

LIGHTGUIDE INTERCONNECTION CABLES, BUILD-OUTS, AND CONNECTORS

DESCRIPTION AND USE

DIGITAL TRANSMISSION SYSTEMS

CONTENTS	PAGE	CONTENTS	PAGE
1. GENERAL	2	A. LS1A-A Lightguide Interconnection Cable	4
2. LIGHTGUIDE INTERCONNECTION CABLE	2	B. LS1T-N Lightguide Interconnection Cable	4
LA-TYPE LIGHTGUIDE INTERCONNECTION CABLE	3	C. LS4A-A Lightguide Interconnection Cable	4
A. LA1A-A Lightguide Interconnection Cable	3	LT-TYPE LIGHTGUIDE INTERCONNECTION CABLE	5
B. LA1T-N Lightguide Interconnection Cable	3	A. LT1A-A Lightguide Interconnection Cable	5
C. LA4A-A Lightguide Interconnection Cable	3	3. LIGHTGUIDE CONNECTORS	5
LB- AND LC-TYPE LIGHTGUIDE INTERCONNECTION CABLE	3	A. 1000A Lightguide Connector	5
A. LB1B-B Lightguide Interconnection Cable	3	B. 1000C Lightguide Connector	5
B. LB2B-B Lightguide Interconnection Cable	3	C. 1001A Lightguide Connector	6
C. LC1A-B Lightguide Interconnection Cable	4	D. 1001C Lightguide Connector	6
LL-TYPE LIGHTGUIDE INTERCONNECTION CABLE	4	E. 1002A Lightguide Connector	6
A. LL1A-A Lightguide Interconnection Cable	4	F. 1003A Lightguide Connector	6
B. LL4A-A Lightguide Interconnection Cable	4	G. 1005A Lightguide Connector	7
LS-TYPE LIGHTGUIDE INTERCONNECTION CABLE	4	H. 1006A Lightguide Connector	7
		I. 1007A Lightguide Connector	7
		J. 1011A Lightguide Connector	7
		K. 1012A Lightguide Connector	7

CONTENTS	PAGE
L. 1013A Lightguide Connector	8
4. LIGHTGUIDE BUILD-OUTS	8
LA1A-D CABLE-TYPE LIGHTGUIDE INTERCONNECTION BUILD-OUT	8
400(), 500(), AND 600() CABLE-TYPE LIGHTGUIDE BUILD-OUT	8
401, 501, AND 601 BARREL-TYPE LIGHTGUIDE BUILD-OUT	9
5. HANDLING AND CLEANING OF LIGHTGUIDE CONNECTORS	9
PROCEDURES IN MAKING AN OPTICAL CONNECTION	9
6. REFERENCES	9

1. GENERAL

1.01 This document describes the single-fiber and multiple-fiber lightguide interconnection cables, lightguide connectors, and lightguide build-outs used in lightwave transmission and loop systems. For each of these categories, a description of the available types and their coding, compatibility, and typical system applications is presented.

1.02 The specific reasons for reissuing this section are listed below. Equipment Test Lists are not affected.

- Include the description and illustration of the LA1T-N, LA4A-A, LB1B-B, LB2B-B, LC1A-B, LL1A-A, LL4A-A, LS1A-A, LS1T-N, LS4A-A, and LT1A-A lightguide interconnection cables
- Include LA- or LS-type interconnection cable applications in FT3/FT3C/FTX-180 lightwave transmission systems
- Include LL1A- and LL4A-type lightguide interconnection cable applications in loop plant lightwave systems

- Include description and illustration of 1000C, 1001C, 1005A, 1006A, 1007A, 1011A, 1012A, and 1013A-type lightguide interconnection cable connectors
- 1A and 1B fanouts are manufacture discontinued. All other 1-type fanouts are A and M status
- Include description and illustration of the 400(), 500(), or 600() cable-type lightguide build-out
- Include description and illustration of the 401(), 501(), or 601() barrel-type lightguide build-out
- Respecify LA1A-D lightguide interconnection cable as LA1A-D cable-type lightguide build-out and manufacture discontinued. Its usage is replaced by 400(), 500(), or 600() cable-type lightguide build-out.

In addition to the above specific changes, this practice has been completely reorganized and is considered a general revision. As a result, revision arrows are not used.

2. LIGHTGUIDE INTERCONNECTION CABLE

2.01 The single-fiber lightguide cable consists of a lightguide fiber surrounded by an inner and outer protective jacket with reinforcing yarns in between for tensile strength (Fig. 1). There are several types of single-fiber lightguide cables manufactured and factory cut to specified lengths on order. In addition to these single-fiber lightguide cables, there are multiple-fiber lightguide cables available. The shorter lengths of both single- and multiple-fiber lightguide cables are connectorized to become lightguide interconnection cables (Table A). All interconnection cables are identified by a serial number, date code, length, and cable type printed on the sheath at each end of the cable. Multifiber cables also have unit numbers on each single-fiber cable.

2.02 Lightguide interconnection cables are used between lightguide cable interconnection units (equipment) (LCIE, LSCIE with interconnect panels, or equivalent) or wavelength division multiplex (WDM) filter assembly and the lightwave transmission equipment in central offices or line repeater stations. One of their advantages enables rearrange-

ment of optical circuit paths. The LB-type interconnection cables are used as optical data links in electronic switching equipment.

2.03 When installed on frameworks or cable racks, single-fiber cables should not be stored or secured in place with a bending radius of less than 3.81 cm (1.5 inches). Quad-fiber cables should not be stored or secured with a bending radius less than 10.16 cm (4 inches). Short-term bending to a radius less than 3.81 cm (1.5 inches) or 10.16 cm (4 inches) during handling or installation is not detrimental, but pulling the cable tight over sharp corners or over right-angle bends should be avoided. Tight lacing of singles, duplex, or bundles of singles to frame or equipment support members will induce microbending losses in the glass fibers. It is recommended that loose cable ties be used or that reasonable care be exercised when lacing so that impressions are not formed in the cables.

LA-TYPE LIGHTGUIDE INTERCONNECTION CABLE

A. LA1A-A Lightguide Interconnection Cable

2.04 The LA1A-A lightguide interconnection cable (Fig. 2) consists of a specified length of 1800A lightguide cable terminated at each end by conical connector plugs (Fig. 3). These are molded directly onto the fiber. After molding, the plugs are fitted with a threaded, spring-loaded connector cap (Fig. 4) which has a nominal spring force of four pounds. These connectors have a maximum diameter of 1.27 cm (0.5 inches) and are designed to be used with the 1000A, 1001A, 1002A, or 1003A lightguide connectors. They also can be used with the 1000C and 1001C lightguide connectors when the connectors are equipped with the 401(), 501(), or 601() barrel-type lightguide build-outs. The plugs and threads of a connector are protected when not in use by a soft plastic protective cap.

2.05 The LA1A-A lightguide interconnection cable is used in FT3, FT3C, and FTX-180 Lightwave Digital Transmission Systems. One end of the LA1A-A connects to the LCIE or LSCIE with interconnect panel (Fig. 5), or WDM filter assembly. Refer to AT&T practices 365-302-101 for more information on the LCIE, 365-302-103 for the LSCIE, or equivalent, or 365-560-114 for the WDM assembly. The other end of the LA1A-A lightguide interconnection cable connects to an MX3 lightwave terminating multiplex assembly (LTMA), an MX3 or MX3C lightwave

terminating frame (LTF), an FT3/FT3C/FTX-180 line repeater bay (LRB), an FT3C-SX lightwave span terminating frame (FT3C-SX), or a WDM filter shelf assembly. FTX-180 applies to MX3C LTF and FT3C-SX upgraded equipment configuration.

B. LA1T-N Lightguide Interconnection Cable

2.06 The LA1T-N lightguide interconnection cable (Fig. 7) consists of a specified length of multimode cable terminated at one end by a quick-clip connector plug and a threaded spring-loaded blue connector plug at the other end. The quick-clip connector enables repeated use connection to multimode or single mode fiber connectors. The LA1T-N cable is primarily used with the MULTIMODE OPTICAL LOSS TEST SET (OLTS) and single mode OLTS. When used on single mode fiber connections, it is used at the receive end of a fiber where the lightwave propagation is from single mode fiber to multimode fiber termination.

C. LA4A-A Lightguide Interconnection Cable

2.07 The LA4A-A quad-type lightguide interconnection cable (Fig. 6 and Table A) consists of four specified lengths of lightguide cable. Each cable is terminated at each end by the applicable conical connector plug molded onto the fiber. The four single-fiber cables are bound by a common sheath. This arrangement is preferred over individual single-fiber cables for installation ease.

LB- AND LC-TYPE LIGHTGUIDE INTERCONNECTION CABLE

A. LB1B-B Lightguide Interconnection Cable

2.08 The LB1B-B lightguide interconnection cable (Fig. 8) consists of a specified length of 1800B lightguide cable terminated at each end by 1005A lightguide connector plugs. The connector plugs are directly molded onto the fiber and have a maximum diameter of 1.12 cm (0.44 inches). The 1005A connector plug is designed to mate with the 1007A lightguide connector. The LB1B-B is used in electronic switching equipment as an optical data link.

B. LB2B-B Lightguide Interconnection Cable

2.09 The LB2B-B lightguide interconnection cable (Fig. 9) is a dual cable composed of two LB1B-B cables bound by a common sheath. The sys-

tem application of the LB2B-B lightguide interconnection cable is the same as the LB1B-B cable.

