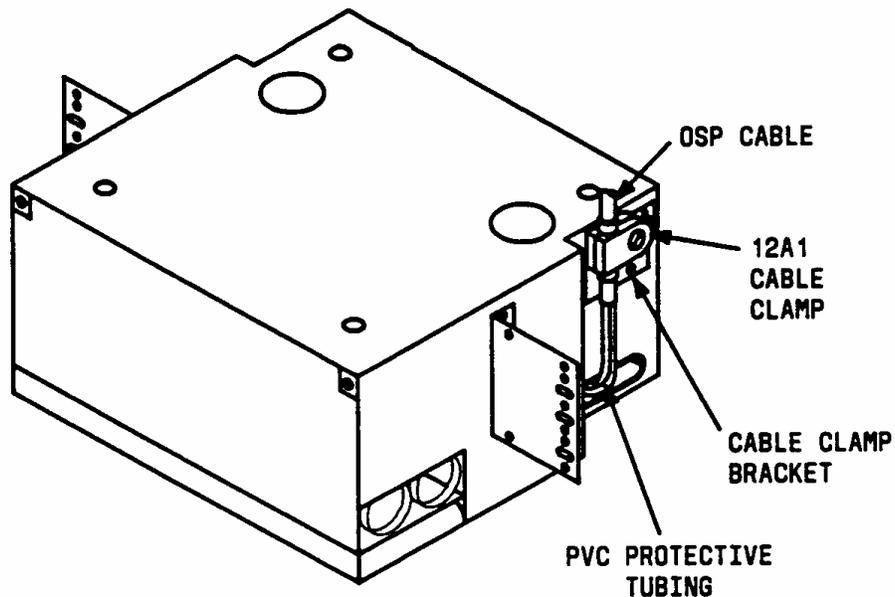
#### Termination of OSP Cables

The distribution shelves can also accommodate any OFS OSP cable construction including ribbon or *LIGHTPACK* cables. These OSP cables are

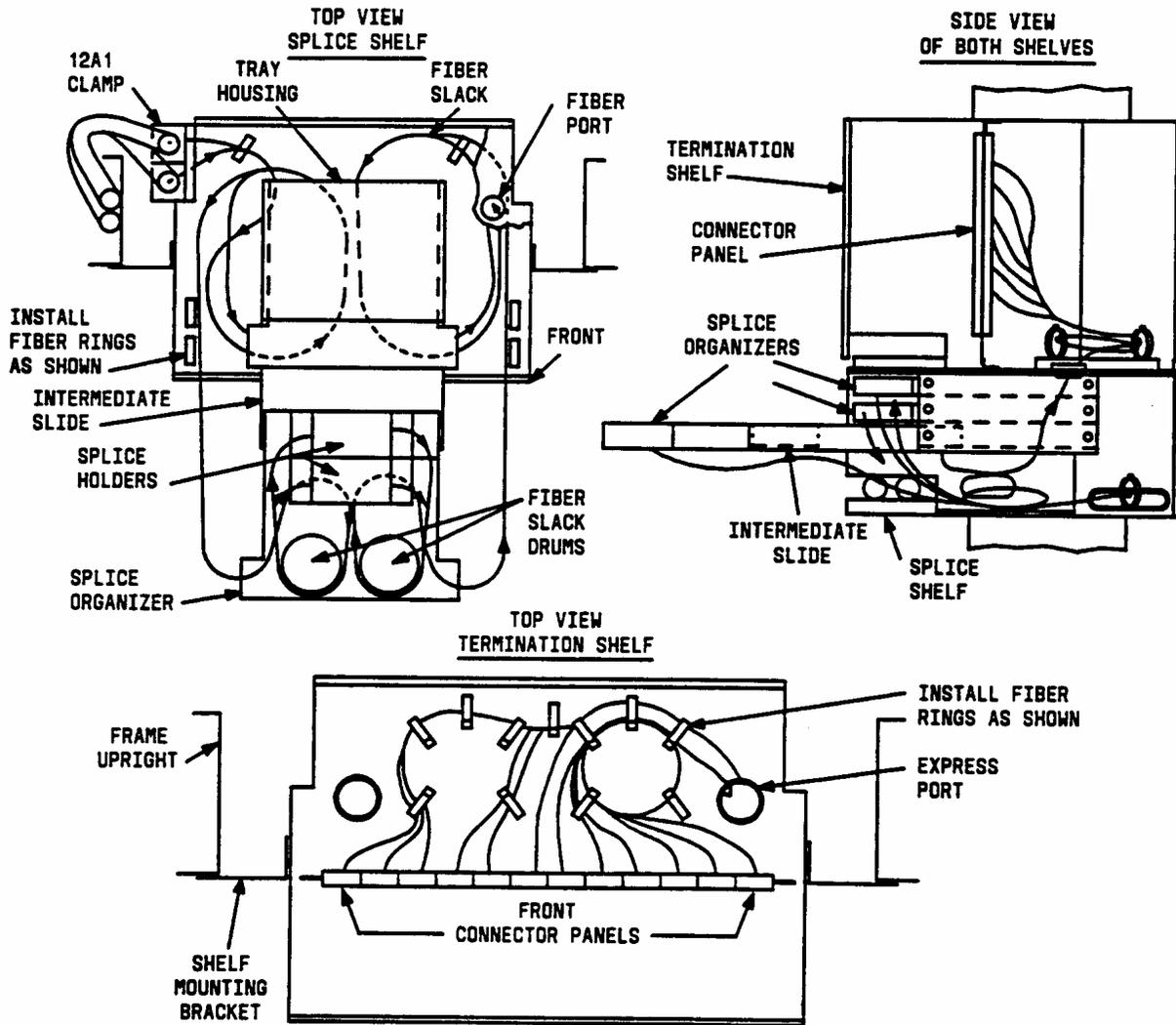
routed directly to the distribution shelves and terminated using one of three basic approaches.

- 1. Direct Termination of OSP Cables** — Detailed methods are currently available for direct termination of OSP cables with field mountable connectors. Either **LIGHTPACK** or unconnectorized ribbon OSP cables may be routed directly to a LST1U-072/7 Fiber Optic Termination Shelf for direct termination. The OSP cables are secured and grounded on the cable clamp bracket attached to the side of the shelf. The installation procedures in OFS 636-299-110 describe clamping, blocking, and grounding methods for OSP cable sheaths. The procedures also detail methods for buffering the individual fibers in preparation for field mounting connectors. Once the fibers are buffered and connectorized, the fibers enter the shelf and the cable is clamped as shown in the figure below. The method for directly terminating OSP fibers is similar to the method for terminating buffered fibers. Fiber slack may be coiled and stored in the rear of the shelf. Direct termination is selected when the least number of splices is desired, often because this represents the lowest cost.

OSP Cables Secured to Shelf



2. **Combined Individual Fiber Splice and Termination** — Individual fiber low-loss splicing can be accomplished with the OFS mechanical splice or with fusion splicing. The combination shelves are used for fiber splicing and termination. The individual fiber splice involves splicing a preconnectorized buffered pigtail to an individual OSP fiber as shown in the figure below. The individual fibers may be joined by a variety of techniques including the OFS Rotary Mechanical Splice (RMS) or fusion splice. The connectorized pigtails are terminated on six-pack connector panels in the termination shelf.



## OSP Fibers Connected to Buffered Pigtails

### Splicing

---

An important component of the splice system is the splice organizers for mechanical splicing (LT1A-M/M), fusion splicing (LT1A-F/F), and mass fusion splicing (LT1A-MF/MF). The splice organizers provide an efficient fixture for organizing fiber splices and excess fiber slack. Each step of the procedure for preparing the fiber ends, splicing, and dressing the finished splices into the splice tray is detailed in the instruction sheets provided with the organizers. Splice procedures are covered in practices for the respective technology. The splice organizers may be used in several cabling configurations: on-frame splicing, off-frame splicing, or OCEF splicing.

#### On-Frame Splicing

On-frame splicing allows the installer to construct a splice in front of the splice shelf. A work shelf or temporary work platform is typically positioned in front of the frame for constructing the splice. Both the OSP fibers and the buffered pigtails are routed into the splice organizer while it is in the extended position as shown in the figure on the next page. In this position, the splicer can access the entire splice tray for easy organization of the splices and fiber slack.

On-frame splicing is recommended for most applications due to the ease with which cables and pigtails are organized. Standard 60-inch (1.52 m) pigtails and 60 inches (1.52 m) of exposed OSP cable fibers are used for on-frame splicing. The 60 inches (1.52 m) of exposed OSP fiber is protected inside PVC tubing. The slack can be easily stored in the base of the shelf.

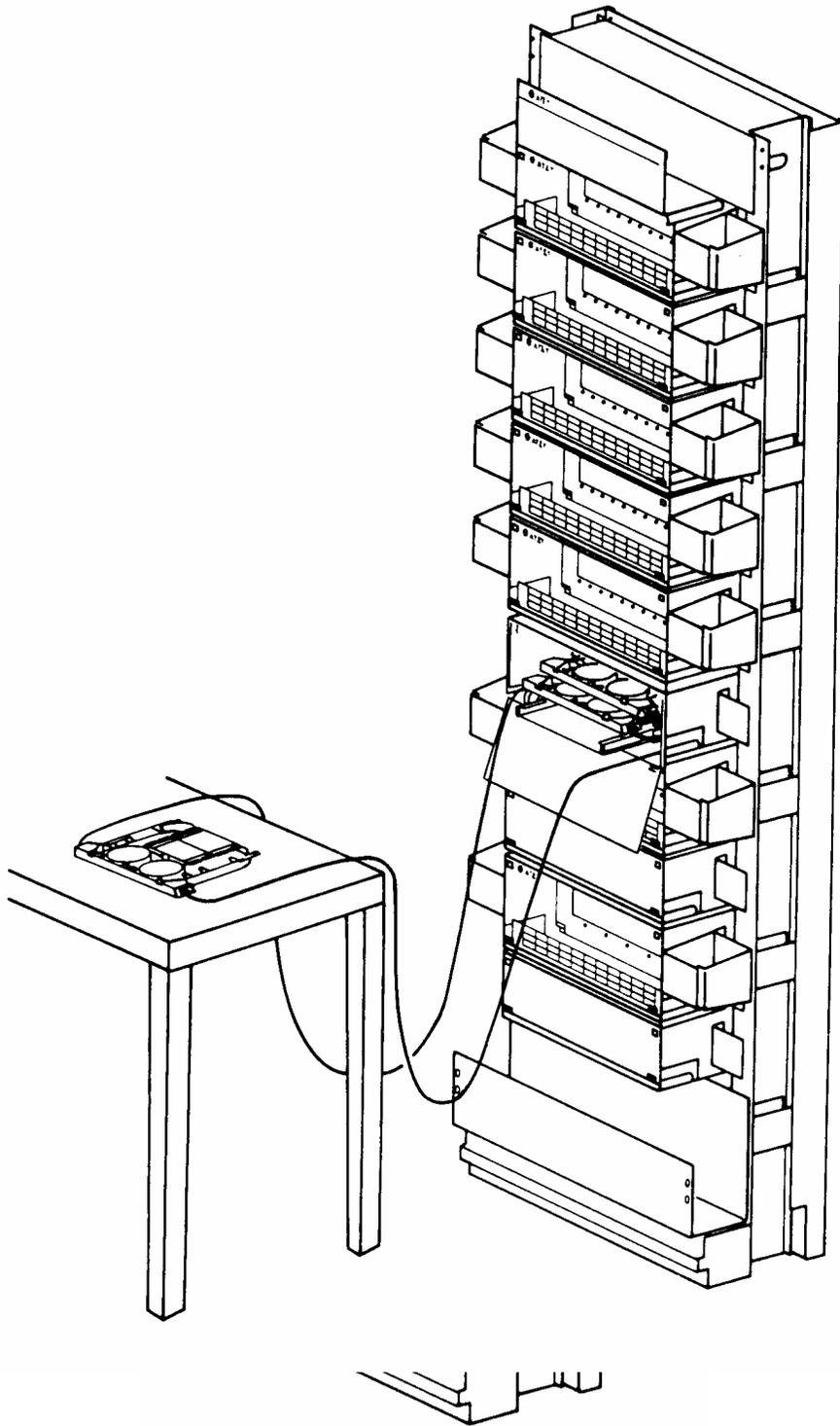
#### Off-Frame Splicing

When using certain methods such as fusion splicing, it may be difficult to position the splice equipment in front of the splice shelf. Off-frame splicing allows the splice organizer to be removed from the shelf and positioned up to 8 feet (2.44 m) away from the shelf. This allows the splicer to locate the splicing apparatus on a table adjacent to the frame. The OSP fibers are routed to the splice location in protective PVC tubing.

Off-frame splicing requires extra long pigtails and exposing a longer length of OSP fibers. Extra care must be used in coiling the slack after positioning the splice organizer back in the shelf.

#### OCEF Splicing

The OCEF cabinets provides an efficient splice point for fiber away from the LGX frame. Directions for storing splices in the OCEF cabinet are provided in the instruction sheets supplied with the cabinet.



**On-Frame Splicing**

**Off-Frame Splicing**

**Issue 6**

**OFS**

**Page 15-19**



## Operation and Maintenance

16

### Section Contents

---

The *LGX*<sup>®</sup> Fiber Distribution Frame (FDF) is easy to operate and maintain. However, past experience has taught that efficient jumper management and organization can only be achieved if simple guidelines are followed. This chapter outlines the simple guidelines for managing fiber jumpers. Several useful operational and maintenance procedures are also included as reference in this chapter. The chapter covers the following:

- General Operations Guidelines 16-2
- Fiber Slack Management 16-3
- Fiber Jumper Placement 16-11
- Routing Field Terminated Jumpers 16-13
- Routing Stock Length Jumpers 16-18
- Routing Interconnect Cables 16-30
- Removing a Jumper 16-36
- Circuit Attenuation 16-32
- Circuit Record 16-32
- Moving a Fiber System 16-32
- Restoration 16-34
- Maintenance 16-34

### General Operations Guidelines

---

The *LGX* Fiber Distribution Frame is designed for easy, efficient operation. A key part to the flexibility of the *LGX* frame is the ability to easily route, install, and manage fiber jumpers.

#### Service Connection Methods

Fiber jumpers used on the *LGX* frame are usually individual or duplex fiber cables, preassembled with connectors on both ends. These fiber optic jumpers are used primarily for connecting an Outside Plant (OSP) facility termination to a Fiber Optic Transmission System (FOTS) termination. The *LGX* frame allows the user to provide optic services on a short interval

**using one of the two service connection methods: cross-connect or interconnect.**

- **Cross-Connect** — With this option, the FOTS equipment cables and OSP cables are permanently cabled and terminated at the **LGX** frame. A short fiber optic jumper is routed from the outside plant termination connector to the equipment termination connector. The cross-connect provides added flexibility while building two connectors into the circuit.
- **Interconnect** — This method of service provisioning connects an outside plant fiber termination directly to servicing equipment with a long jumper cable. A long single fiber or multifiber jumper is routed in the overhead rack to the equipment frame and terminated directly at the Lightwave equipment. The interconnect provides less flexibility but builds only one connector into the circuit.

The **LGX** frame was designed primarily to add flexibility to fiber optic service provisioning. The cross-connect is used almost exclusively to provide fiber service. However, transmission requirements on a particular span may not allow the loss associated with two connectors built into the circuit with a cross-connect. In this case, an interconnect with one connector may be used.

### **Care and Handling of Fiber Optic Jumpers and Connectors**

When routing factory-assembled jumpers on the **LGX** distribution frame, care should be exercised to protect the optical connectors. The optical connector end face may easily be scratched if dropped or bumped. A recommended practice is to always keep the cap or plug on the optical connector while routing the jumper through the cable pathway. This will ensure that the connector is protected from damage and remains clean until the final connection is made.

Optical connectors are usually cleaned per standard requirements prior to connecting fiber jumpers. It may be desirable to locate the cleaning materials in the vicinity of the **LGX** frame so they are easily accessible when needed.

The following general guidelines are recommended for handling fiber jumpers and optical connectors.

1. **Use optical connector caps during jumper routing.** The connector plug caps or covers should always be kept on preconnectorized jumper cables while routing in order to prevent damage to the polished fiber tips.
2. **Do not secure jumpers with tie wraps.** Cable ties should never be tightly secured around fiber jumper cables because they may add circuit loss. Ties may be used for containment only, but not for tight wrapping. Ties that cannot be easily moved over contained jumpers are too tight and should be removed and replaced with looser ties.
3. **Maintain minimum bend radius.** Fiber jumper cables must be arranged in turns, bends, and loops not less than the minimum bending radius of the cable. For individual jumper cables, the minimum

bending radius is 1.5 inches (38 mm). For jacketed building cables, the minimum bending radius is 3 inches (76 mm).

4. During installation or removal, handle jumpers with care: do not tug, twist, or tie jumpers.

## **Fiber Slack Management**

---

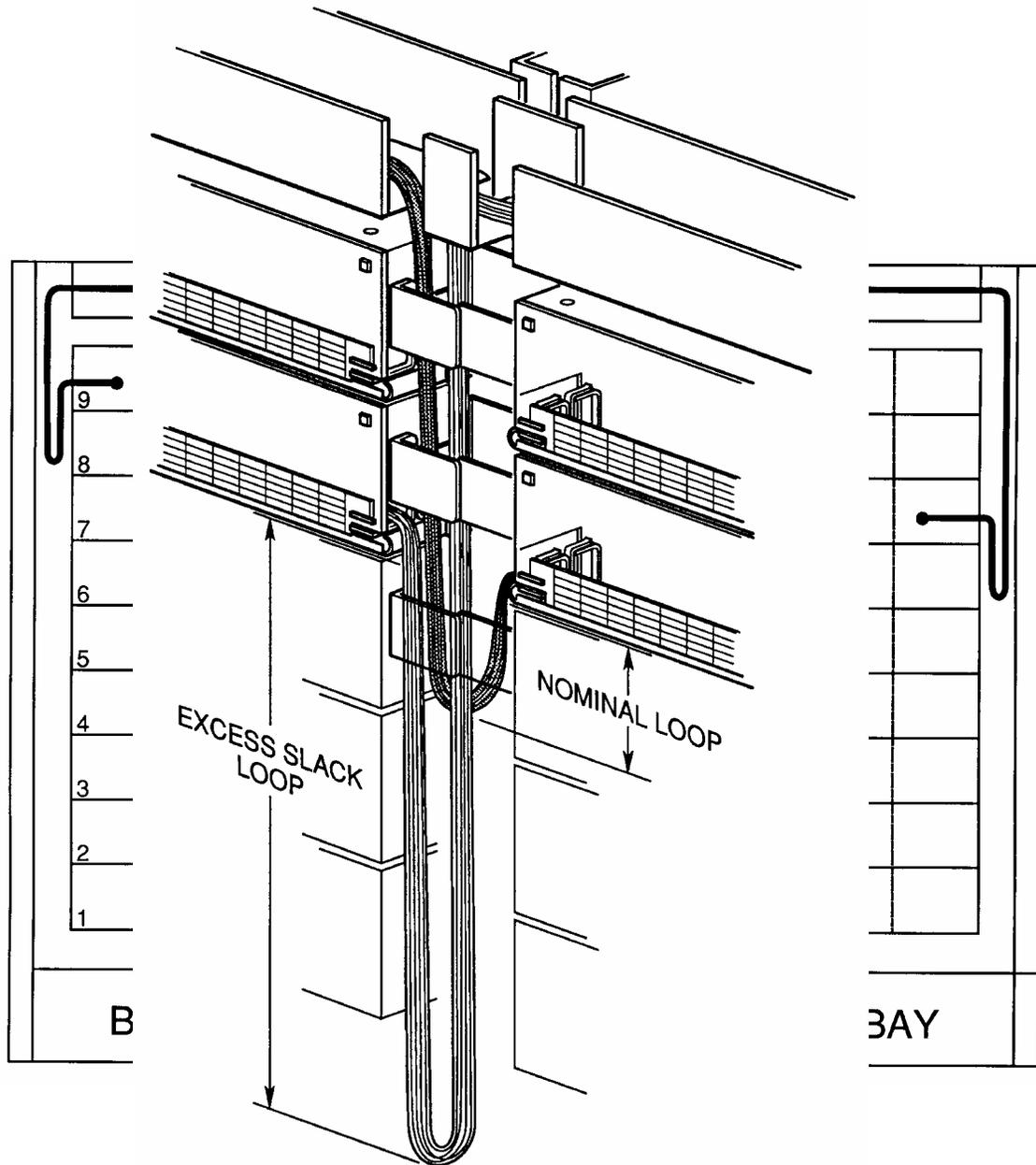
The *LGX* frame allows service connections to be made rapidly and easily with cross-connection jumpers. Efficient *LGX* frame operations will best be achieved by considering ahead of time how to handle cross-connect jumper slack. The *LGX* frame provides several methods for handling fiber jumper slack:

- **The Slack Elimination Method** — Limits jumper slack through the use of jumpers customized to match precise length requirements. Jumper lengths are typically customized on site or in a staging area using field-mounted optical connectors. This method results in an absolute minimum amount of slack, and therefore is often the most desirable.
- **The Slack Management Method** — Provides procedures for managing the excess slack that can accumulate when stock length (preconnectorized) jumpers are used for cross-connect applications. For users who specify stock length jumpers, slack management is by far the most economical approach. A significant amount of slack can simply and easily be managed in the *LGX* frame troughs without congestion. The slack management methods are recommended over slack storage.
- **The Slack Storage Method** — Usually not recommended. However, slack storage is provided in special circumstances such as storing slack from extra long interconnect cables. Slack storage is discouraged primarily because it makes tracing and removal of jumpers difficult and also because a significant amount of frame space may be consumed by slack storage shelves.

### **Slack Elimination Method**

Slack elimination is usually accomplished by fabricating jumpers to the exact length required to complete a cross-connection. Custom fabrication can be easily completed with any of OFS high-performance field-mountable optical connectors. Field Terminating optical connectors will eliminate slack since all jumpers are constructed to the specific length required. The figure below illustrates the shortest jumper length and route required to cross-connect connector A to connector B. When fabricating exact length jumpers, users should allow for at least 6 inches (152 mm) of slack, but no more than 10 inches (254 mm) of slack, so jumpers are not pulled tight in the trough system. The methods and procedures for determining exact jumper lengths and routes are covered in subsequent sections.

### Slack Elimination Method

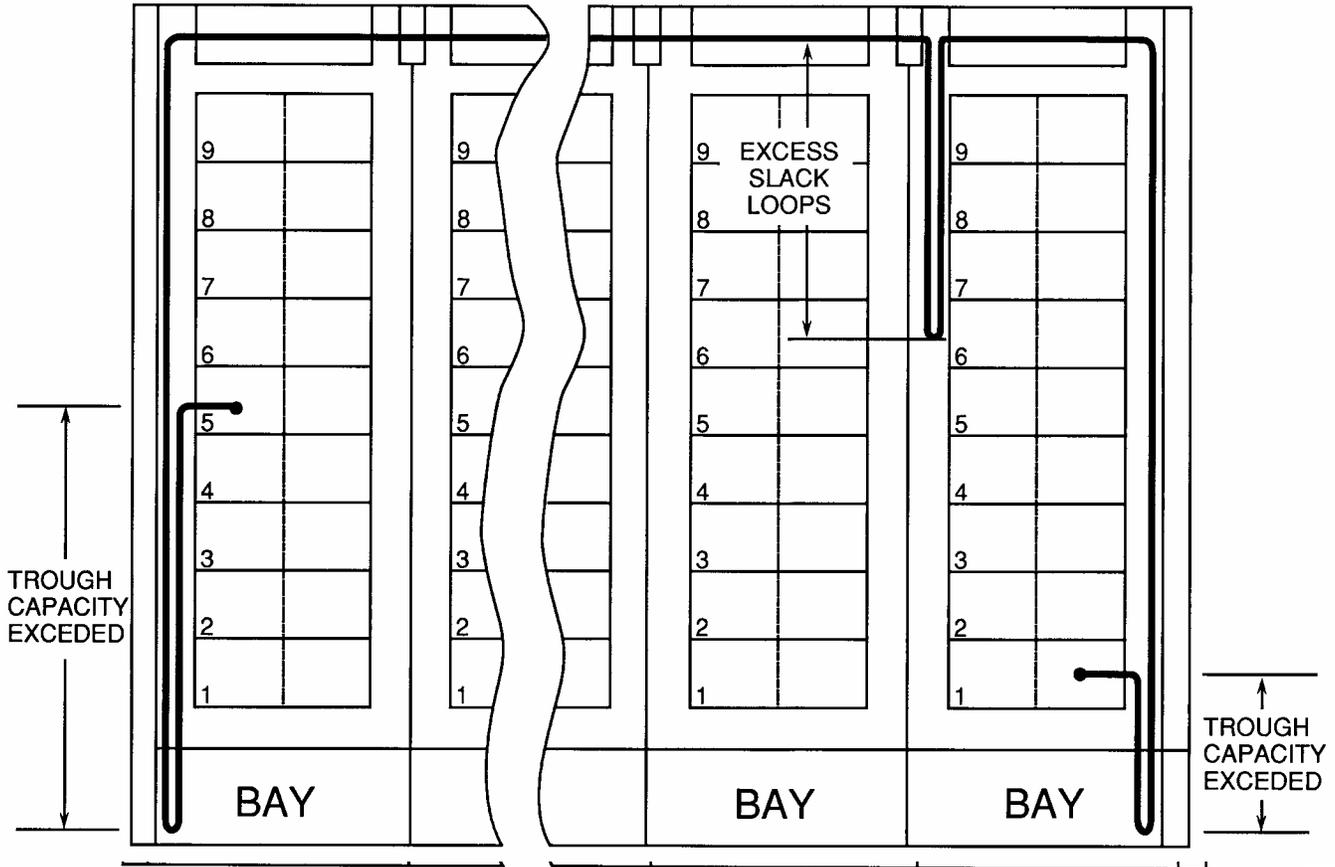


### Slack Management Method

When using a specified set of preconnectorized jumper lengths for multiple cross-connection applications, some level of fiber jumper slack is encountered. Adequate space is provided on the LGX frame for managing fiber jumper slack using the vertical troughs as shown in the figure below.

**Slack Loop in Vertical Trough**

The figure below illustrates that a jumper sized to cross-connect connector A to connector B can also be used to cross-connect connector C to connector D. The excess slack can be managed by creating slack loops in the vertical troughs in the immediate vicinity of the jumper ends.

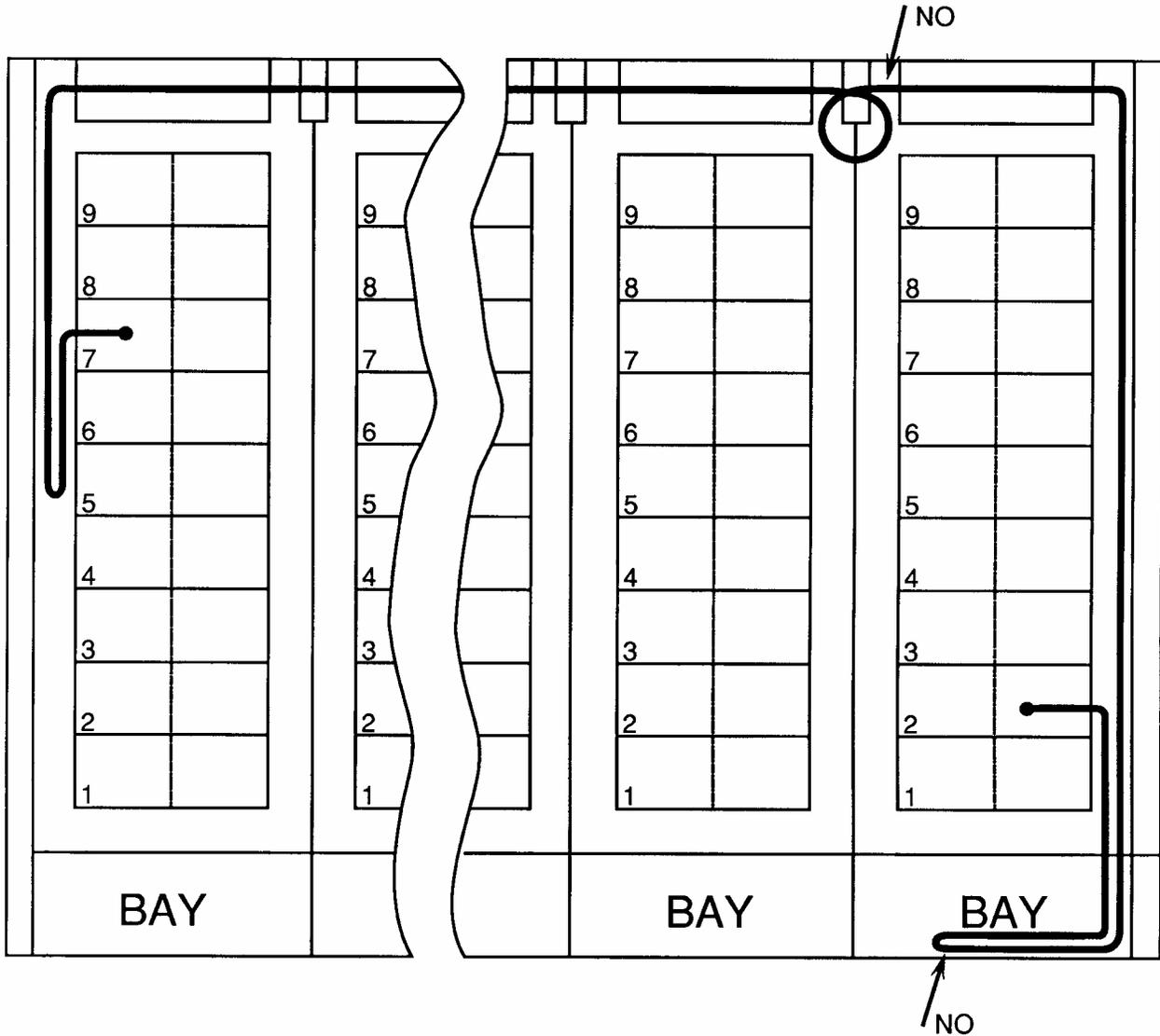


Managing Slack Loops Using Vertical Troughs

In situations where the slack cannot be adequately handled by creating slack loops at the ends, additional slack loops can be created in adjacent vertical troughs as shown in the figure below. Adjacent vertical troughs should only be used to manage excess slack in cases where the capacity at the ends has been exceeded.