C. LC1A-B Lightguide Interconnection Cable

2.10 The LC1A-B lightguide connection cable (Fig. 10) is composed of a specified length of 1800B lightguide cable terminated at one end by a 1005A lightguide connector plug and terminated at the other end by a threaded, spring-loaded conical connector plug. Both connector plugs are directly molded onto the fiber. The 1005A lightguide connector plug has a maximum diameter of 1.12 cm (0.44 inch) and is designed to mate with the 1007A lightguide connector. The connector plug has a maximum diameter of 1.27 cm (0.5 inch) and is used with the 1000A, 1001A, 1002A, or 1003A lightguide connectors or with the 1000C or 1001C lightguide connectors when those connectors are equipped with the 401-, 501-, or 601-type lightguide build-out barrels. The connector plugs of the LC1A-B are protected when not in use by a plastic protective cap.

LL-TYPE LIGHTGUIDE INTERCONNECTION CABLE

A. LL1A-A Lightguide Interconnection Cable

2.11 The LL1A-A lightguide interconnection cable (Fig. 2) is similar to the LA1A-A cable except that it consists of a specified length of 1860A lightguide cable. Each end of the LL1A-A lightguide cable is terminated by a conical spring-loaded connector plug. Each plug is protected when not in use by a soft plastic protective cap. The LL1A-A interconnection cable can connect with 1000A, 1001A, 1002A, or 1003A lightguide connectors or with the 1000C or 1001C lightguide connectors when these connectors are equipped with the 401-, 501-, or 601-type lightguide build-out barrels.

2.12 The LL1A-A lightguide interconnection cable is used in loop plant lightguide systems. It is used to interconnect loop plant lightwave transmission terminals with the LCIE or lightguide cable interconnection terminal (LCIT), or equivalent. Refer to AT&T practice 363-202-101 for LL1A-type lightguide cable applications.

B. LL4A-A Lightguide Interconnection Cable

2.13 The LL4A-A lightguide interconnection cable (Fig. 6) is a quad cable made of four LL1A-A cables bound by a common sheath as described in

paragraph 2.07 for the LA4A-A cable. The system application of the LL4A-A cable is the same as the LL1A-A cable in paragraph 2.12.

LS-TYPE LIGHTGUIDE INTERCONNECTION CABLE

A. LS1A-A Lightguide Interconnection Cable

2.14 The LS1A-A lightguide interconnection cable (Fig. 2) is similar to the LA1A-A cable except that it consists of a specified length of single-mode 2000A lightguide cable. Each end of the LS1A-A lightguide cable is terminated by a conical spring-loaded connector plug. The plug threads of each connector are protected when not in use by a soft plastic protective cap. The LS1A-A lightguide interconnection cable provides low loss single mode lightguide fiber connections when interconnected with 1011A, 1012A, and 1013A lightguide connectors, or with 1000C or 1001C lightguide connectors equipped with 601() barrel-type lightguide build-outs.

2.15 The LS1A-A lightguide interconnection cable is used in the transmit fiber paths in single mode FT3, FT3C, or FTX-180 applications. One end of the LS1A-A connects to the LSCIE with interconnect panel (Fig. 5), or equivalent. The other end of the LS1A-A interconnection cable would connect to an FT3/FT3C/FTX-180, LRB, or MX3 LTF, MX3C LTF, FTX-180 (LTF), or FTX-180 (SX).

B. LS1T-N Lightguide Interconnection Cable

2.16 The LS1T-N lightguide interconnection cable (Fig. 7) consists of a specified length of single mode cable terminated at one end by a quick-clip connector plug and a threaded spring-loaded blue connector plug at the other end. The quick-clip connector enables repeated use connection to single mode facility fiber connectors. The LS1T-N cable is primarily used with the single mode OLTS. The blue connector plug of the LS1T-N cable is normally connected to the transmit connector on the single mode OLTS.

C. LS4A-A Lightguide Interconnection Cable

2.17 The LS4A-A quad-type lightguide interconnection cable (Fig. 6 and Table A) consists of four specified lengths of lightguide cable. There are two 1800A multimode fibers (orange) and two 2000A single mode (yellow) fiber cables. Each cable is terminated at each end by a conical connector plug molded directly onto each fiber. This quad cable is

equivalent to two LA1A-A and two LS1A-A cables bound by a common sheath.

2.18 The system applications of LS4A-A cables is single mode FT3/FT3C/FTX-180 central office or line repeater station installations where the LSCIE or equivalent has an interconnect panel. In this case, the LS4A-A cables are preferred instead of individual LA1A-A and LS1A-A cables because of ease in installation.

LT-TYPE LIGHTGUIDE INTERCONNECTION CABLE

A. LT1A-A Lightguide Interconnection Cable

2.19 The LT1A-A lightguide interconnection cable (Fig. 2) consists of a specified length of multimode cable terminated on each end by a threaded spring-loaded blue connector. The LT1A-A cable is primarily used in the multimode OLTS. It can be used on single-mode systems at the receive end of a fiber where the lightwave propagation is from single-mode to multimode termination.

3. LIGHTGUIDE CONNECTORS

A. 1000A Lightguide Connector

3.01 The 1000A lightguide connector (Fig. 11 and 12) is a panel-mounted "6-pack" connector. It provides six optical connections between multimode lightguide cables or cable-type lightguide build-outs terminated with a threaded, spring-loaded conical connector plug. These multimode lightguide cables may be LA-type or LL-type interconnection cables, WDM pigtail cables, LA1A-D, 400(), or 500() cable-type lightguide build-outs. (A WDM pigtail cable is an LA1A-A cable without a connector plug at the WDM filter assembly.) The 1000A connector has a mounting flange and is panel mounted with two screws. Adjacent to the six connector ports is an identification strip which can be removed and labeled with circuit identification according to user needs. The connector consists of a molded polycarbonate housing, six molded polycarbonate retaining rings, six precision molded alignment sleeves, and a molded plexiglass retaining card. The individual connector ports are protected by soft plastic protective caps when not in use. ***Always connect the internal smooth connector-end first to insure proper alignment of the conical connector plugs.***

3.02 The 1000A lightguide connectors are used in the ED-8C001-50 LCIE and in the ED-8C0004-50 LCIT. In lightguide trunking systems the 1000A provides an interface between 1-type lightguide cable fanouts and LA-type or WDM pigtail cables. For this LCIE version, 1A, 1B, 1C, or 1D lightguide cable fanouts connect on one side, and LA-type cables from MX3 LTMA, FT3 LSTA, MX3 LTF, MX3C LTF, FT3/FT3C/FTX-180 LRB, FT3C-SX, or WDM pigtails from a WDM filter assembly on the other side. For this LCIT version, 1A and 1C lightguide cable fanouts connect to one side and LA-type cables from the equipment above connect to the other side. In loop carrier systems, the 1000A lightguide connectors on the LCIT version have 1E or 1J fanouts on one side and LL-type cables on the other side from an optical line interface unit. The 1A and 1B fanouts are manufacture discontinued. The 1C and 1D are rated A and M.

B. 1000C Lightguide Connector

3.03 The 1000C lightguide connector (Fig. 13) is a panel-mounted "6-pack" connector that, when equipped with barrel-type lightguide build-outs, provides six optical connections for multimode or single mode lightguide cables or cable-type lightguide build-outs terminated with threaded, spring-loaded connector plugs. The 1000C connector has a mounting flange and is panel mounted with two screws. The 1000C lightguide connector may be mounted on panels designed to accept the 1000A connector. There is a horizontal identification strip at the top and bottom of the face of the 1000C lightguide connector and a vertical identification strip adjacent to the six connector ports. These identification strips can be removed and labeled with circuit identification according to user needs. The 1000C connector consists of a molded polycarbonate housing, two plexiglass card windows for the horizontal identification strips, and one molded plexiglass retaining card for the vertical identification strip. The individual connector ports are protected by soft plastic protective caps when not in use.

3.04 The 1000C lightguide connector is mounted on the face of the 3-type lightguide ribbon fanout (Fig. 14) used in the ED-8C005-50 LCIT, ED-8C006-50 LCIE, and ED-8C010-50 LCIM. Six single fibers of the lightguide ribbon are fanned out and internally connected by the manufacturer to each rear connector port of the 1000C connector. The rear of the 1000C connector when mounted on the 3-type fanout is not

normally accessible. When equipped with the barrel-type lightguide build-outs, the 1000C connector provides connection sites between the single fibers of the fanned out lightguide ribbon and the LA-, LL-, or LS-type lightguide interconnection cables or WDM pigtail cables. The 1000C connector is also mounted in the LSCIE, LSCIT, and LSCIM. They are also used on 2-type WDM filter packs of a WDM filter assembly.

C. 1001A Lightguide Connector

3.05 The 1001A lightguide connector (Fig. 15) is a panel-mounted connector that provides an optical connection between LA-type lightguide interconnection cable and a printed wiring board mounted connector plug on the multimode 8-type and 11-type regenerators, or receive connector plug on single mode 8-type or 11-type regenerators. The connector consists of a molded polycarbonate housing, a molded polycarbonate retaining ring, and a precision-molded epoxy alignment sleeve. The overall length of the polycarbonate housing is 2.74 cm (1.08 inches) and it has a 2.86-cm (1.125-inch) diameter mounting flange. The housing is panel-mounted with two shoulder-type screws that allows it to float .203 cm (0.08 inches) vertically and .076 cm (0.03 inches) horizontally to aid in seating the 8-type or 11-type regenerator. The nominal insertion force per connector is four pounds. ***Always connect the smooth inner-surface connector end first to insure proper alignment of the conical connector plugs.***

3.06 The 1001A is mounted on the backplane panel for regenerator slots of the FT3/FT3C LRB, MX3 LTMA, MX3 or MX3C LTF, and the FT3C-SX. The connector is mounted on the rear of the bay with smooth end extending through the panel to the front (plug-in) side of the bay. This enables screw-in connection of lightguide interconnection cables at the rear of the bay. When the 1001A is not in use, the exposed end(s) is protected with a soft plastic cap.