### Slack Loop in Adjacent Vertical Trough

All excess jumper slack should be managed using the vertical troughs. Storing fiber slack loops in the lower raceway is not recommended as it will



increase jumper pileup and cause congestion. Forming slack coils around the jumper support bracket as shown in the figure below is also not recommended as it will increase jumper pileup and cause congestion in the upper raceway.

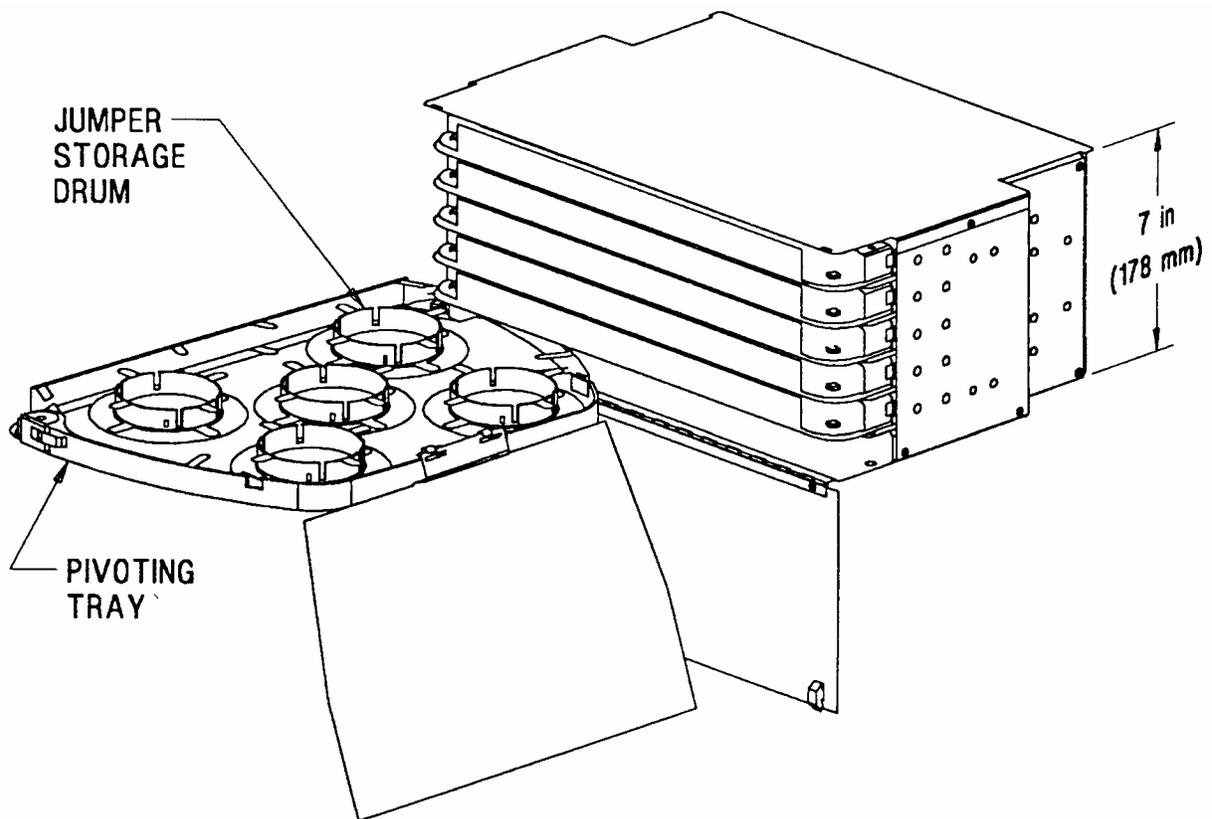
### Slack Pileup and Coiling Slack

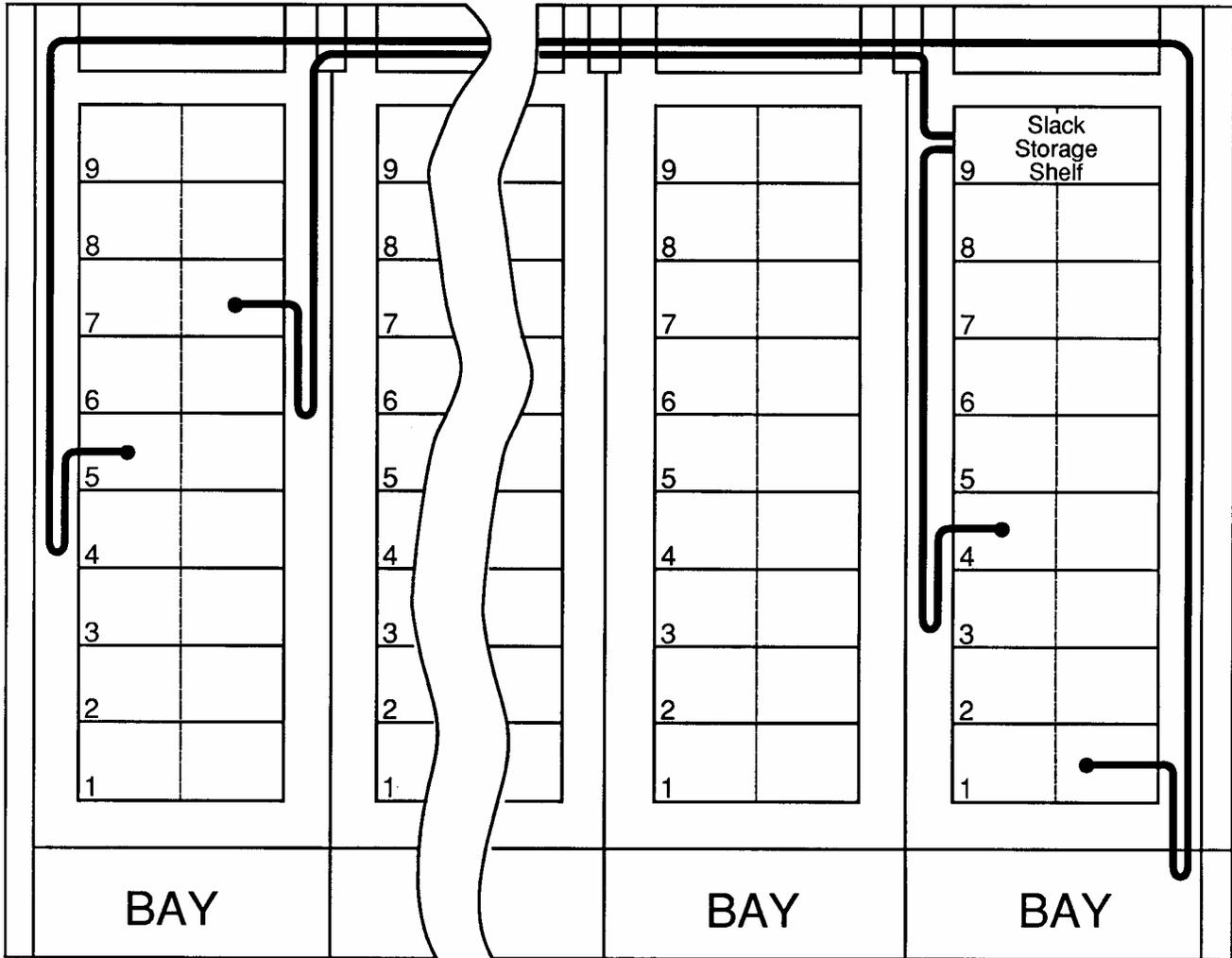
#### Slack Storage

Slack Storage is usually not recommended at the FDF primarily because it makes tracing and removal of jumpers difficult and also because a

significant amount of frame space may be consumed by storage shelves. However, slack storage may be necessary in special circumstances. In these cases, jumper slack can be stored using the LSJ1RP-30/7 Slack Storage Shelf as shown in the figure below. The jumper slack should be neatly coiled around the drums provided and stored in the base of the hinged jumper storage trays. When several jumpers are stored together, the jumpers should be tagged for easy relocation. Small slack loops should still be provided at the termination points and at points where jumpers enter the slack storage shelf so that jumpers are not pulled tight in the trough system as shown in the figure on the next page.

### Slack Storage Shelf





Slack Storage Procedure

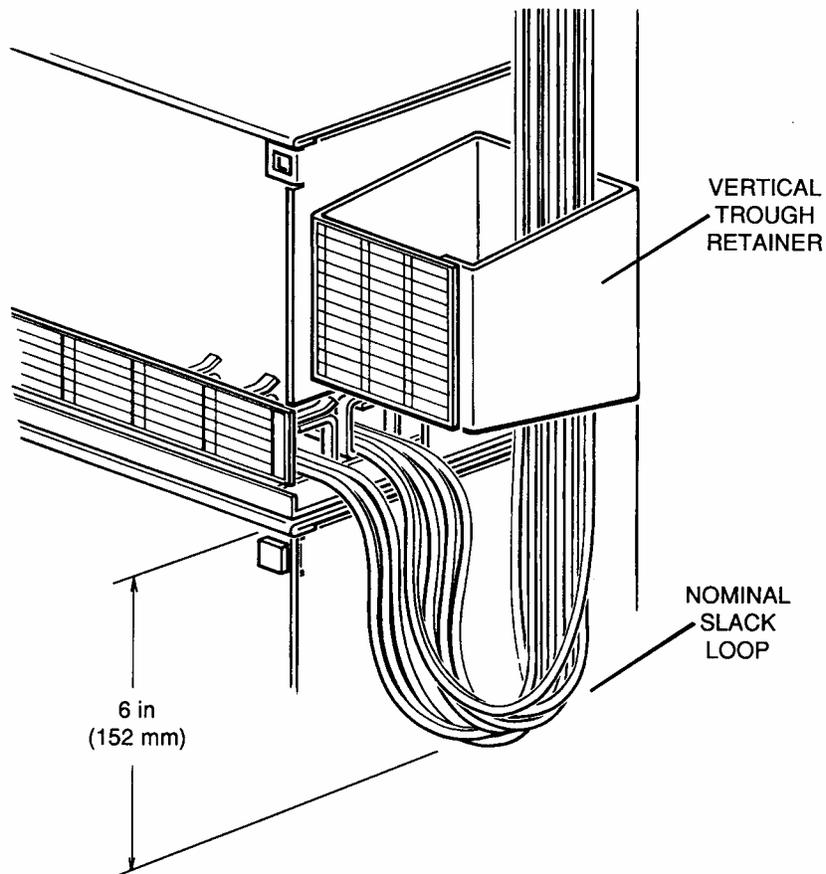
### Fiber Jumper Placement

All jumpers routed on the front of the LGX frame should be carefully dressed. A nominal slack loop should be allowed for all fibers in the vertical trough area as shown in the figure below. The slack loop allows the fiber jumpers to be easily removed and it makes the tracing of jumpers easier. The slack loop also ensures that no jumper is pulled tight across the edge of a shelf or vertical retainer. Adequate slack can be managed in the vertical troughs while limiting excess slack. The following general

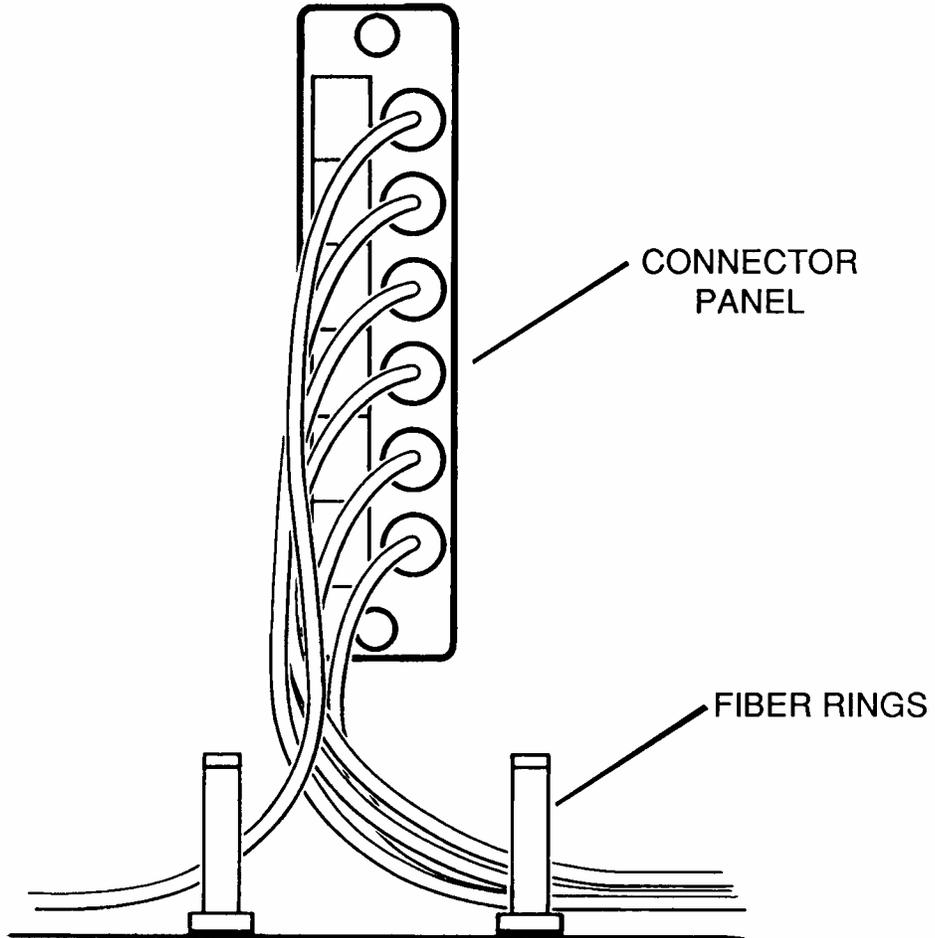
procedures for routing jumpers apply to all LGX circuit connections. When routing jumpers:

1. **Dress jumpers on the shelf using the fiber rings:** Jumpers are dressed on the shelf by routing the fibers inline (see figure on next page) with the connector panels and through the fiber rings in the front of the shelf.
2. **Place jumper into vertical trough:** Allow a nominal slack loop in jumpers going up vertical troughs (see figure below). Dress jumpers going down vertical troughs over the shelf radius. Jumpers are fanned into the vertical trough and into the jumper retainers.

### Slack Loop in Vertical Trough



**Dress Jumpers on Shelf Using Fiber Rings**



## Routing Field Terminated Jumpers

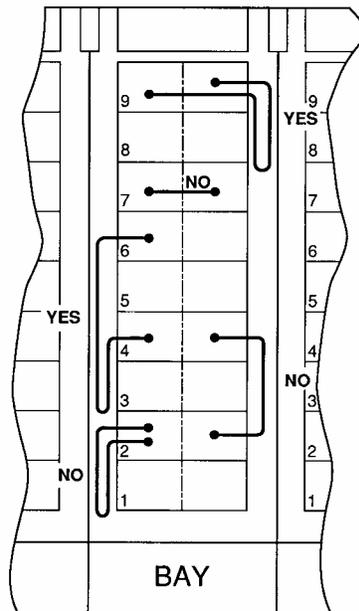
Field Terminating optical connectors allows the construction of jumper cables in the field without excess slack. The use of field-mounted connectors is a cost-effective method for cross-connection or interconnection jumper installation.