D. 1001C Lightguide Connector

3.07 The 1001C lightguide connector (Fig. 16) is a panel-mounted connector. When equipped with a 401(), 501(), or 601() barrel-type lightguide build-out, the 1001C connector provides an optical connection between an LA- or LS-type lightguide interconnection cable and a printed wiring board mounted connector plug on the 8-type, 11-type, and 14-type regenerators. The connector consists of a molded polycarbonate housing 1.73 cm (0.68 inches)

long having a 2.86 cm (1.125 inches) diameter mounting flange. The housing is panel-mounted with two shoulder-type screws that allow it to float .203 cm (0.08 inches) vertically and .076 cm (0.03 inches) horizontally to aid in seating the regenerator. When the 1001C is not in use, the exposed end(s) is protected with a soft plastic cap.

3.08 The 1001C lightguide connector is mounted on the backplane panel for regenerator slots of the FT3/FT3C/FTX-180 LRB, MX3 LTMA, FT3 LSTA, MX3 or MX3C LTF, FT3C-SX, or FTX-180 equipment configuration. The 1001C lightguide connector is mounted on the rear of the backplane for FT3, FT3C, and FTX-180 regenerator slots. The nonthreaded internal surface end of the connector is on the plug-in side of the bay. This enables screw-in connection of the LS- or LA-type lightguide cables at the rear of the bay. ***After equipping the 1000C connectors with the appropriate barrel-type lightguide build-out, always connect a lightguide cable to the build-out screw-in end first (regenerator or 38B extender unseated) to insure proper alignment of the conical connector plugs.***

E. 1002A Lightguide Connector

3.09 The 1002A lightguide connector (Fig. 17) provides an optical connection between two terminations of LA- or LL-type lightguide interconnection cables. The connector consists of a molded polycarbonate housing, a molded polycarbonate retaining ring, and a precision-molded epoxy alignment sleeve. The polycarbonate housing is 1.27 cm (0.5 inches) in diameter and 3.12 cm (1.23 inches) long. No provision for mounting is provided. ***Always connect the side of the 1002A connector with the smooth outer-surface first to insure proper alignment of the conical connector plugs.***

F. 1003A Lightguide Connector

3.10 The 1003A lightguide connector (Fig. 18 and 19) is a panel-mounted connector that provides an optical connection between two terminations of LA-type or LL-type lightguide interconnection cables. The connector consists of a molded polycarbonate housing, a molded polycarbonate retaining ring, and a precision-molded epoxy alignment sleeve. The overall length of the polycarbonate housing is 3.12 cm (1.23 inches) and it

has a 2.86-cm (1.125-inch) mounting flange. The flange has two elongated holes for panel mounting which allows the connector to float.

3.11 The 1003A lightguide connector is used in manufacture on the 190A optical loss test set (manufacture discontinued), the multimode optical time domain reflectometer, KS-22820 multimode OLTS, and single mode OLTS. It is also used on the 38A and receive side of the 38B extender boards.

G. 1005A Lightguide Connector

3.12 The 1005A lightguide connector plug (Fig. 20) is a threaded, spring-loaded, field-mountable connector plug designed to terminate 1800B single-fiber lightguide cable. It consists of a connector plug, a spring, spring retainers, and an internally threaded fastener cap. The 1005A connector is designed to mate with the 1007A lightguide connector (Fig. 22).

H. 1006A Lightguide Connector

3.13 The 1006A lightguide connector (Fig. 21) is a threaded, spring-loaded, field-mountable connector designed to terminate 1800A single-fiber lightguide cable. It consists of a connector plug, a spring, spring retainers, and an externally threaded fastener cap. The 1006A connector can mate with a 1000A through 1003A or a 1011A, 1012A, or 1013A lightguide connector. The 1006A connector can also mate with a 1000C or 1001C lightguide connector equipped with a barrel-type lightguide build-out.

I. 1007A Lightguide Connector

3.14 The 1007A lightguide connector (Fig. 22) is a panel-mounted connector that provides an optical connection between two LB1B-B lightguide interconnection cables. The connector consists of an externally threaded, molded polycarbonate housing, a polycarbonate retaining ring, and a precision-molded alignment sleeve. The overall length of the polycarbonate housing is 1.09 cm (0.43 inches) and it has a 2.22 cm (0.875-inch) mounting flange. The flange has two elongated holes for panel mounting. The 1007A lightguide connector is used in manufacture on the 1250A lightwave transmitter and the 1350A lightwave receiver to provide optical data links for switching equipment.

J. 1011A Lightguide Connector

3.15 The 1011A lightguide connector (Fig. 15) is a panel-mounted connector that provides an optical connection between a lightguide interconnection cable and a printed wiring board mounted connector plug on a regenerator. The 1011A lightguide connector is similar to the 1001A connector. Although the 1011A lightguide connector is intended for interconnection of LS-type cable, it can be used to connect a single-mode LS-type cable to a multimode LA-type cable only when lightwave propagation is from the single-mode to the multimode fiber (receive end of optical path). The 1011A connector consists of a molded yellow polycarbonate housing, a molded polycarbonate retaining ring, and a precision-molded epoxy alignment sleeve. The overall length of the polycarbonate housing is 2.74 cm (1.08 inches) and it has a 2.86-cm (1.125-inch) diameter mounting flange. The housing is panel-mounted with two screws that allow it to float .203 cm (0.08 inches) vertically and .076 cm (0.03 inches) horizontally to aid in seating the 8-type or 11-type regenerator. The nominal insertion force per connector is four pounds. ***Always connect the smooth inner-surface connector end first to insure proper alignment of the conical connector plugs.***

3.16 The 1011A is mounted on the backplane panel of the initial FT3 and FT3C single mode applications. Its usage is being superseded by the 1001C lightguide connector for later FT3 and FT3C single mode (and multimode) applications. The flange and screw-in end are mounted on the rear of the bay with the smooth end extending through the panel to the front (plug-in) side of the bay. This enables screw-in connection of lightguide interconnection cables. When the 1011A is not in use, the exposed end(s) is protected with a soft plastic cap.

K. 1012A Lightguide Connector

3.17 The 1012A lightguide connector (Fig. 17) provides an optical connector between two terminations of LS-type lightguide interconnection cable. The 1012A lightguide connector is similar to the 1002A connector. The 1012A connector consists of a yellow molded polycarbonate housing, a molded polycarbonate retaining ring, and a precision-molded epoxy alignment sleeve. The polycarbonate housing is 1.27 cm (0.5 inches) in diameter and 3.12 cm (1.23 inches) long. No provision for mounting is provided. Although the 1012A lightguide connector is intended

for interconnection of LS-type cables, it can be used to connect single-mode LS-type cables to multimode LA-type cables only when lightwave propagation is from the single mode to the multimode fiber (receive end of optical path). ***Always connect the side of the connector with the smooth outer-surface first to insure proper alignment of the conical connector plugs.***

L. 1013A Lightguide Connector

3.18 The 1013A lightguide connector (Fig. 18 and 19) is a panel-mounted connector that provides an optical connection between two terminations of LS-type lightguide interconnection cable. The 1013A lightguide connector is similar to the 1003A connector. The connector consists of a yellow molded polycarbonate housing, a molded polycarbonate retaining ring, and a precision-molded epoxy alignment sleeve. The overall length of the polycarbonate housing is 3.12 cm (1.23 inches) and it has a 2.86-cm (1.125-inch) mounting flange. The flange has two elongated holes for panel mounting. Although the 1013A lightguide connector is intended for interconnection of LS-type cables, it can be used to connect single mode LS-type cables to multimode LA-type cables only when lightwave propagation is from the single mode to the multimode fiber (receive end of optical path).

3.19 The 1013A lightguide connector is used on the transmit side of the single mode optical time reflectometer, single mode OLTS, and 38B extender board.

4. LIGHTGUIDE BUILD-OUTS

LA1A-D CABLE-TYPE LIGHTGUIDE INTERCONNECTION BUILD-OUT

4.01 The LA1A-D cable-type lightguide build-out (Fig. 23) consists of a specified length of 1800A lightguide interconnection cable terminated at each end by a conical connector plug molded directly onto the fiber. The connector plug on one end is modified by the attachment of a carbon-coated filter (Fig. 24) to give an insertion loss of 10 to 13 dB. A pink polycarbonate, threaded, spring-loaded fastener cap is used on this end. The nonfiltered end uses a black, threaded, spring-loaded fastener cap. The plugs and threads of the fasteners are protected when not in use by a soft black plastic protective cap.

4.02 The modified end with the pink fastener cap is connected at the receive end of the optical path in the LCIE, LSCIE, or equivalent, or at the WDM filter assembly. The pink end should be connected at a 1000A lightguide connector or at a 1000C lightguide connector equipped with a 0 dB loss lightguide build-out shown in Table C to give the nominal insertion loss of 10 to 13 dB. The LA1A-D cable-type lightguide build-out is designed to be used with the 1000A through 1003A lightguide connectors and with the 1000C or 1001C connector equipped with the barrel-type lightguide build-out listed in Tables B or C as applicable.

4.03 The LA1A-D cable-type lightguide build-out was initially used to provide build-out optical attenuation in the FT3 and FT3C systems. They were installed in the receiver end of these systems. They were either used in place of LA1A-A cables to provide build-out optical attenuation or shorter lengths were interconnected with a 1002A lightguide connector to the LA1A-A cables to insert optical loss. The other types of lightguide build-outs listed in the following paragraphs are now preferred. The LA1A-D cable lightguide build-out is manufacture discontinued.

400(), 500(), AND 600() CABLE-TYPE LIGHTGUIDE BUILD-OUT

4.04 The 400(), 500(), or 600() cable-type lightguide build-out (Table B and Fig. 25) consists of a 26.7 to 41.9 cm (10.5 to 16.5 inch) length of 1800A lightguide interconnection cable terminated at one end by a conical connector plug and at the other end by a white biconical connector. The white biconical connector is designed to accept a single-fiber cable terminated with an externally threaded spring-loaded connector.

4.05 The difference between the 400(), 500(), or 600() cable-type lightguide build-out is the wavelength of the lightwave transmission system application and the mode of the lightguide fiber. The 400() cable-type lightguide build-out is intended for use in 0.82 μm wavelength multimode fiber lightwave transmission systems. The 500() cable-type lightguide build-out is intended for use in 1.3 μm wavelength multimode fiber systems. The 600() cable-type lightguide build-out is intended for use in 1.3 μm wavelength single-mode fiber lightwave transmission systems. The optical attenuation value of the lightguide build-out is designated by a letter (Table B). The lightguide build-out designation and its at-

tenuation letter code are stamped on the biconical connector housing, eg, 400A, 500A, 600A, etc (Fig. 27).

401, 501, AND 601 BARREL-TYPE LIGHTGUIDE BUILD-OUT

4.06 The 401(), 501(), or 601() barrel-type lightguide build-out (Table C and Fig. 26) consists of a 2.29 cm (0.9 inch) long biconical sleeve housed in a polycarbonate barrel 1.27 cm (0.5 inch) in diameter. Note in Table C that the 401A through 601S barrel-type lightguide build-out is designed to be mounted onto a 1000C (Fig. 14) or 1001C (Fig. 17) lightguide connector. Also note in Table C that the 401A1 through 601S1 barrel-type lightguide build-out is used only on the 1000C or 1001C connector. Each will accept a single lightguide interconnection cable terminated with an externally threaded, spring-loaded connector plug.

4.07 The difference between the 401(), 501(), and 601() barrel-type lightguide build-out is the wavelength of the transmission system application and the mode of the lightguide fiber. The 401 barrel-type lightguide build-out is intended for use in 0.82 μm wavelength multimode fiber lightwave systems. The 501 barrel-type lightguide build-out is intended for use in 1.3 μm wavelength multimode fiber lightwave systems. The 601 barrel-type lightguide build-out is intended for use in 1.3 μm wavelength single-mode fiber lightwave systems. The optical attenuation value of the lightguide build-out is designated by a letter (Table C). The 401M, 501M, 601M, and the 601S barrel-type lightguide build-out have a nominal attenuation value of 0 dB. The 601S barrel-type lightguide build-out is used when connecting a single-mode fiber to a single-mode fiber. The 601M barrel-type lightguide build-out is used only when lightwave propagation is from single-mode fiber to multimode fiber (the 601S may be used in this application but is not mandatory). The 601S barrel-type lightguide build-out is yellow. The 401M, 501M, or 601M barrel-type lightguide build-out barrel is gray. All other barrel-type build-outs are white. The lightguide build-out designation and its attenuation letter code are stamped on the barrel housing, eg, 401A, 401A1, 401B, 401B1, etc (Table C and Fig. 26).

5. HANDLING AND CLEANING OF LIGHTGUIDE CONNECTORS

5.01 In order to achieve low loss connections, great care must be exercised in handling and clean-

ing the fiber ends, the plugs, and the sleeves. ***This is especially important for single mode-to-single mode propagation connections.*** The end faces and the conical alignment tapers of the plugs and sleeves must be kept free of dust and foreign materials at all times. The plug at each end of the lightguide interconnection cable should be covered with a soft plastic cap, supplied with the cable, when not assembled into a connector.

PROCEDURES IN MAKING AN OPTICAL CONNECTION

5.02 The correct procedure for making a good optical connection is as follows:

- (1) Before connecting a plug into an alignment sleeve, wipe the interior of the alignment sleeve with one or more new clean cotton swabs until the swab shows no visible dirt or grit. If there is a plug already connected to one end of the alignment sleeve, carefully remove the plastic protective cap on the unterminated side of the alignment sleeve and carefully wipe the fiber-end face of that plug, using a new, clean cotton swab and isopropyl alcohol. Use a compressed air duster with clean, dry-compressed air to blow out any lint on the inner surface of the alignment sleeve and on the plug-end face.
- (2) Using a **new** piece of optical-quality, lint-free tissue, carefully wipe the fiber-end face and the conical alignment taper of the plug to be connected. Blow off any lint and dust with clean, dry compressed air. Insert the plug into the alignment sleeve, making sure the alignment taper of the plug does not touch anything but the conical surface of the alignment sleeve during insertion. The fiber-end face itself should not be touched by anything. Screw in the threaded-end cap until it is firmly seated and only finger tight.
- (3) Repeat Steps 1 and 2 for the installation of the second plug into a sleeve.
- (4) Make sure the single-fiber cable is not under tension. There should be no bends or radii less than 3.81 cm (1.5 inches) in the cable.

6. REFERENCES

6.01 The following documents are associated with lightguide interconnection facilities (check appropriate Numerical Index for availability).

NUMBER	TITLE	NUMBER	TITLE
103-486-113	FT3C Portable Violation Monitor (KS-22671, L1) Description, Operation, and Maintenance	365-560-114	Wavelength Division Multiplex (WDM) Filter Assembly Description
103-486-114	190A Optical Loss Test Set Description, Operation, and Maintenance	365-560-115	J98734S Line Repeater Bay Description
103-486-115	Multimode Optical Loss Test Set (KS-22820) Description, Operation, and Maintenance	365-602-100	MX3/MX3C Digital Multiplex and FT3/FT3C/FTX-180 Lightwave Terminals General Description
103-486-116	Single-Mode Optical Loss Test Set Description, Operation, and Maintenance	365-602-102	J98734L MX3 Lightwave Terminating Multiplex Assembly (LTMA) Description
365-302-101	Lightguide Cable Interconnection Units for Ribbon-Type Cable Description	365-602-103	J5X014AF MX3 Radio Terminating Multiplex (RTM) Description
365-302-103	Lightguide Cable Interconnection Units for Stranded-Type Cable, Description	365-602-104	MX3 Lightwave Terminating Frame (LTF) Description
365-326-100	Optical Order Channel and Alarm Telemetry (OOCAT) System Description	365-602-105	MX3 Lightwave Terminating Frame (LTF) Monitoring, Protection Switching, and Alarm Circuits Description
365-326-101	Optical Order Channel and Alarm Telemetry (OOCAT) Facility Description	365-602-107	MC-90 Maintenance Communication Facility for 90 Mb/s Lightwave Systems Description
365-326-300	Optical Order Channel and Alarm Telemetry (OOCAT) System Acceptance and Maintenance Tasks (TOP)	365-602-108	J98734N MX3 Lightwave Span Terminating Assembly (LSTA) Description
365-560-100	FT3 Lightwave Digital Transmission System General Description	365-602-109	FT3C-SX Lightwave Span Terminating Frame Description
365-560-101	Line Repeater Station Description, FT3/FT3C Lightwave Digital Transmission Systems	365-602-110	MX3C Lightwave Terminating Frame (LTF) Description
365-560-105	J98734R Line Repeater Bay Description	365-671-501	T3 and T4 Facilities Trouble Sectionalization Tasks (TOP)
365-560-110	FT3C Lightwave Digital Transmission System General Description	365-675-561	J98734L MX3 Lightwave Terminating Multiplex Assembly (LTMA) Acceptance Tasks (TOP)
		365-675-562	J98734L MX3 Lightwave Terminating Multiplex Assembly (LTMA) Maintenance Tasks (TOP)

NUMBER	TITLE	NUMBER	TITLE
365-675-566	MX3 Lightwave Terminating Frame (LTF) Acceptance Tasks (TOP)	855-351-130	MX3 Digital Multiplex and FT3 Lightwave Digital Transmission System Applications Engineering
365-675-567	MX3 Lightwave Terminating Frame (LTF) Maintenance Tasks (TOP)	855-351-135	MX3C Digital Multiplex, FT3C-SX, and FT3C Digital Transmission System Applications Engineering
365-675-568	MX3C Lightwave Terminating Frame (LTF) Acceptance Tasks (TOP)	855-354-100	Engineering and Implementation Methods Systems (EIMS) Digital Hierarchy
365-675-569	MX3C Lightwave Terminating Frame (LTF) Maintenance Tasks (TOP)	855-354-101	FT3/FT3C Transmission Engineering Design Guide for Graded Cable
365-675-570	J98734N MX3 Lightwave Span Terminating Assembly (LSTA) Acceptance and Maintenance Tasks (TOP)	855-354-102	Lightguide Cable Grounding, Bonding, and Insulation Engineering Considerations
365-675-571	Line Repeater Station Acceptance and Maintenance Tasks (TOP), FT3/FT3C Lightwave Digital Transmission Systems	855-354-110	FT3/FT3C/FTX-180 Lightguide Path Tests Description, Requirements, and Procedures
365-675-574	FT3C-SX Lightwave Span Terminating Frame Acceptance Tasks (TOP)	855-354-111	FT3/FT3C/FTX-180 Regenerator Section Transmission Engineering Design Guide
365-675-575	FT3C-SX Lightwave Span Terminating Frame Maintenance Tasks (TOP)	855-354-115	FT3 to FT3C Conversion Planning and Implementation
365-675-580	MC-90 Maintenance Communications Facility Acceptance and Maintenance Tasks (TOP)	855-354-116	FT3C to FTX-180 Conversion Planning and Implementation
640-252-101	Lightguide Cable Splicing, General	855-354-120	Maintenance Features and Interfaces, FT3C Lightwave Digital Transmission System
640-252-115	Optical Time Domain Reflectometer KS-22732, L1 Description and Use	855-354-125	MC-90 Maintenance Communications Facility for 90 Mb/s Lightwave Systems Engineering Considerations.
855-350-115	Optical Order Channel and Alarm Telemetry (OOCAT) System Engineering Design		