### Cross-Connecting Within a Single Bay Using the Shortest Route

When routing jumpers within a single or mixed bay, all jumpers should take the shortest path to minimize the length. Cross-connecting jumpers within an LGX single bay can be accomplished by following these simple routing guidelines:

- **Jumpers should exit or enter a shelf using the same vertical trough.** It is recommended that the jumper be routed into the vertical trough nearest the starting connector. This will help distribute the jumper load and prevent excessive jumper pileup in a single vertical trough.
- **Jumpers should always be routed into a vertical trough to create a small jumper loop.** The small loop shown in the figure below allows the fiber jumper to be easily removed and makes tracing of jumpers easier.

It is recommended that jumper cordage be routed between the two terminal connection points, using the procedure described above, prior to field terminating connectors to ensure the proper length. **NOTE:** The minimum recommended jumper length for OFS depressed cladding fiber is 2 feet (0.6 m). For matched cladding fibers, the minimum recommended jumper length is 6.6 feet (2 m).



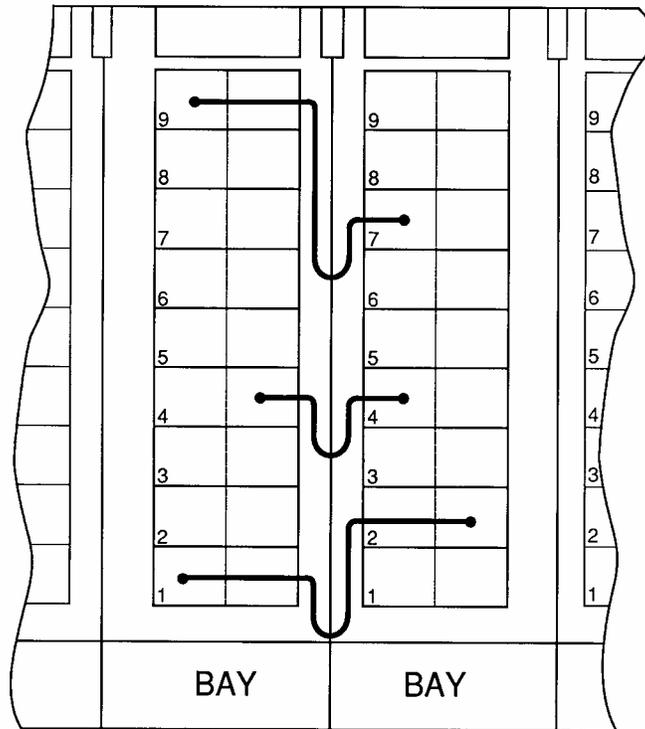
### Routing Field-Terminated Jumpers Within Single Bays

### Cross-Connecting Field-Terminated Jumpers Between Adjacent Bays

When routing cross-connect jumpers between adjacent bays, all jumpers should take the shortest path through the common vertical trough to minimize the length. Cross-connecting jumpers between adjacent LGX bays can be accomplished by following these simple routing guidelines:

- Connect one jumper end to the originating connector and route jumper to the common vertical trough between the adjacent bays, as shown in the figure below.
- Dress jumper into vertical trough and create a nominal slack loop, as shown in the figure on the previous page.
- Route jumper to the terminating connector through the common vertical trough, and connect remaining jumper end.
- Adjust the nominal slack loop, and dress jumper behind jumper retainers and fiber rings.

It is recommended that jumper cordage be routed between the two terminal connection points, using the procedure described above, prior to field terminating connectors to ensure the proper length. **NOTE:** The minimum recommended jumper length for OFS depressed cladding fiber is 2 feet (0.6 m). For matched cladding fibers, the minimum recommended jumper length is 6.6 feet (2 m).



## Routing Field-Terminated Jumpers between Adjacent Bays

### Cross-Connecting Field-Terminated Jumpers Beyond Adjacent Bays

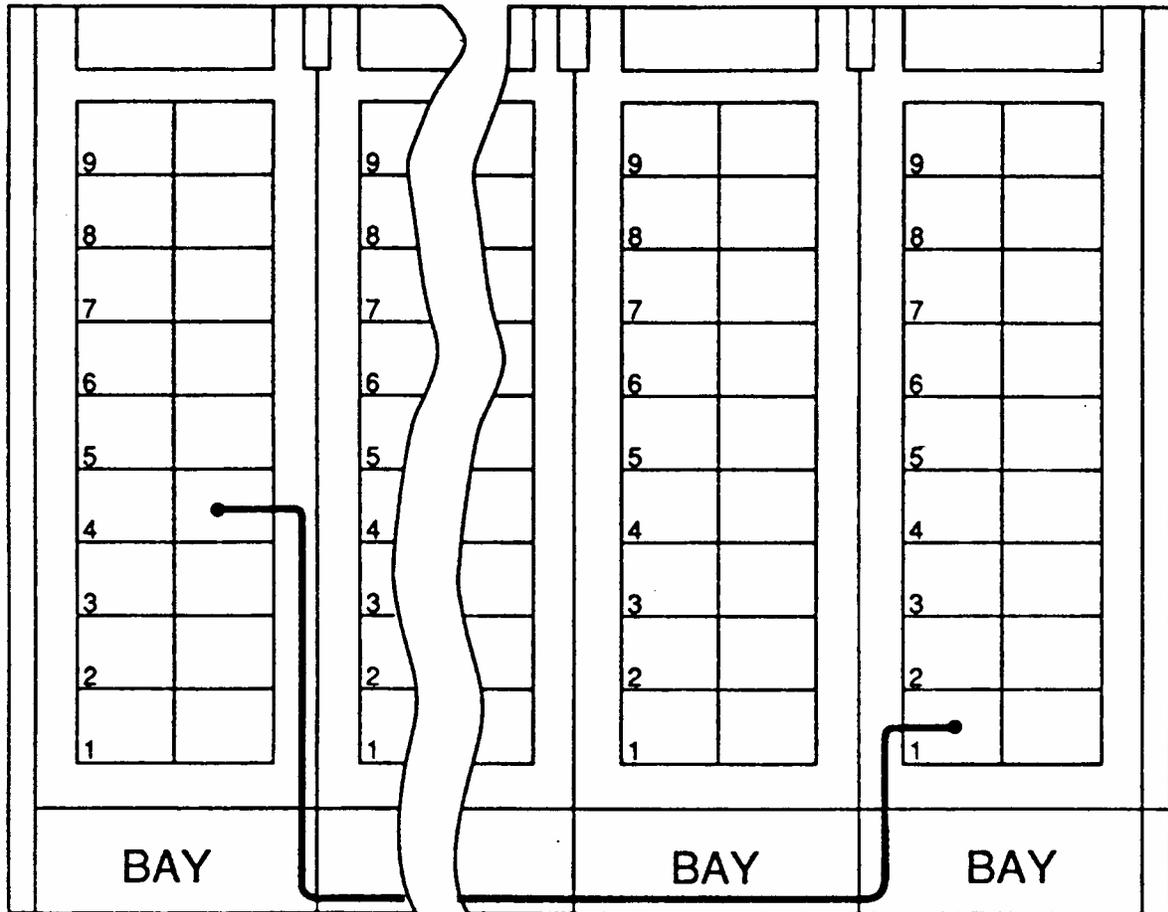
**When routing cross-connect jumpers beyond adjacent bays, jumpers should be routed using either the Lower Raceway or the Upper Raceway depending on the positions of the originating and terminating shelves within the respective bays.**

### Routing Field-Terminated Jumpers Using the Lower Raceway

**If both the originating and terminating connectors are located at the bottom of the respective bays as shown in the figure on the following page (shelf positions 1 through 4), the jumper is routed using the Lower Raceway. Routing jumpers using the Lower Raceway can be accomplished by following these simple routing guidelines:**

- At the starting bay, connect one jumper end to the originating connector and route jumper, left or right, to the nearest vertical trough.
- Route the jumper down the vertical trough and through the Lower Raceway to the ending bay. Dress jumpers going down vertical troughs over the shelf radius.
- At the ending bay, route jumper up the left or right vertical trough nearest to the terminating connector, and connect remaining jumper end. Dress jumpers going up vertical troughs over the shelf radius.
- **Adjust jumper ends so they are not tight, and dress jumper behind jumper retainers and fiber rings.** An additional 6 inches (152 mm) should be added to jumper lengths to prevent the jumper from being pulled too tight between connection points.

**It is recommended that jumper cordage be routed between the two terminal connection points, using the procedure described above, prior to field terminating connectors to ensure the proper length. NOTE: The minimum recommended jumper length for OFS depressed cladding fiber is 2 feet (0.6 m). For matched cladding fibers, the minimum recommended jumper length is 6.6 feet (2 m).**



#### Routing Field Terminated Jumpers Using the Lower Raceway

#### Routing Field-Terminated Jumpers Using the Upper Raceway

If both the originating and terminating connectors are located at the top of the respective bays as shown in the figure below (shelf positions 5 through 9), the jumper is routed using the Upper Raceway. Routing jumpers using the Upper Raceway can be accomplished by following these simple routing guidelines:

- At the starting bay, connect one jumper end to the originating connector and route jumper, left or right, to the nearest vertical trough. Create a nominal slack loop in the vertical trough.

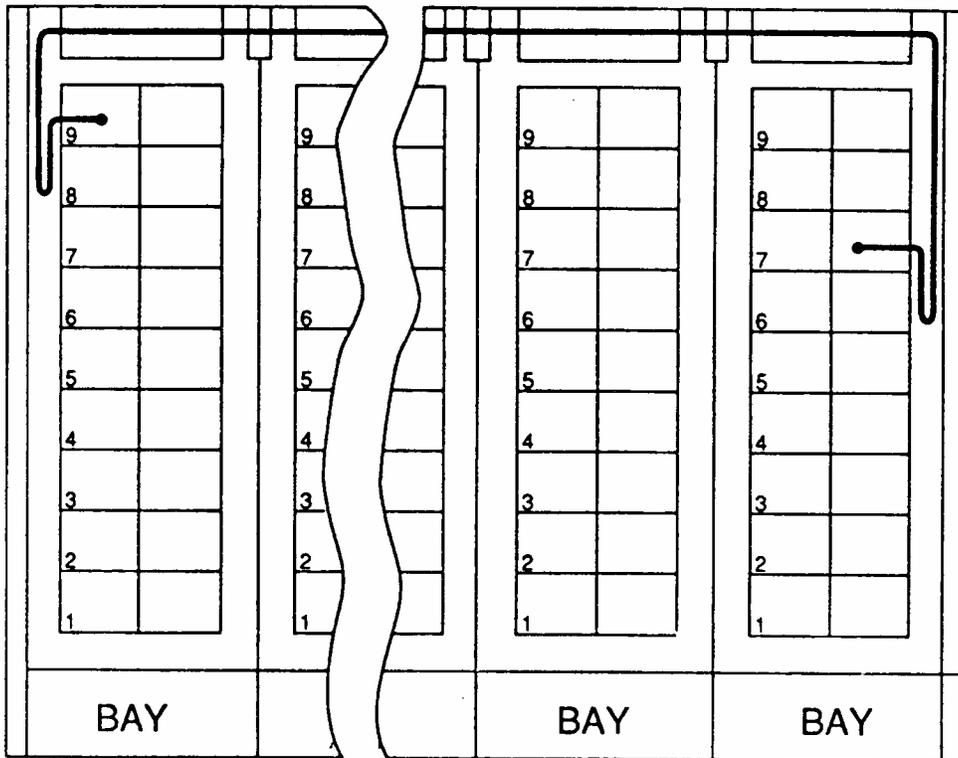
- Route the jumper up the vertical trough and through the Upper Raceway to the ending bay.
- At the ending bay, route jumper down the left or right vertical trough nearest to the terminating connector, and connect remaining jumper end. Create a nominal slack loop in the vertical trough.
- Adjust the nominal slack loops at both jumper ends, and dress jumper behind jumper retainers and fiber rings.

It is recommended that jumper cordage be routed between the two terminal connection points, using the procedure described above, prior to field terminating connectors to ensure the proper length. NOTE: The minimum recommended jumper length for OFS depressed cladding fiber is 2 feet (0.6 m). For matched cladding fibers, the minimum recommended jumper length is 6.6 feet (2 m).

### Routing Field-Terminated Jumpers Using the Upper Raceway

## Routing Stock-Length Jumpers

When using a specified set of preconnectorized jumper lengths for multiple cross-connection applications, some level of fiber jumper slack is encountered. Adequate space is provided on the LGX frame for managing fiber jumper slack using the vertical troughs. This section provides the methods and procedures to properly select and route jumpers within a single bay, between adjacent bays, and lineups that extend beyond



adjacent bays.