TABLE A
LIGHTGUIDE INTERCONNECTION CABLES

LIGHTGUIDE INTERCONNECTION CABLE TYPE	NO. OF FIBERS	OUTER SHEATH COLOR	TYPICAL APPLICATION
LA1A-type	1	Orange	FT3, FT3C, FTX-180
LA1T-N	1	Orange	Multimode OLTS and single mode OLTS (equipped with quick-clip connector on one end)
LA2A-type	2	Orange (2 orange inner fibers)	FT3, FT3C, FTX-180
LA4A-type	4	Orange	FT3, FT3C, FTX-180
LB1B-type	1	White	Electronic switching equipment
LB2B-type	2	White	Electronic switching equipment
LL1A-type	1	Gray (slate)	Loop carrier system
LL2A-type	2	Orange (2 orange inner fibers)	Loop carrier system
LL4A-type	4	Orange	Loop carrier system
LS1A-type	1	Yellow	FT3, FT3C, FTX-180
LS1T-N	1	Yellow	Single mode OLTS (equipped with quick-clip connector on one end)
LS4A-A	4	Orange (2 orange and 2 yellow inner fibers)	FT3, FT3C, FTX-180
LT1A-A	1	Orange	Multimode OLTS and single mode OLTS

TABLE B

400, 500, AND 600 CABLE-TYPE LIGHTGUIDE BUILD-OUTS

CABLE-TYPE LIGHTGUIDE BUILD-OUT DESIGNATION	LIGHTWAVE TRANSMISSION WAVELENGTH (μm)	LIGHTGUIDE FIBER MODE	OPTICAL LOSS ATTENUATION (dB)
400A 400B 400C 400D	.825	Multimode	5 - 8 10 - 13 15 - 18 20 - 23
500A 500B 500C 500D 500E 500F	1.3	Multimode	4 - 6 6 - 8 8 - 10 10 - 12 12 - 14 14 - 16
600A 600B 600C 600D 600E	1.3	Single mode	2 - 4 4 - 6 6 - 8 8 - 10 10 - 12

TABLE C

401, 501, AND 601 BARREL-TYPE LIGHTGUIDE BUILD-OUTS

BATTERY-TYPE LIGHTGUIDE BUILD-OUT DESIGNATION	LIGHTWAVE TRANSMISSION WAVELENGTH (μm)	LIGHTGUIDE FIBER MODE	BARREL- TYPE COLOR	CONNECTOR COMPATIBILITY		OPTICAL LOSS ATTENUATION (dB)
				1000C	1001C	
401A	.825	Multimode	White	X		5 - 8
401A1			White	X	X	5 - 8
401B			White	X		10 - 13
401B1			White	X	X	10 - 13
401C			White	X		15 - 18
401C1			White	X	X	15 - 18
401D			White	X		20 - 23
401D1			White	X	X	20 - 23
401M			Gray	X		.3 max.
401M1			Gray	X	X	.3 max.
501A	1.3	Multimode	White	X		4 - 6
501A1			White	X	X	4 - 6
501B			White	X		6 - 8
501B1			White	X	X	6 - 8
501C			White	X		8 - 10
501C1			White	X	X	8 - 10
501D			White	X		10 - 12
501D1			White	X	X	10 - 12
501E			White	X		12 - 14
501E1			White	X	X	12 - 14
501F			White	X		14 - 16
501F1			White	X	X	14 - 16
501M			Gray	X		.3 max.
501M1			Gray	X	X	.3 max.
601A	1.3	Single Mode	White	X		2 - 4
601A1			White	X	X	2 - 4
601B			White	X		4 - 6
601B1			White	X	X	4 - 6
601C			White	X		6 - 8
601C1			White	X	X	6 - 8
601D			White	X		8 - 10
601D1			White	X	X	8 - 10
601E			White	X		10 - 12
601E1			White	X	X	10 - 12
601M			Gray	X		.3 max.
601M1			Gray	X	X	.3 max.
601S			Yellow	X		.3 max.
601S1			Yellow	X	X	.3 max.

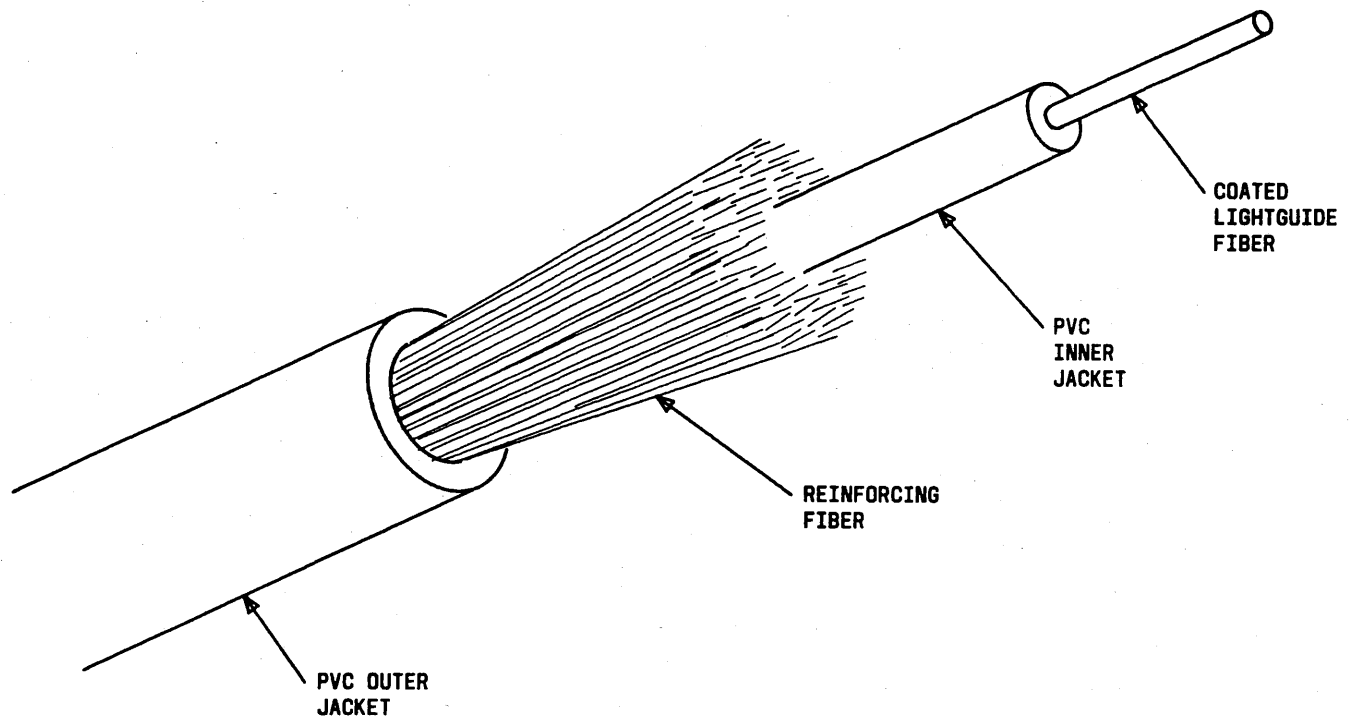


Fig. 1 — Single-Fiber Lightguide Cable

NOTE:

CABLE DESIGNATION	CABLE SHEATH COLOR
LA1A-A	ORANGE
LL1A-A	GREY (SLATE)
LS1A-A	YELLOW
LT1A-A	ORANGE WITH BLUE CONNECTORS

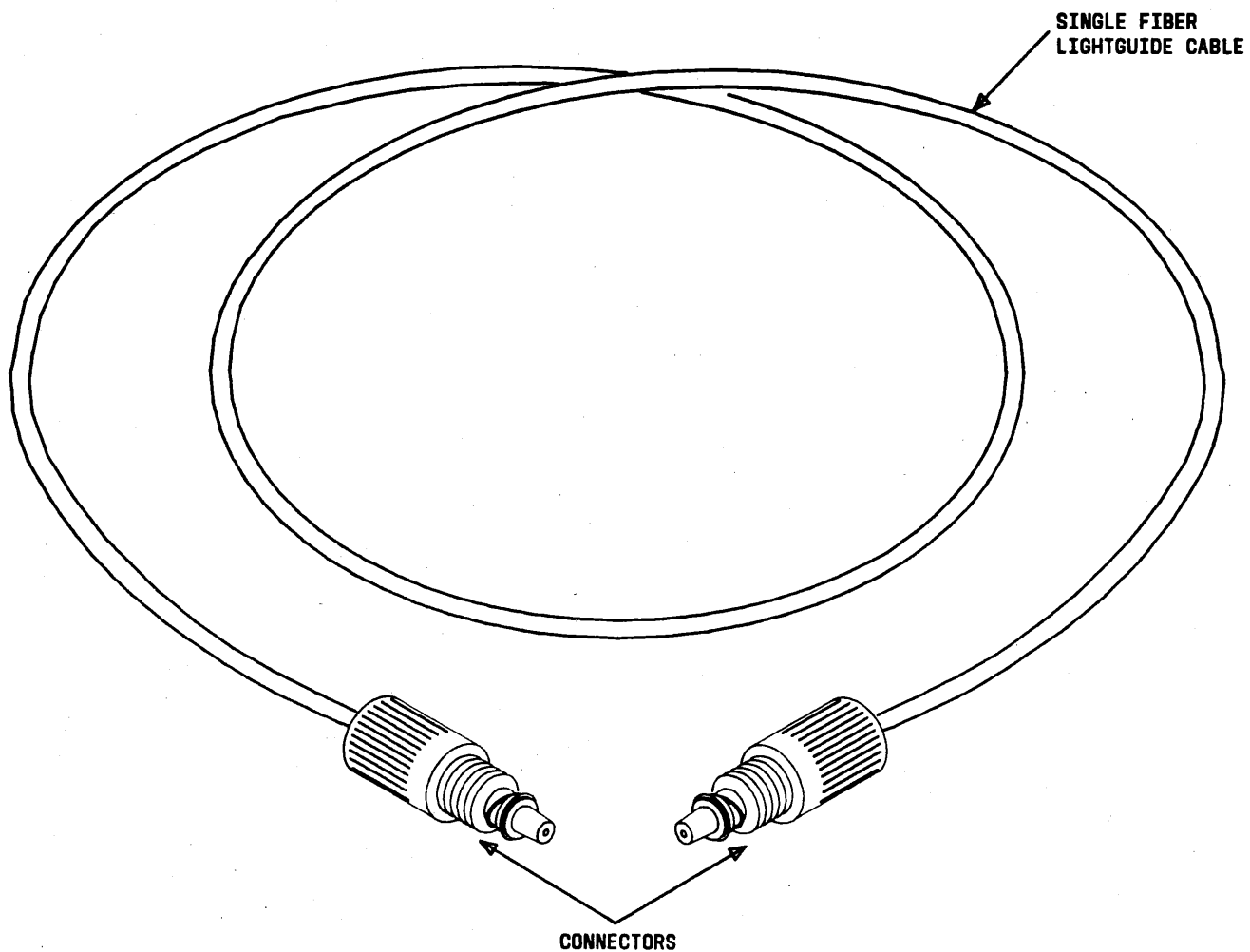


Fig. 2—Typical LA1A-A, LL1A-A, LS1A-A, or LT1A-A Single-Fiber Lightguide Interconnection Cable

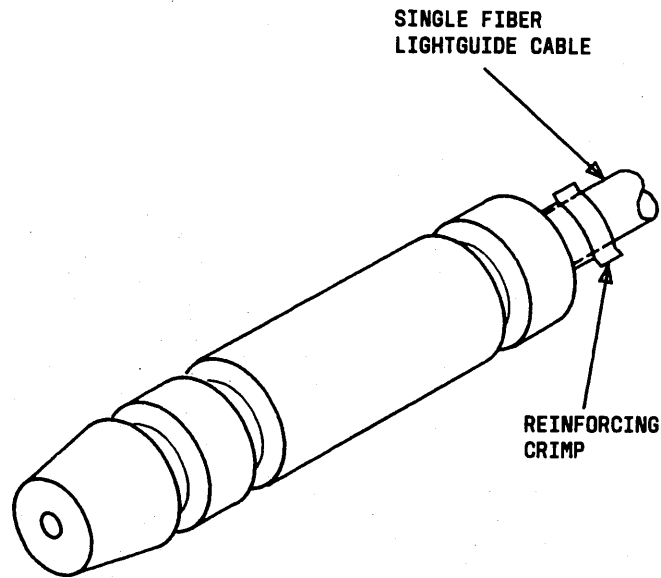


Fig. 3—Conical Connector Plug

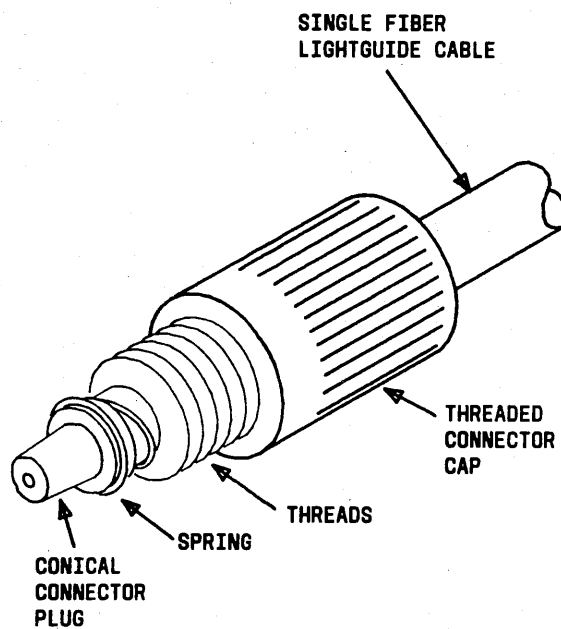


Fig. 4—Threaded, Spring-Loaded Connector

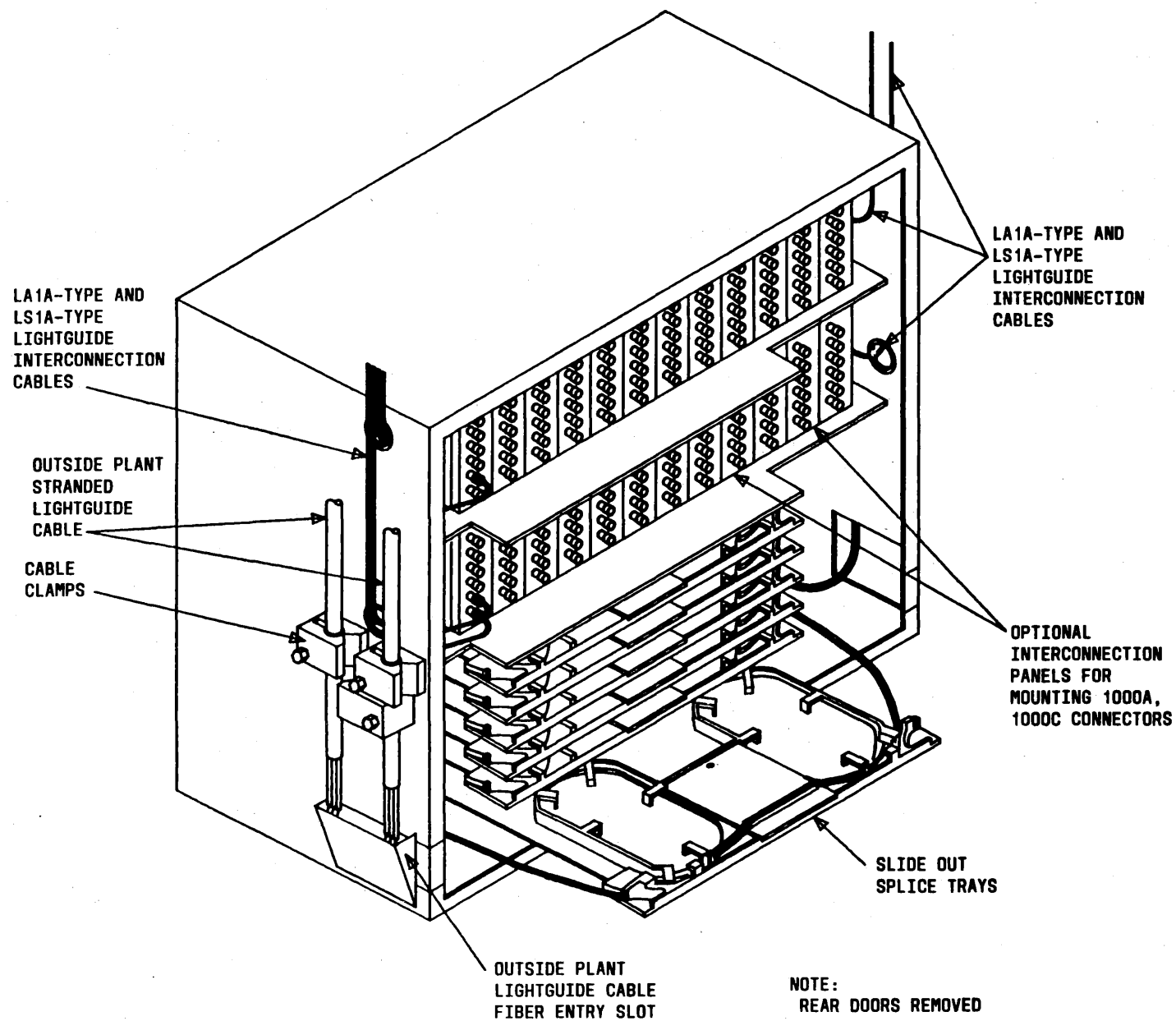


Fig. 5—Typical Installation of Lightguide Stranded Cable Interconnection Equipment (LSCIE) Rear View

NOTE:

DESIGNATION	SINGLE FIBER SHEATH COLOR
LA4A-A	ORANGE
LL4A-A	GREY (SLATE)
LS4A-A	2 ORANGE AND 2 YELLOW

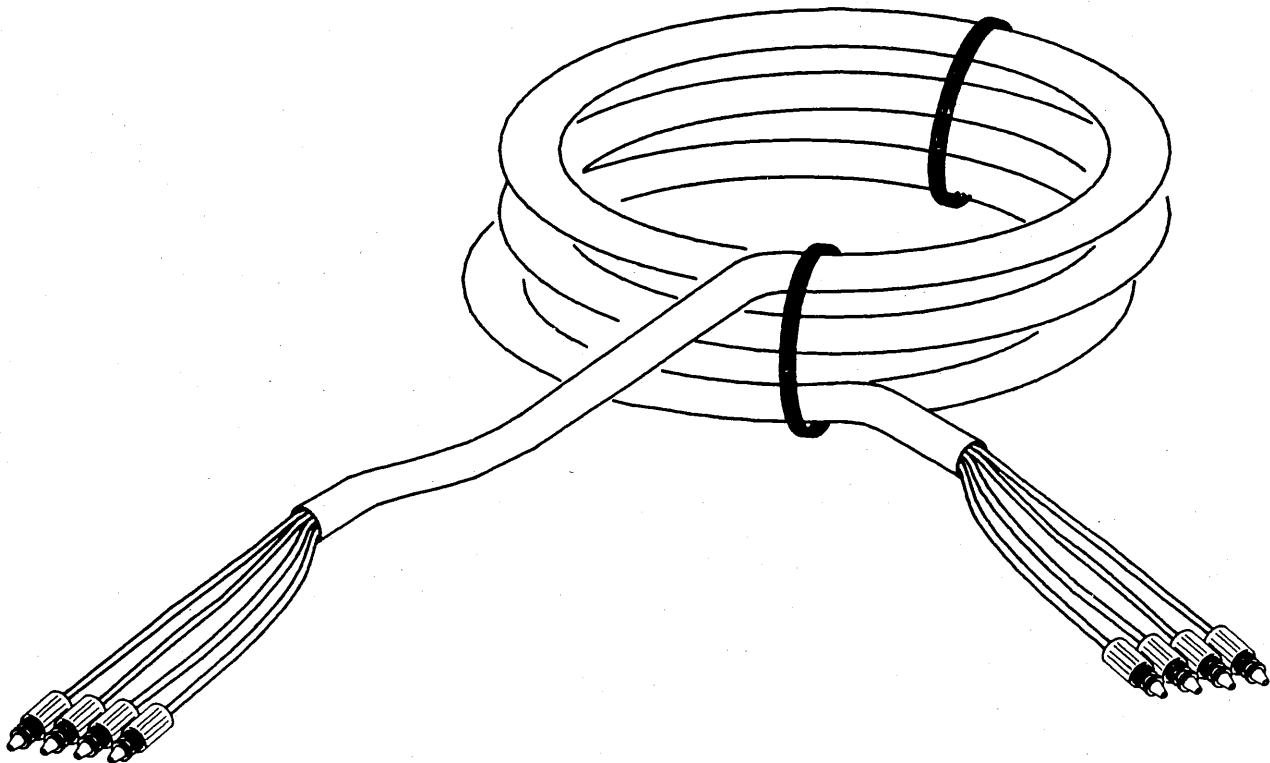


Fig. 6—LA4A-A, LL4A-A, or LS4A-A Lightguide Interconnection Cable

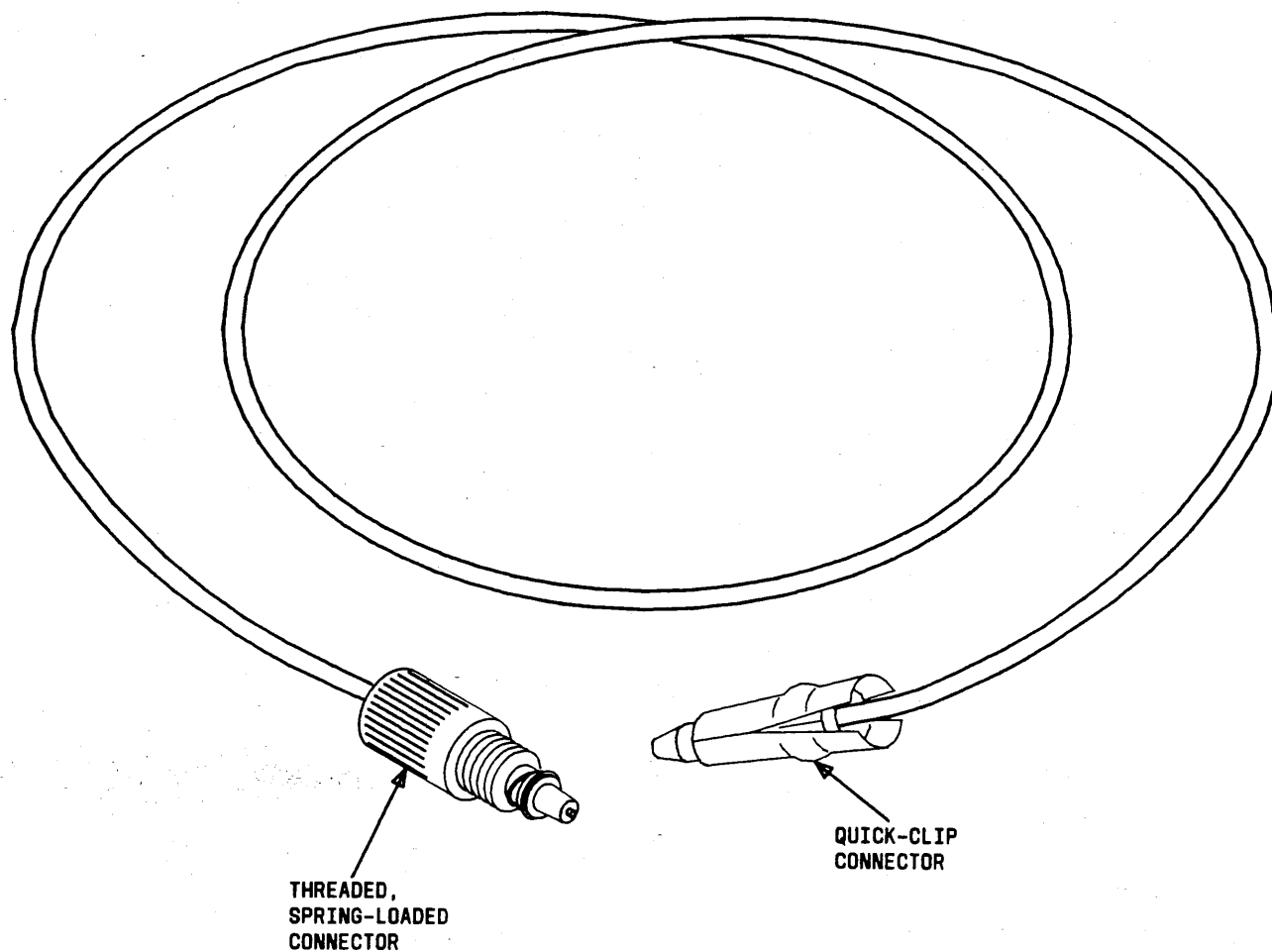


Fig. 7—LA1T-N or LS1T-N Lightguide Interconnection Cable

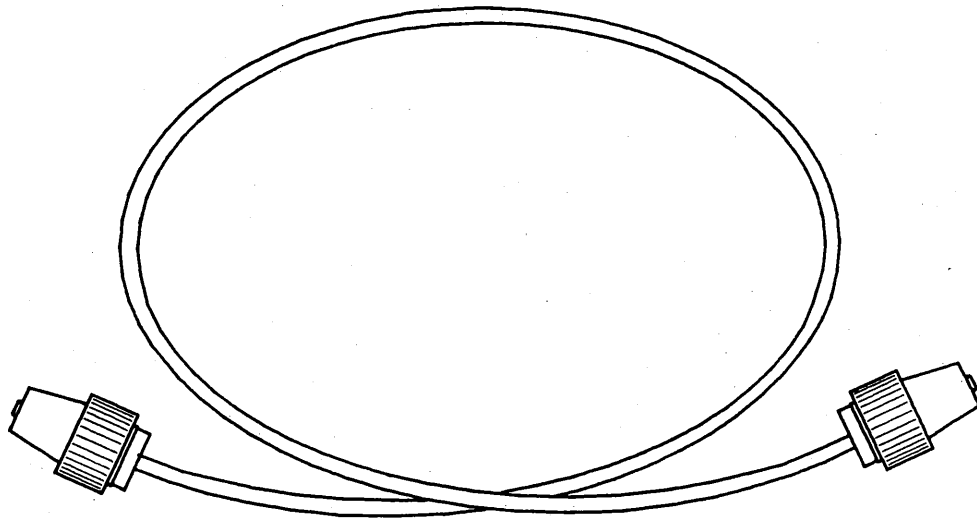


Fig. 8—LB1B-B Lightguide Interconnection Cable

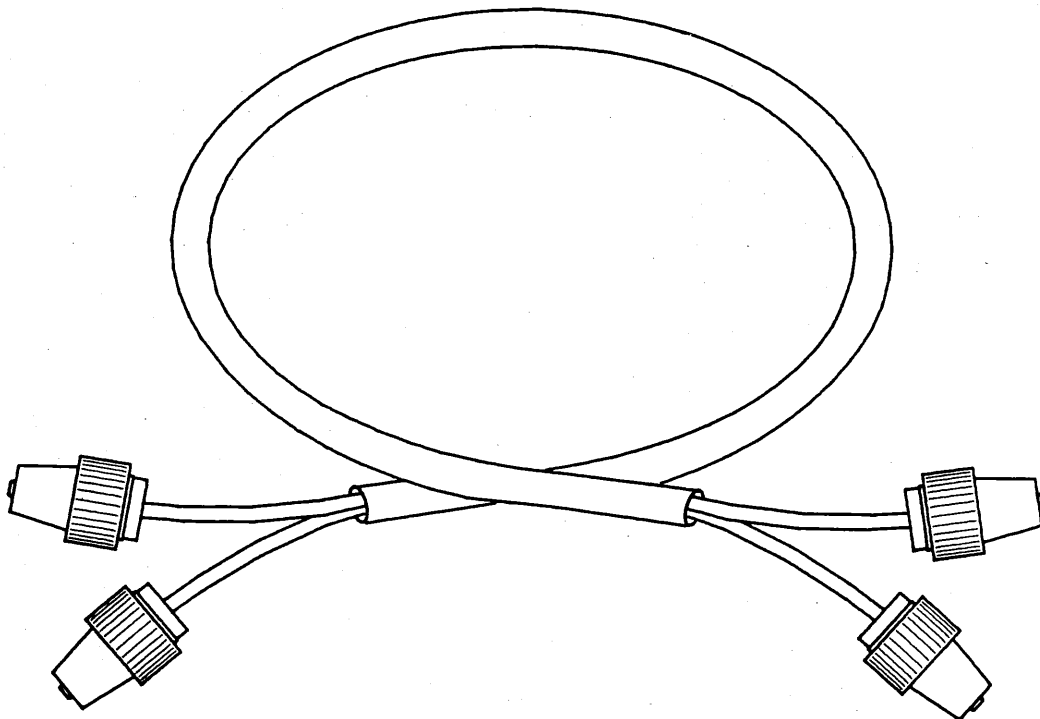