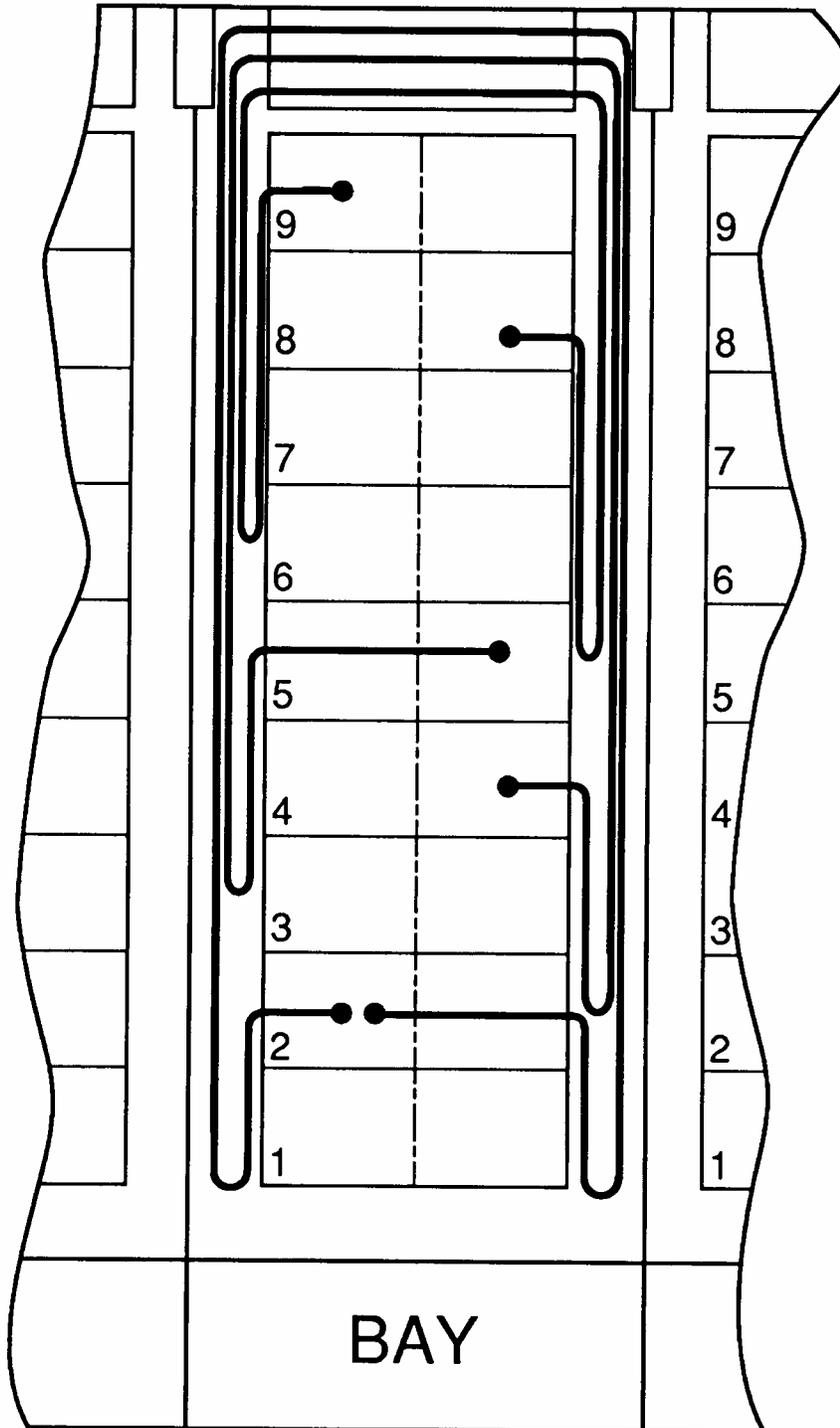
## Routing Jumpers Within a Single Bay

**Cross-connections within a single bay may be required in arrangements where facility and equipment terminations are mixed in one bay. Cross-connecting jumpers within an LGX single bay FDF as shown in the figure on the following page, can be accommodated using the following simple guidelines:**

- **Loop jumpers across the Upper Raceway.** Jumpers are always routed over the Upper Raceway.
- Connect one end of the jumper using the left vertical trough, and connect the remaining end using the right vertical trough.
- **Adjust the slack loops at both jumper ends to be about equal, and dress jumper behind jumper retainers and fiber rings.** Excess slack should be adjusted so that the slack loops at both ends of the jumper do not rest or build up in the Lower Raceway.

## Jumper Length Selection When Routing Within a Single Bay

**All connector positions within a single bay can be cross-connected using 16-foot (4.9 m) jumper lengths. Shorter 10-foot (3.1 m) jumper lengths can also be used, but limited to cross-connecting between shelf positions 5 through 9.**



**Routing Jumpers Within Single Bays**

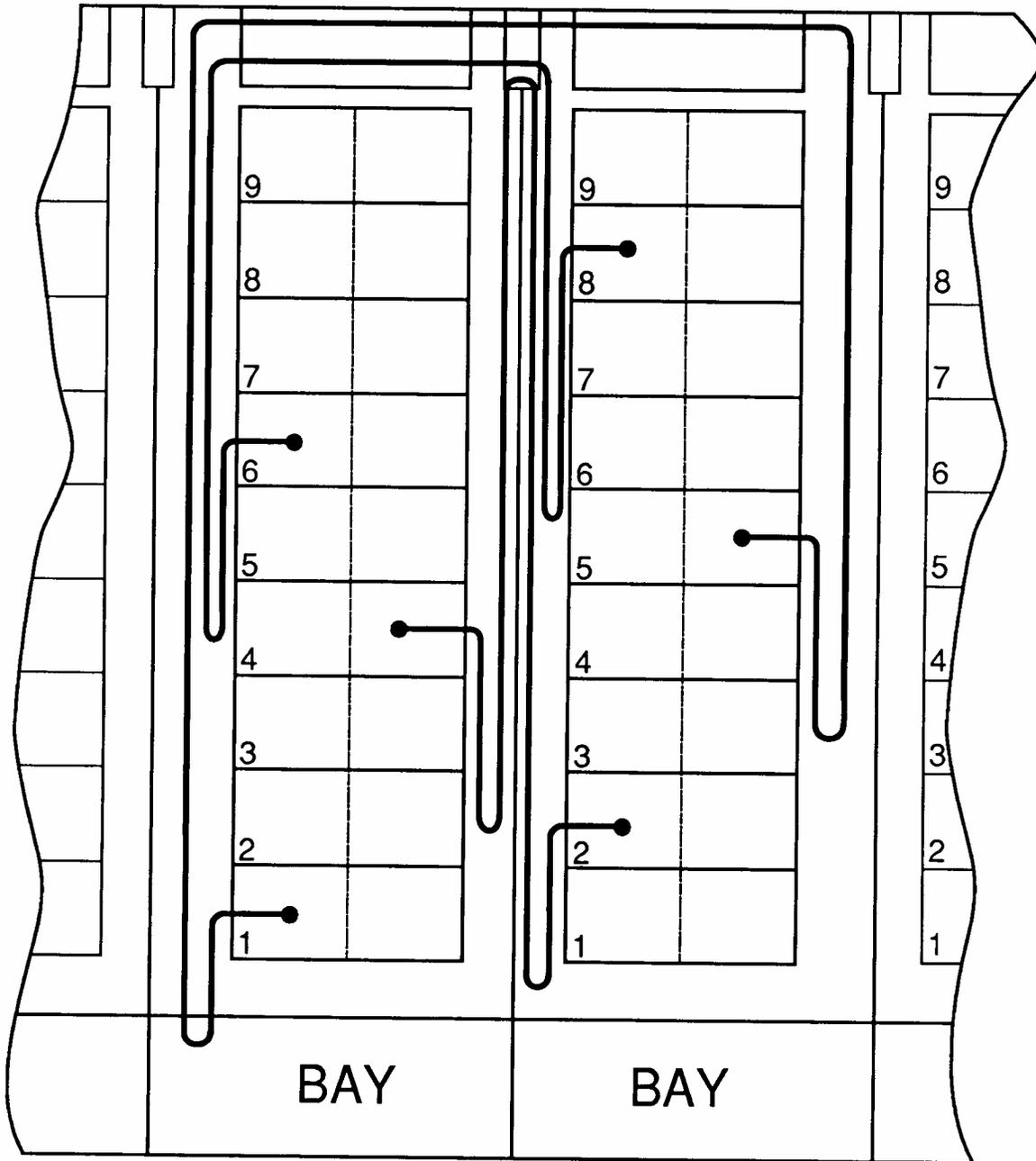
**Routing Jumpers Between Adjacent Bays**

Jumpers can easily be routed between adjacent bays by following simple guidelines:

- At the starting bay, connect one jumper end (A, C, E, or F shown in the figure on the next page) and route jumper, left or right, to the nearest vertical trough.
- Route the jumper up and over the Upper Raceway or Jumper Support Bracket to the adjacent bay. All jumpers are always routed either over the Upper Raceway or Jumper Support Bracket.
- At the adjacent bay, route the jumper down the left or right vertical trough nearest the terminating connector and connect remaining jumper end (B, D, F, or G shown in the figure on the next page). (In a small number of applications, there is the possibility that a jumper may need to be routed through the left side of a shelf when the terminating connector is located on the right and vice versa.
- **Adjust the slack loops at both jumper ends to be about equal, and dress jumper behind jumper retainers and fiber rings.** Excess slack should be adjusted so that the slack loops at both ends of the jumper do not rest or build up in the Lower Raceway.

#### **Length Selection for Jumpers Routed Between Adjacent Bays**

**All connector positions within a single bay can be cross-connected using 16 feet (4.9 m) jumper lengths.**



**Routing Specified Length Jumpers Between Adjacent Bays**

**Routing Stock Length Jumpers Beyond Adjacent Bays**

When routing cross-connect jumpers beyond adjacent bays, jumpers are routed using either the Lower Raceway or Upper Raceway depending on the position of the shelf within the originating bay. Jumpers originating in shelf positions 1 through 4 of the starting bay are routed using the Lower Raceway. Jumpers originating in shelf positions 5 through 9 of the starting bay are routed using the Upper Raceway.

### Routing Stock-Length Jumpers Using the Lower Raceway

**If the originating connectors are located in shelf positions 1 through 4 of the starting bay, then jumpers are routed using the Lower Raceway. Routing jumpers using the Lower Raceway can be accomplished by following these simple routing guidelines:**

- At the starting bay, connect one jumper end (A or C, shown in the figures on the next two pages) to the designated connector and route jumper, left or right, to the nearest vertical trough.
- **Route the jumper down the vertical trough to the Lower Raceway.** Dress jumpers going down vertical troughs over the shelf radius.
- Route jumper along the Lower Raceway toward the ending bay, and to the vertical trough that precedes the trough nearest the terminating connector.
- Route jumper up the vertical trough and over the Upper Raceway or Jumper Support bracket to the ending bay.
- At the ending bay, route the jumper down the left or right vertical trough nearest to the terminating connector, and connect remaining jumper end (B or D, shown in the figures on the next two pages).
- **Adjust the slack loop, and dress jumper behind jumper retainers and fiber rings.** Excess slack should be adjusted so that the slack loops at both ends of the jumper do not rest or build up in the Lower Raceway. Adjustments for excess slack can be made by creating slack loops in adjacent troughs.

### Length Selection for Jumper Using the Lower Raceway

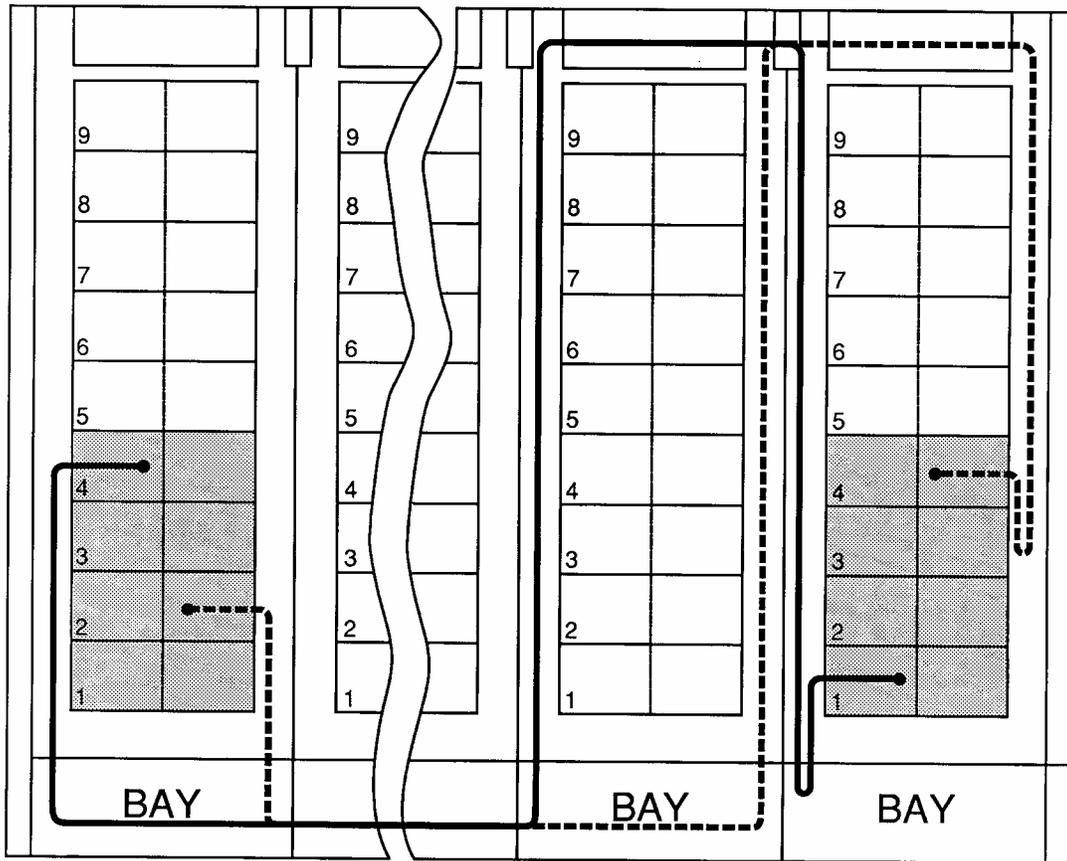
**The correct jumper length can be selected by following these simple steps:**

- Determine the positions of the shelves containing the required connections at the starting and ending bays.
- If cross-connecting bottom-to-bottom, use Table 16-1. If cross-connecting bottom-to-top, use Table 16-2.
- Using the table, determine the total number of bays being cross-connected and locate the recommended jumper length.
- Use the figures on the next two pages together with the guidelines above to properly route the jumper.

**Table 16-1. Jumper Selection Table — Cross-Connecting Bottom- to-Bottom**

The lengths in this table to be used with the figure below.

Number of Bays	3,4	5,6	7,8,9	10,11,12	13	14,15,16	17,18	19,20,21
Jumper Length Feet (meters)	25 (7.6)	30 (9.2)	35 (10.7)	40 (12.2)	45 (13.6)	50 (15.2)	55 (16.6)	60 (18.1)

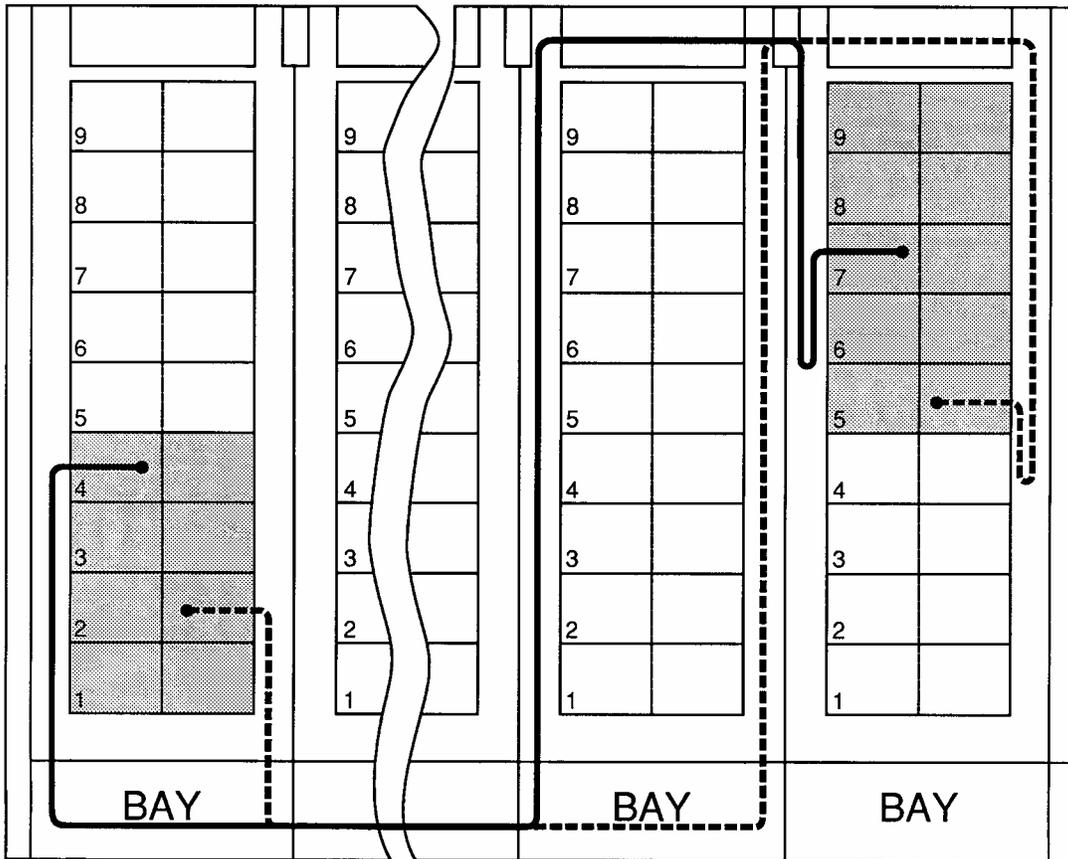


**Routing Specified Length Jumpers Using the Lower Raceway Bottom-to-Bottom**

**Table 16-2. Jumper Selection Table — Cross-Connecting Bottom to Top**

The lengths in this table to be used with the figure below.

Number of Bays	3	4,5	6,7	8,9,10	11,12	13,14	15,16,17	18,19,20	21
Jumper Length Feet (meters)	20 (6.1)	25 (7.6)	30 (9.2)	35 (10.7)	40 (12.2)	45 (13.6)	50 (15.2)	55 (16.6)	60 (18.1)



**Routing Specified Length Jumpers Using the Lower Raceway Bottom- to-Top**

### Routing Specified Length Jumpers Using the Upper Raceway

**If the originating connectors are located in shelf positions 5 through 9 of the starting bay, then jumpers are routed using the Upper Raceway. Routing jumpers using the Upper Raceway can be accomplished by following these simple routing guidelines:**

- At the starting bay, connect one jumper end (A or C shown in the figures on the next two pages) to the designated connector and route jumper, left or right, to the nearest vertical trough.
- Route the jumper up the vertical trough and through the Upper Raceway to the ending bay.
- At the ending bay, route the jumper down the left or right vertical trough nearest to the terminating connector and connect remaining jumper end (B or D, shown in the figures on the next two pages).
- **Adjust the slack loops at both jumper ends to be about equal, and dress jumper behind jumper retainers and fiber rings.** Excess slack should be adjusted so that the slack loops at both ends of the jumper do not rest or build up in the Lower Raceway. Adjustments for excess slack can be made by creating slack loops in adjacent troughs.

### Specified Length Jumpers When Using the Upper Raceway

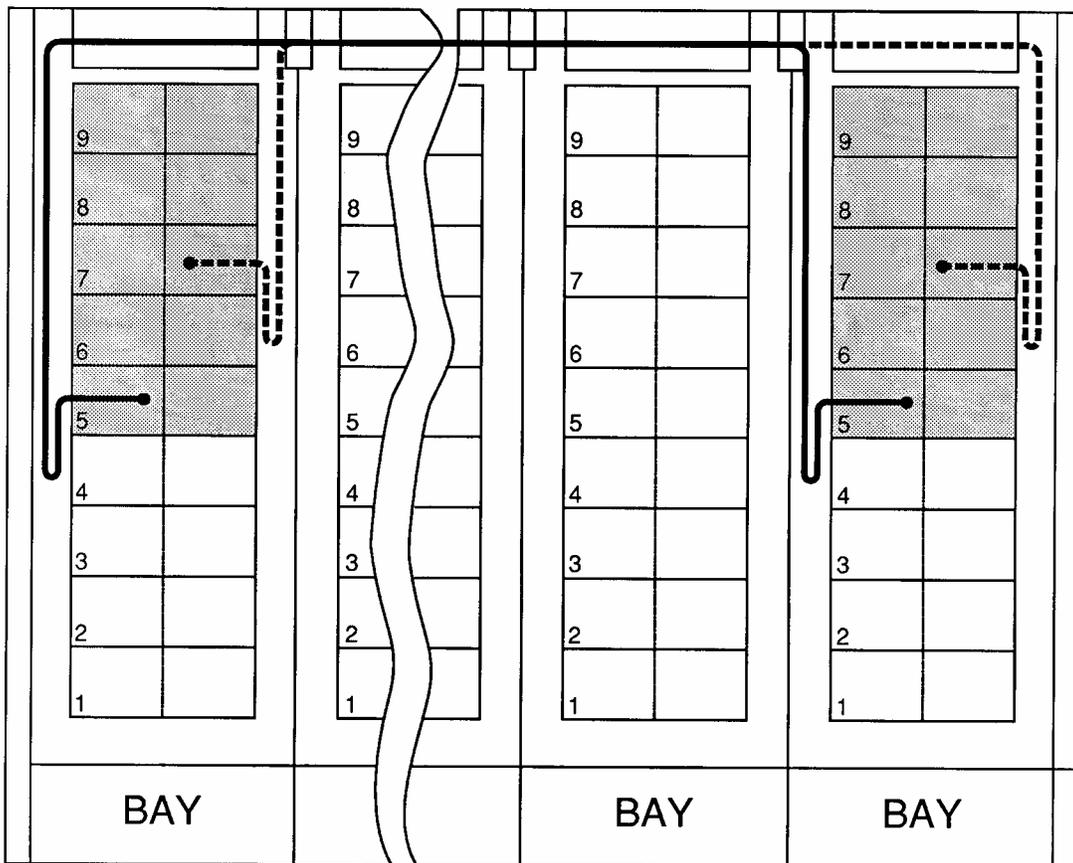
**The correct jumper length can be selected by following these simple steps:**

- Determine the positions of the shelves containing the required connections at the starting and ending bays.
- If cross-connecting top-to-top, use Table 16-3. If cross-connecting top-to-bottom, use Table 16-4.
- Using the table, determine the total number of bays being cross-connected and locate the recommended jumper length.
- Use the figures on the next two pages together with the guidelines above to properly route the jumper.

Table 16-3. Jumper Selection Table — Cross-Connecting Top to Top

The lengths in this table to be used with the figure below.

Number of Bays	3	4,5	6,7,8	9,10	11,12	13,14	15,16,17	18,19	20,21
Jumper Length Feet (meters)	16 (4.9)	20 (6.1)	25 (7.6)	30 (9.2)	35 (10.7)	40 (12.2)	45 (13.6)	50 (15.2)	55 (16.6)

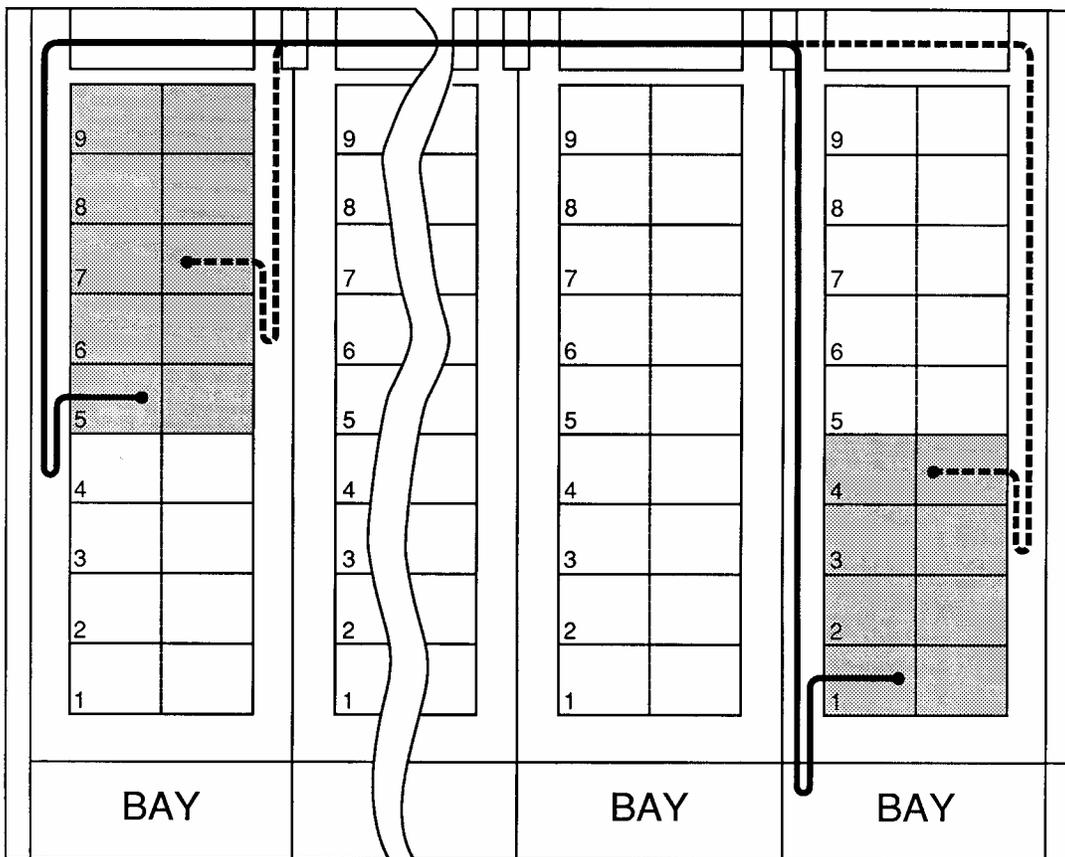


Routing Specified Length Jumpers Using the Upper Raceway Top-to-Top

**Table 16-4. Jumper Selection Table — Cross-Connecting Top-to-Bottom**

The lengths in this table to be used with the figure below.

Number of Bays	3,4	5,6,7	8,9	10,11	12,13	14,15,16	17,18	19,20,21
Jumper Length Feet (meters)	20 (6.1)	25 (7.6)	30 (9.2)	35 (10.7)	40 (12.2)	45 (13.6)	50 (15.2)	55 (16.6)



**Routing Specified Length Jumpers Using the Upper Raceway Top-to-Bottom**

**Stocking Plan**

Table 16-5 and Table 16-6 provide stock jumper ordering ratios for arrangements extending beyond adjacent bays. The ratios represent the probability of randomly cross-connecting the specified jumpers across the lineups consisting of three or more bays. Table 16-5 provides jumper

stocking ratios that will minimize the amount of excess slack when using the specified jumper lengths. Table 16-6 provides jumper stocking ratios that will reduce the number of different length jumpers necessary to administer the specific lineup at the expense of adding more slack to the system.

Since it is not possible to anticipate every application of the LGX frame, it is recommended that Table 16-5 and Table 16-6 be used only to stock enough jumpers for initial applications; for example, to provide one month's supply of jumpers. After the initial application, it should be possible to establish stocking ratios which more accurately reflect a specific users' layout or configuration.

Table 16-5. Stocking Ratios to Minimize Excess Slack

Number of Bays per Lineup	Lucent Stock Jumper Lengths									
	Feet					Meters				
	10 ft. 3.1m	15 ft. 4.6m	20 ft. 6.1m	25 ft. 7.6m	30 ft. 9.2m	35 ft. 10.7m	40 ft. 12.2m	45 ft. 13.6m	50 ft. 15.1m	55 ft. 16.6m
3	24%	61%	11%	4%						
4	19%	51%	19%	10%						
5	16%	43%	23%	16%	2%					
6	14%	38%	24%	20%	5%					
7	12%	33%	23%	24%	7%	1%				
8	11%	30%	22%	26%	9%	3%				
9	10%	27%	21%	27%	11%	5%				
10	9%	24%	19%	27%	13%	7%				
11	8%	22%	18%	27%	14%	9%	1%			
12	7%	21%	17%	26%	15%	11%	3%			
13	7%	19%	16%	25%	15%	12%	5%	1%		
14	6%	18%	15%	24%	15%	13%	6%	1%		
15	6%	17%	15%	23%	15%	14%	8%	3%	1%	
16	6%	16%	14%	23%	14%	14%	8%	4%	2%	
17	5%	15%	13%	22%	14%	14%	9%	5%	2%	
18	5%	14%	13%	21%	14%	14%	9%	6%	3%	1%
19	5%	13%	12%	20%	14%	14%	10%	7%	4%	1%
20	4%	13%	12%	20%	13%	14%	10%	7%	5%	2%

To use Table 16-5, determine the number of bays in the specific lineup in the left column, then run across to determine the recommended set of jumpers from the top row, and the corresponding stocking or ordering ratios for each specific length. For example, a specific application requires that 100 optical circuit connections per month be provided on an LGX lineup consisting of four bays, and it is desired to determine the jumper

lengths and the quantities of these jumpers that can be used for this application. Using Table 16-5:

- Locate the four-bay lineup in the left column.
- Read across to the right to determine that this arrangement can be administered with four jumper lengths.
- The first months' order would consist of nineteen 10-foot (3.1 m) jumpers, fifty-one 15 foot (4.6 m) jumpers, nineteen 20-foot (6.1 m) jumpers, and ten 25-foot (7.6 m) jumpers for a total of 100 jumpers.

In this example, it would be recommended that the user monitor the first months' order to provide information based on actual jumper use. This would provide information on jumper use based on the actual layout of fiber optic equipment. All future monthly orders could then be amended based on this experience.

**Table 16-6. Stocking Ratios to Minimize the Number of Different Lengths**

Number of Bays per Lineup	Lucent Standard Jumper Lengths					Added Jumper Slack Feet	
	15 ft. 4.6m	25 ft. 7.6m	35 ft. 10.7m	45 ft. 13.6m	55 ft. 16.6m	Single	Duplex
3	85%	15%				1,700'	850'
4	70%	30%				2,500'	1,250'
5	59%	39%	2%			3,310'	1,650'
6	51%	44%	5%			4,090'	2,040'
7	45%	47%	8%			4,760'	2,380'
8	40%	48%	12%			5,360'	2,680'
9	36%	48%	16%			6,030'	3,010'
10	33%	47%	20%			6,730'	3,360'
11	30%	45%	23%	1%		7,430'	3,720'
12	28%	43%	26%	3%		8,200'	4,100'
13	26%	41%	27%	5%		9,000'	4,500'
14	24%	40%	28%	8%		9,790'	4,900'
15	23%	38%	28%	10%	1%	10,580'	5,290'
16	21%	37%	28%	12%	2%	11,360'	5,680'
17	20%	35%	28%	14%	3%	12,140'	6,070'
18	19%	34%	28%	15%	4%	12,930'	6,460'
19	18%	32%	28%	16%	6%	13,690'	6,850'
20	17%	31%	27%	17%	7%	14,430'	7,210'

To use Table 16-6, determine the number of bays in the specific lineup in the left column, then run across to determine the recommended set of jumpers from the top row, and the corresponding stocking or ordering

ratios for each specific length. For example, a specific application requires that 100 optical circuit connections per month be provided on an LGX lineup consisting of four bays, and it is desired to determine the jumper lengths and the quantities of these jumpers that can be used for this application. Using Table 16-6:

- Locate the four bay lineup in the left column.
- Read across to the right to determine that this arrangement can be administered with four jumper lengths.
- The first months' order would consist of seventy 15-foot (4.6 m) jumpers and thirty 25-foot (7.6 m) jumpers for a total of 100 jumpers.

Compared to using Table 16-5, this method uses only two jumper sizes but adds between 1,250 feet (381 m) and 2,500 feet (762 m) more slack to the system. In this example, it would be recommended that the user monitor the first months' order to provide information based on actual jumper use. This would provide information on jumper use based on the actual layout of fiber optic equipment. All future monthly orders could then be amended based on this experience.

## **Routing Interconnect Cables**

---

### **Interconnection Jumpers**

Routing interconnect jumpers is similar to routing cross-connect jumpers except that the equipment terminal end of the jumper is in another bay or lineup. The terminal end of the jumper is placed onto the front of the LGX frame and routed (see figure on next page) into the Fiber Protection System or the overhead rack to the fiber optic equipment position. All interconnect cables should be secured where they transition on or off the cable rack. Local provisions should be made to maintain minimum bend radius.

- **Dress jumpers on the shelf utilizing fiber rings:** Jumpers originating on the left side of the shelf are routed to left; jumpers originating on the right side of the shelf are routed to right. Interconnect jumpers are terminated and dressed on the shelf in a similar manner to cross-connect jumpers.
- **Place jumper into vertical trough:** allow proper slack loop [approximately 12 inches (305 mm)] in jumpers going upward toward overhead cable rack.
- Interconnect jumpers can use horizontal raceway enroute to cable way.
- Maintain minimum bend radius while in overhead cable rack.

### **Routing Building Cable Type Interconnect Jumpers**

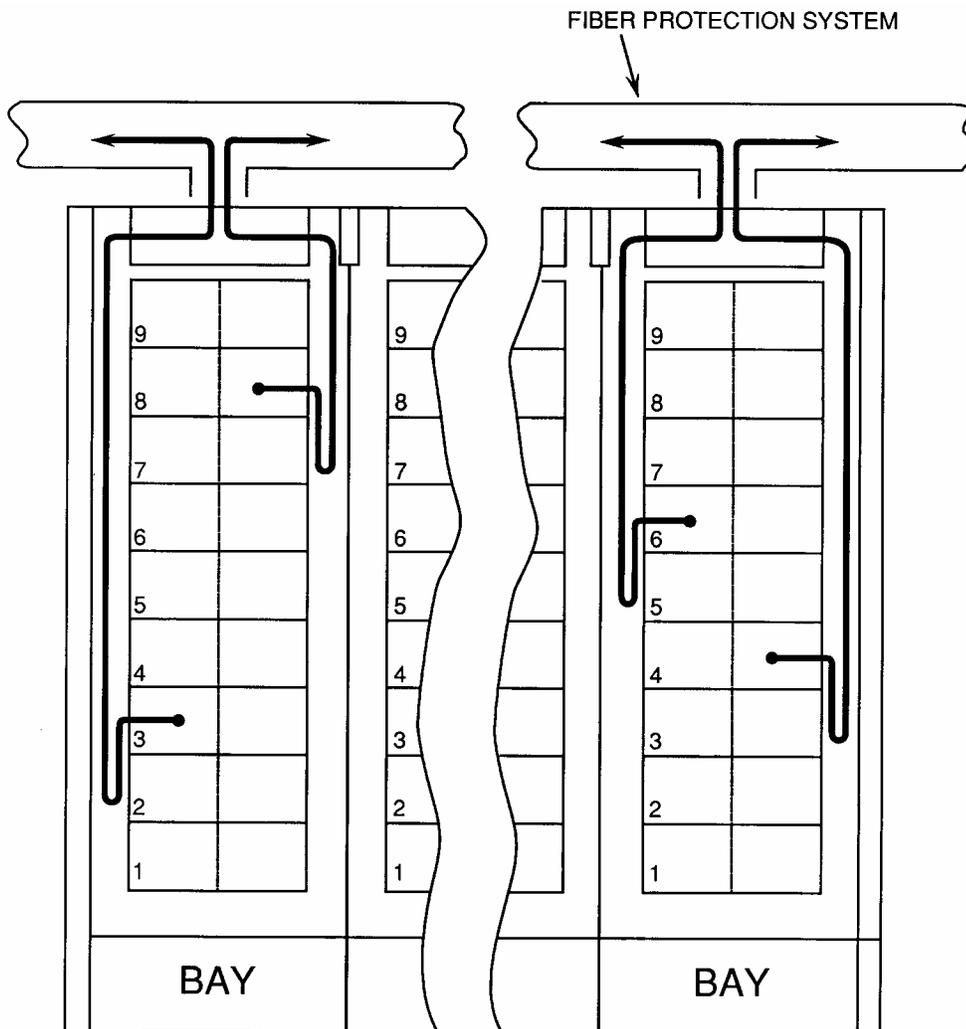
Building cables may also be used as interconnect jumper cables between an LGX frame bay and the electronic equipment. Building cables are buffered insulated fibers contained in a single outer jacket.

Building cables are normally field terminated with connector plugs. The Breakout Kit (D-181774) can be used to break building cable out into individual fibers protected in tubing. The building cable sheath is terminated in the vertical trough and the fibers in protective tubing are transitioned into a shelf. These buffered fibers are placed in protective tubing and can be handled as other individual jumper cables. OFS also provides these cables connectorized with desired lengths through service centers. Building interconnect cables are routed the same as interconnect cables previously described.

### Routing Interconnect Jumpers

## Removing a Jumper

Removing a fiber jumper in good condition will allow it to be used again. A



jumper is usually removed in reverse order of the original routing. When removing a jumper, keep the optical connectors and couplings clean and scratch free by using dust caps on both connectors and couplings. Care should be exercised when removing a fiber jumper from the frame: do not tug, twist, or tie the jumper. Special care should also be taken not to disturb or cause hits on adjacent fibers.

## **Circuit Record**

---

A record of all cross-connect jumpers should be maintained as part of the complete record of office equipment. The form shown on the next page provides a format for maintaining circuit cross-connect records. The form contains space for location identification information and system identification for both sides (A and B) of a cross-connect jumper. Location information required for a complete record includes frame, shelf panel, and connector identifiers. A space is also provided to specify if a jumper is placed for cross-connection (X) or interconnection (I).

## **Moving a Fiber System**

---

A fiber optic transmission system can easily be moved at the *LGX* frame. To maintain a working system during the move, the system should be switched to the protection lines. If no protection lines are available, it may be necessary to disconnect working lines for a short period of time.

Once a system is moved to the protection lines, a new cross-connect or interconnect jumper can be routed at the *LGX* frame. A fiber system may be routed to a different servicing facility. This transition may be done at the near end only or both the far and near end.

Once the new span is tested the working system can be switched from the protection line back onto the service line. The protection line can be moved in a similar manner. Thus an entire fiber system could be moved by coordinating jumper routing and protection switching. A procedure for moving a fiber system in the section on Retrofit Applications.



to the original facility, the fiber system can be moved back following guidelines in the previous paragraph.

## **Maintenance**

---

### **General**

In general the *LGX* frame requires little maintenance. It is desirable to keep the *LGX* frame as clean as possible to keep dust out of optical connections. Miscellaneous tools and equipment should be cleared from the *LGX* frame area for efficient operations.

### **Label Maintenance**

Labels may become worn over time and may need to be replaced. Standard *LGX* frame replacement labels should be ordered. New labels may be installed directly over the old labels. The shelf label bracket can be snapped out for easy application of label. The jumper retainer labels may be installed directly on the retainers without removing them from the frame. Shelf bracket labels may be replaced with the hinged shelf label, which provides increased identification space.

### **Monitor Jumper Pileup**

The *LGX* frame pathways, as described in this guide, are more than adequate to handle most all cable combinations. It is recommended that the *LGX* frame pathways be monitored to ensure ample space for adding and removing jumpers. As a maintenance procedure, any jumpers that are too tight should be rerouted to provide the appropriate slack. The accumulation of tight jumpers may result in cable pathway blockage and difficult jumper tracing and removal.

### **Edge Material**

Plastic edge material may be desired for attaching to the top edges of the shelf exit slot. These protectors will reduce possible damage to jumpers inadvertently pulled against the slot edge. Edge material may be provided locally as Richco Plastics Co. Channel/edge protector part No. CH20-141.

## References

For more information related to the LGX<sup>®</sup> System, consult the following:

### Fiber Cable and Apparatus

- OFS Fiber Optic Products catalog, 2492C
- Optical Cable Entrance Facility Reference Guide, 636-299-113

### Bay Frame Application

- Bay Frame Application, Planning, Engineering and Ordering Guide, 065-215-200
- ED-8C503-50 Switching Application Outlets and Connections
- ED-8C505-50 Miscellaneous Attachment Hardware
- ED-8C508-50 Common Systems Method of Grounding Network Bay Frame
- ED-8C509-50 Base Assemblies and AC Service Provisioning
- ED-8C804-50 Bay Extenders
- ED-8C806-50 Guard Rail Adapters/Extenders
- ED-8C808-50 Wrist Strap
- ED-8C810-50 Bay Frame Functional Kits

### Related Common Systems

- **ED-8C120** Fiber Protection System
- Fiber Protection System, OFS Practice 636-299-130
- **ED-8C612** Cable Management System
- ED-4C685-72 Ladder-Type Cable Racking

## **LGX Instruction Sheet Documents**

---

The following list provides the instruction practices used most commonly with the *LGX* product line. Other instruction sheets are provided with each product.

636-299-104-1	<b>LGX</b> Distributing Frame Installation
636-299-104-2	Rear Duct Door Installation
636-299-104-3	End Guard Installation, Group 4, Group 8
636-299-104-4	<b>LGX</b> Frame Method of Cabling
636-299-103-5	LST1U-072/7 Fiber Optic Shelf Installation
636-299-103-7	LSC1U-072/12 Combination Shelf Installation
636-299-103-8	LSC1U-144/21 Combination Shelf Installation
636-299-103-11	LSS1U-072/5 Splice Shelf Installation
636-299-103-12	LSS1U-144/7 Splice Shelf Installation
636-299-103-14	LSJ1U-072/5 Fiber Optic Jumper Storage Shelf Installation
636-299-103-15	LT1A Splice Organizer Installation
636-299-103-17	81A Shield Installation
636-299-103-18	82A Shield Installation
636-299-103-19	LST1F-072/7 Front Access Shelf Installation
636-299-103-22	LSC2U-024/5 Fiber Optic Combination Shelf Installation
636-299-103-46	LCM Module Installation
636-299-103-38	FEX1A Frame Extension Kit Installation
636-299-103-25	Pivoting Termination/Slack Storage Shelf Installation
636-299-121-1	24-in Fiber Distributing Frame Bay Installation
636-299-121-2	24-in Electronic Equipment Bay Installation
636-299-121-3	24-in End Guard Installation

## Glossary

---

### A

#### Administration

Functions performed by operations personnel to accurately maintain records and identification of telecommunication fiber optic cable facilities, equipment and related circuits.

#### Alternate Splice Area (ASA)

Typically an area in a Wire Center used for splicing Outside Plant (OSP) fiber optic cables to in-building fiber optic cables. This may be a position outside the Cable Entrance Facility (CEF) such as on the first floor or a chamber adjacent to the CEF, or it could be a area of the CEF cleared for growth and dedicated to fiber optic splicing.

#### Alternating Bay Layout

An equipment arrangement where a bay of outside plant facility cable terminations is located immediately adjacent to a bay of equipment fiber terminations.

#### Assignment

The administrative or operations process of determining the termination and connecting locations for outside plant fibers and transmission equipment connections. Also, the selection of facilities and equipment terminations to complete an optical fiber circuit or service. Where a fiber distributing frame is utilized, the process of identifying a circuit and cross-connect jumper to complete the service connection. Also the process whereby fibers are allocated to a fiber test equipment connection.

#### Attenuation

The decrease in average optical signal power after transmission from one point to another. Attenuation is usually expressed in decibels (dB), ten times the base ten log of the ratio of near-end (incident) power to far-end (transmitted) power.

#### Auxiliary Equipment

Maintenance equipment mounted on the Digital Signal Cross-Connect (DSX) that provides functions other than cross-connecting DS1 or DS1C circuits, such as communications panels, Quasi-Random Signal Sources, fuse and alarm panels, fault locate and order wire circuits, etc.

#### Auxiliary AC Power

Typically AC 110 V supply of power to equipment area for operation of some equipment such as computer equipment but primarily used for appliance outlets for portable test equipment. Also used to operate aisle lighting.

#### AWG

American Wire Gauge

---

### B

#### Backbone Subsystem

The backbone subsystem is the main feeder cable running from the cable entrance point to the distribution frame near the equipment area.

#### Biconic Connector

Optical connector with a conical shape for highly repeatable optical connections.

#### Buffered Fiber

A fiber with a plastic coating that acts as a buffer to strengthen the fiber.

#### Building Cable

Term used to describe in-building plant cable as opposed to OSP cable. Building cable typically will not protect the transmission media from moisture and other environmental factors found in the outside plant. Building cables are constructed from nonflammable grade materials.

---

C

**Cable Access Fireproofing**

Procedure and materials required to apply fire stopping to openings where cables pass between floors or walls. Fire stopping standards are followed with these procedures.

**Cable Duct**

A single pipe, tube, or conduit.

**Cable Entrance Conduits**

The cable entrance conduits are typically holes in the Wire Center foundation where cable conduits enter the Cable Entrance Facility.

**Cable Entrance Facility (CEF)**

Primary entrance point for cables into the building, typically where conduits from the street end. The CEF usually has a framing structure for the organization of splices and cables.

**Cable Management System**

A total cable pathway system from point-to-point within the Wire Center designed so that cable placement will be clear and growth will be easy to accomplish. As in OFS Cable Management System, this system may integrate a means of segregating and protecting fiber and a means to integrate AC power and aisle lighting.

**Central Office Ground Bus**

A ground bar that is connected into the Central Office Ground System to provide for multiple connections on a particular floor.

**Central Office Ground System**

A system of ground cables and connections that brings all metallic points within the office to the same ground potential.

**Central Office Terminal (COT)**

Equipment used for multiplex/demultiplex and analog/digital conversion functions at the central office end of the loop T-carrier circuit. The COT may be provisioned to provide line-powering (that is, interface directly with loop T-carrier) or to interface with a DS1 signal at the DSX.

**Central Office (CO)**

A telephone company building typically housing a switching system and other transmission equipment. Also known as Exchange Center or Wire Center.

**Churn**

The connection, disconnection, and rearrangement activity of cross-connections at a frame.

**Closure**

A facility used for storing and environmentally sealing fiber splices — typically placed in a cable entrance facility or in the outside plant environment.

**Communication Panel**

A piece of auxiliary communication equipment that provides various voice communication circuits that are used in system maintenance operations. The panel may provide access to an order wire which provides maintenance communications between the central office and any repeater location along the span.

**Connecting Block/Panel**

The basic component of a distribution frame that typically holds an array of connectors that allow repeatable connections. These blocks provide the functionality for simple interconnection.

**Cross-Connect**

A service connection method where fibers are terminated on the FDF and then connected with a short length of fiber jumper cable.

---

D

**Decibel (dB)**

**A logarithmic unit of power ratios.**

**Digital Loop Carrier**

A carrier system used for pair gain in loop applications.

**Digital Multiplexers (MUX)**

Equipment that provides an interface between different bit rates in the digital network. Multiplexers combine a number of individual channels into a common bit stream for transmission. Multiplexers also do demultiplexing.

**Distribution Frame**

Generally describing the fiber distribution frame.

**Distribution Frame Subsystem**

An important component in structured cabling system useful for terminating and distributing cables to equipment.

**Distribution System**

A system of cables, connectors, distribution frames, and other components such as cable racks used to provide interconnection throughout a facility.

**Duplex Cord**

A patch cord that connects both directions of transmission simultaneously.

**D4 Connector**

An optical connector sometimes specified for Wire Center applications.

---

**E**

**Equipment Cabling Subsystem**

Part of the cabling structure typically between the distribution frame and the equipment.

**Equipment Frame**

A structural frame such as the Lucent Network Bay Frame used to construct a Fiber Distribution Frame or OpCenter Bay Frame.

**Error Detection**

Checking a signal for line-code violations, such as bipolar violations.

**Error rate**

The frequency of errors detected in a DS line, usually expressed as a decimal.

**Exchange Center or Office**

A local telephone exchange building where switching systems are located. Also Central Office or Wire Center.

**Express Trough**

A wire way, typically placed near the top and/or bottom of a bay, that allows jumpers to be routed past the bay. Also see raceway.

---

**F**

**Facility**

A transmission circuit between two central offices, or between a central office and a remote terminal.

**Fanout**

A module or device utilized for converting a multifiber ribbon cable construction into 12 individual fibers with connectors.

**FC Connector**

A threaded optical connector sometimes found in the Wire Center.

**Fiber Building Cable**

A nonflammable cable containing one or multiple fibers. See also Building Cable.

**Fiber Distributing Frame (FDF)**

The fiber distributing frame consists of an equipment frame arrangement for terminating optical equipment and outside plant fibers. Individual fibers are terminated on optical connectors/couplings on shelves mounted into Fiber Distributing Frame bays. A cross-connect and/or interconnect jumper is used to connect fiber optic equipment terminations and outside plant cable terminations at the FDF.

**Fiber Growth Enhancement**

Process of planning and engineering a significantly improved fiber distribution network for the Wire Center including: nonflammable cables, Fiber Distribution Frame, Fiber Protection System, etc.

**Fiber Optic Transmission System (FOTS)**

An optical transmission system consisting of optical terminal equipment at both ends of a fiber optic path. Typical FOTS systems transmit optical signals in digital Optical Carrier (OC) standard formats from OC1 (51.84 Mb/s) to OC48 (2.5 Gb/s) and higher.

**Fiber Protection System (FPS)**

A system of ducts and supports for organizing and protecting fiber building cables and individual fiber interconnection cables. Typically includes radius guides and transition pieces to ensure fiber minimum bend radius criteria.

**Fiber-In-The-Loop**

Deployment of fiber optic feeder and distribution facilities.

**Fire Stopping Material**

Nonflammable material specifically designed to block cable holes and ducts, thereby limiting the propagation of a fire.

**Fusion Splice**

A splice method that joins ends through fusing the two glass surfaces together.

---

**G**

**Grounding**

Process of providing a low-resistance path for electrical signals to earth potential.

---

**I**

**Incremental Growth**

Ability to increase the termination capacity of an installation in an incremental fashion.

**InFoBank™ System Services**

A set of programs accessible to planners and engineers for use in keeping mechanized records for the Wire Center. Programs access data bases on the BDFB, *LGX*, DSX, MDF, Power records and schematics.

**Interconnect**

A service configuration where fibers are connected by using a length of cable connecting two bays not necessarily in the same lineup.

---

**J**

**Jumper**

A manually placed wire, cable, or fiber connection between two terminations, usually on some form of distributing frame. The connection may be single or multiconductor. A jumper is also called a cross-connection.

**Jumper Selection and Routing System (JSRS)**

A software tool incorporated in the FAS system that aids in the selection of the appropriate jumper and specification of instructions for jumper placement on the FDF.

---

**L**

**LGX® Fiber Distributing Frame**

*LGX* is a trademark of OFS. The *LGX* Fiber Distributing Frame consists of an equipment frame equipped with panels of optical connectors. The *LGX* provides for cross-connecting and/or interconnecting fiber optic cables. Fibers are typically terminated on the rear, thus allowing front access for testing and cross-connecting.

**Lightguide Cable Interconnection Equipment (LCIE)**

Previous generation of fiber terminating equipment which provided interconnection to equipment.

**Line Buildout (LBO)**

An attenuator inserted into the signal path to ensure that the received power level is within the manufacturers' specification.

**Long Jumper**

A cross-connect that runs between two separate bays that are not adjacent. Long jumpers are run in the upper or lower express troughs on most distribution frames.

---

**M**

**Maintenance Equipment**

Auxiliary equipment used for testing and maintaining optical services.

**Mechanical Splice**

A splice method where two fibers are joined using mechanical receptacles.

**Mechanized Assignment and Record System (MARS)**

OFS service offering allowing access to mechanized records for a variety of Wire Center cabled systems.

**Mechanized Records**

A set of service offerings that provide mechanized data base records of Wire Center equipment and cabling infrastructure. This primarily includes the MARS or InfoBank System Services.

**Multiple Bay Arrangement**

A lineup of multiple FDF bay frames.

**Multiplexer**

A digital or analog transmission equipment system that combines or separates several signals typically with optical interface.

---

**N**

**Network**

A system of elements connected by links, that is, telecommunication network.

**Network Bay Frame**

An unequal-flange type of frame providing more mounting space than previous generations of frames.

**Network Elements**

Key electronic or optical equipment placed in the network such as switching or transmission equipment.

---

**O**

**Operations, Administration, Maintenance, and Provisioning (OAM&P)**

Common industry term given to the functions performed in support of the telecommunications network.

**Optical Cable Entrance Facility (OCEF)**

An area providing space for splicing fibers connecting equipment to outside plant. Physically, the area is a splice cabinet such as OFS OCEF cabinet.

**Outside Plant (OSP) Cables**

OSP cables are typically used outside of the Wire Center but also may be routed into the cable entrance. Since OSP cables are flammable, the distance of penetration into the building is limited.

---

**P**

**Panel**

A panel is a modular unit used on a distributing frame or equipment frame to hold connectors or blocks; examples include Fiber Patch Panels and Communication Panels. When these panels are mounted on frames, they are often referred to as “shelves.”

**Patch Cord**

A short cable typically utilized at a cross-connect for testing or for maintenance patching (redirecting signals).

**Pathways**

A clearly defined raceway or trough for routing cables or cross-connect jumpers.

---

**R**

**Raceways**

A component of the *LGX* FDF used to hold jumpers routed horizontally between bays.

**Remote Site**

A usually unattended equipment location, away from the CO or central maintenance center.

**Remote Terminal**

Equipment that provides multiplex/demultiplex and analog/digital conversion for loop carrier systems, located at the subscriber end of the loop T-carrier circuit.

**Retrofit**

A procedure for installing a new piece of equipment. For instance, an *LGX* frame can be retrofitted into a Wire Center that currently has older LCIE technology.

**Riser**

A cable typically used in vertical cabling runs between floors.

---

**S**

**SC Connector**

A high-performance push-pull type optical connector.

**Short Jumper**

A cross-connect entirely contained within a single bay. Or run between two adjacent bays. Short jumpers do not require use of an express trough.

**Single Bay FDF**

A single bay of shelves that comprises the entirety of the FDF including OSP terminations and FOTS equipment terminations.

**ST<sup>®</sup> Connector**

ST<sup>®</sup> is a trademark of OFS and a high performance bayonet type optical connector.

---

**T**

**Tie Circuit**

Typical cable and jumpers used to connect circuits with terminations on separate frames or lineups.

---

**U**

**Ultimate Capacity**

The amount of framework required in an installation to accommodate the projected ultimate capacity of a given Wire Center.

---

**V**

**Vertical Trough**

A jumper pathway that is provided between adjacent bays or modules in a frame, allowing jumpers to run vertically on the frame from one panel location to another or between a panel and the upper or lower express trough.

---

**W**

**Wire Center**

A building where all local subscriber facilities converge for service by switching systems. Also Office or Exchange Center.

**Wire Center Modernization**

The process whereby projects are undertaken to modernize various aspects of the Wire Center; that is, switch replacement, upgrade to SONET transmission, upgrade of cable distribution infrastructure.

## Index

---

### A

AC  
Base Appliance Outlet, 9-28  
End Guard Outlet, 5-23  
Lighting Switch, 5-23  
Routing Through End Guard, 9-29

Alternating Bay Lineup, 9-2  
Anchor Bolts, 5-31, 15-2  
Applications,  
Central Office, 10-1  
CATV, 11-1  
Data Cabinet, 13-7  
Outside Plant, 12-1  
Premises Distribution, 13-1  
Retrofit, 14-1  
Wall mount, 13-11

Attenuation, 16-36

---

### B

Bay Arrangement, 9-2  
Bay Numbering, 9-19  
Biconic Connector Panel, 3-5  
Blank Connector Panel, 3-7, 3-11  
Bottom Cable Entry, 9-24, 15-14  
Breakout Cable, 15-8  
Building Cable, 15-8  
Building Entrance Terminal, 13-3

---

### C

Cable Access for Bottom Entry, 9-24, 15-14  
Cable Brackets and Retainers, 5-30  
Cable Clamp, 4-9  
Cable Shield, 4-13  
Cable Management System, 6-15, 9-20  
Cable-Type Conversion, 13-4  
Cabling  
Bottom Entry, 9-24, 15-14  
Overhead, 9-22, 15-10  
Retrofit, 14-3  
Structured Plan, 9-20  
Care for Connectors and Jumpers, 16-6  
Central Office Planning, 10-1  
Circuit Attenuation, 16-36  
Circuit Record, 16-36

Clamp  
12A1, 4-9  
12A2, 4-10

Communications Panel, 6-6  
Connector Panel  
1000-type, 3-2  
1200-type, 3-9

Coordinate System, 9-16  
Cross-Aisle Bridge, 5-33  
Cross-Connect, 1-7

---

### D

Data Cabinet, 13-7  
Direct Termination, 8-4

---

### E

End Guard, 5-22  
End Guard Extenders, 5-24  
Engineering, 9-1  
Equipment Layout, 9-10, 9-15

---

### F

Fanouts,  
Modular, 3-16  
Mini-type, 3-17  
FC Connector Panel, 3-6  
Fiber Distributing Frame, 1-2  
Fiber Distribution Shelves, 2-2  
Fiber Jumper Management, 1-3, 16-1  
Fiber Management  
Removing a Jumper, 16-36  
Slack Elimination, 16-7  
Slack Management, 16-7  
Slack Storage, 16-7  
Fiber Protection System, 6-13  
Field Terminated Jumpers, 16-8  
Filler Panel, 5-32  
Floor Attachment  
Hardware, 5-31  
Method, 15-2

Floor Space Planning, 8-10 – 8-16  
Forecast, 8-3  
Frame Capacity, 8-8  
Functions, 1-7

---

### G

Groups, Network Bay, 5-9  
Groups, Seismic, 5-11

---

Groups, **LGX**, 5-13

---

## **H**

High Density, 2-5, 8-5  
Horizontal raceways, 5-29

---

## **I**

Install Retrofit Cabling, 14-3  
Installation, 15-1  
Interconnect, 1-7, 16-34

---

## **J**

Jumpers (Patch Cords), 7-1  
Jumper Retainers, 5-26  
Jumper Selection and Routing System, 16-2

---

## **L**

Labels, 4-17, 5-28  
Labeling, 15-7  
LC Connector Panels  
1000-type, 3-4  
1200-type, 3-10  
LCM Modules, 3-12  
**LGX FDF**  
Bay Frame, 5-4  
Broadband, 5-18  
Cabling, 15-10  
Capacity,  
Description, 1-2  
End Guard, 5-23  
End Guard Extensions, 5-24  
Framework Groups, 5-13  
Horizontal Raceways, 5-29  
Jumper Retainers, 5-26  
Jumper Support Software, 10-11, 16-2  
Maintenance, 16-38  
OSP Cable Placement, 15-12  
Planning Recommendations, 8-1  
Rear Door, 5-22  
Rear Duct, 5-16  
Rear Duct Extension, 5-17  
Retrofit, 14-1  
Securing Frame to Floor, 15-2  
Shelf Cabling, 15-15  
Lighting, 9-22  
Locks, 4-14  
**LGX Shelves**, 2-1

---

LT1A-F/F Splice Organizer, 4-4  
LT1A-M/M Splice organizer, 4-3  
LT2A-MF/MF Mass Fusion Organizer, 4-5

---

## **M**

Maintenance Equipment, 8-5  
Mass Fusion Splice Holder, 4-8  
Maximum Lineup Size, 8-7  
Mechanical Splice Holder, 4-6  
Multiple Bay Arrangement, 9-2

---

## **N**

Network Bay Frame,  
Bay Frame, 5-9  
Floor Attachment, 5-31, 15-2  
Seismic, 5-11

---

## **O**

Optical Cable Entrance Facility (OCEF), 6-8  
OCEF Splicing, 15-18  
Off-Frame Splicing, 15-18  
On-Frame, Splicing, 15-18  
OSP Applications, 12-1  
OSP Cabinets, 12-8  
Outside Plant Cables, 15-8  
Overhead Cable Access, 15-10, 9-22

---

## **P**

Pigtail Splice, 15-17  
Planning, 8-1  
Floor Space, 8-9  
Frame layout, 9-10  
Service Configuration, 8-3  
Sizing the FDF, 8-5  
Termination Forecast, 8-3  
Termination Methods, 8-4  
Preterminated Cables, 10-7  
Preterminated Modules, 3-12, 10-7  
Preterminated Shelves, 2-18, 10-7

---

## **R**

Raceways, 5-29  
Radius Guides, 4-21

---

Raised Floor, 9-24  
Rear Duct Extension, 5-17  
Remote Terminal Cabinets, 12-8  
Remote Terminal Frame  
Cabling Plan, 12-6  
High Density, 12-8  
Layout, 12-4  
Service Configuration, 12-3  
Sizing, 12-4  
Termination Methods, 12-3  
Removing a Jumper, 16-36  
Replacement Parts, 4-22  
Restoration, 16-38  
Retrofit Applications, 14-1  
Routing Interconnect Jumpers, 16-34  
Routing Stock Jumpers, 16-22

---

Wall Mount Applications, 13-11  
WDM Modules, 3-23

---

## **S**

SC Connector Panel  
1000-type, 3-2  
1200-type, 3-8  
Security, 4-14  
Seismic Network Bay Frame, 5-11  
Service Configuration, 8-3  
Shelf Cabling, 5-15  
Shelf Label, 4-17, 15-7  
Shelf Numbering, 9-17  
Shelves, 2-1  
Single Bay Arrangement, 9-12  
Slack Management, 16-7  
Slack Storage Shelves, 2-14  
Splice Organizers, 4-2  
ST Connector Panel,  
1000-type, 3-3  
1200-type, 3-9  
Structured Cabling Plan, 9-20, 10-3

---

## **T**

Termination Methods, 8-4  
Termination Shelf, 2-2  
Typical Bay Arrangements, 9-2  
Typical Equipment Layouts, 9-10

---

## **U**

Upper Raceway, 5-29

---

## **W**