Fig. 9—LB2B-B Lightguide Interconnection Cable

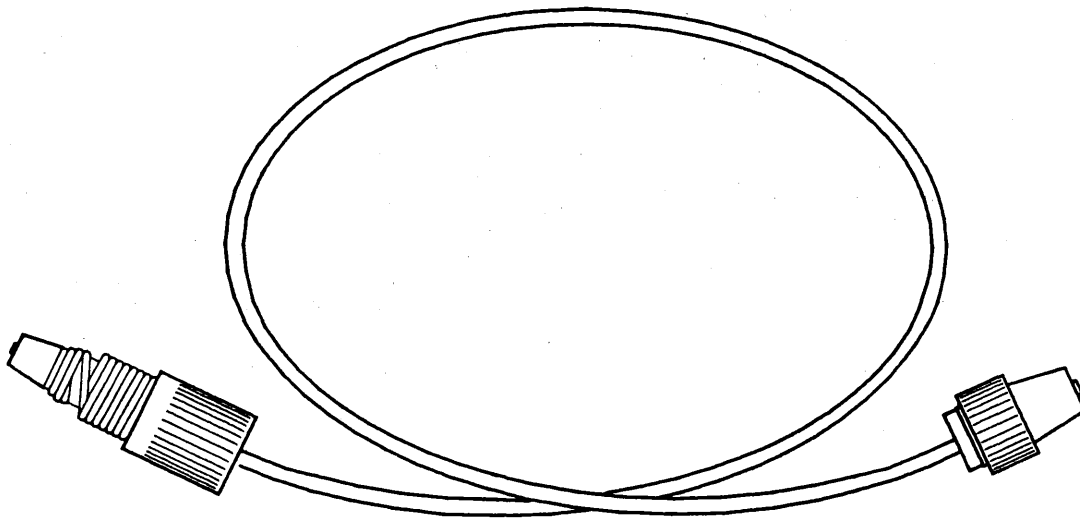


Fig. 10—LC1A-A Lightguide Interconnection Cable

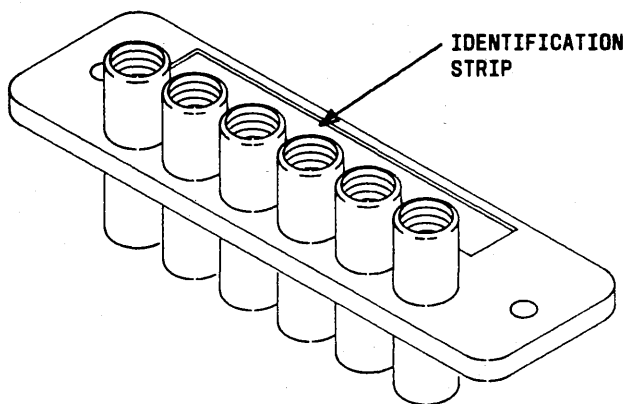


Fig. 11—1000A Lightguide Connector

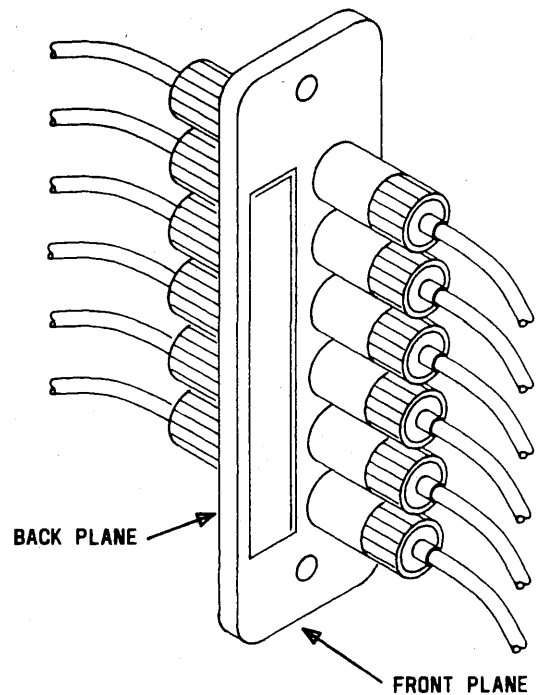


Fig. 12—1000A Lightguide Connector (6-pack) With Single-Fiber Connections

NOTE:
1000C CONNECTOR IS NOT PROVIDED WITH BARREL-TYPE
LIGHTGUIDE BUILD-OUTS

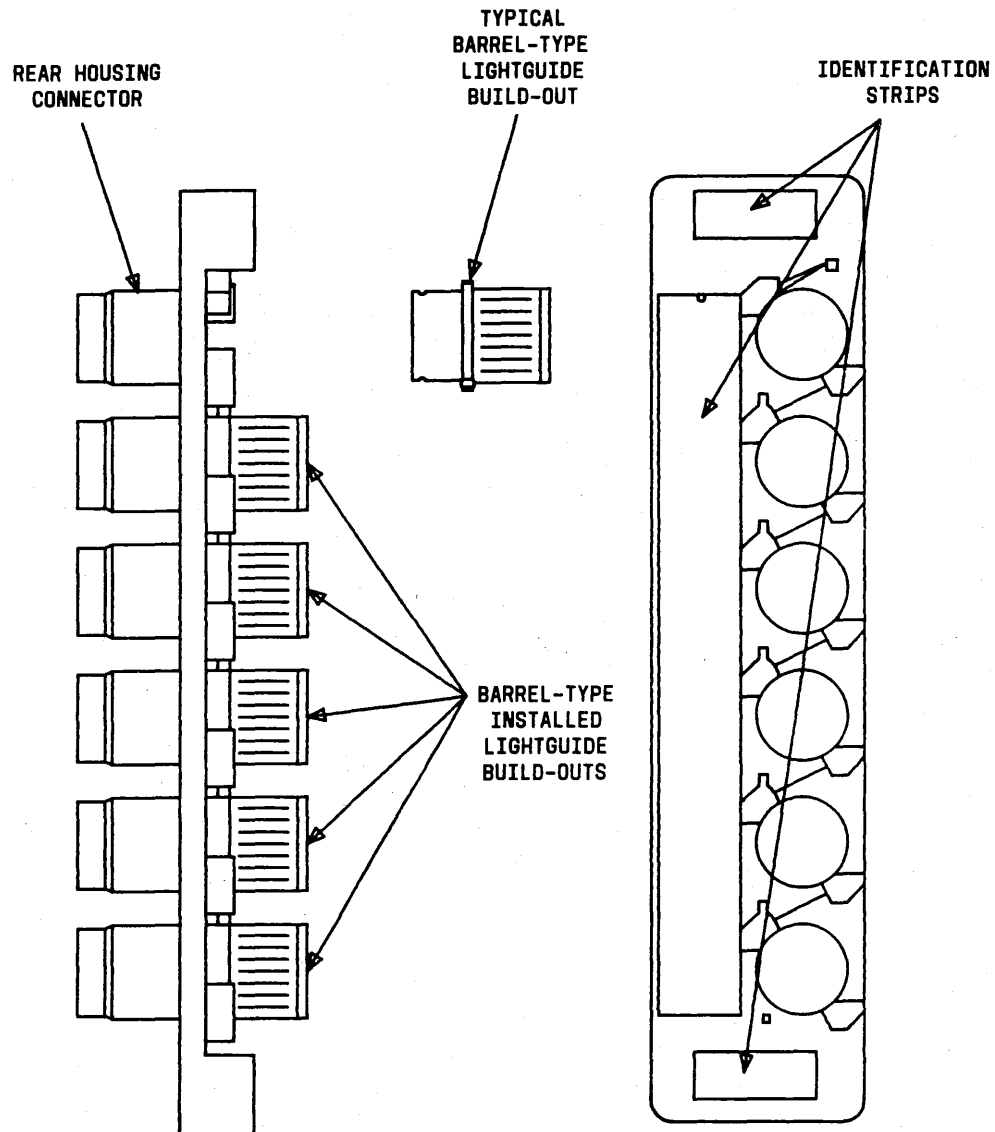


Fig. 13—1000C Lightguide Connector

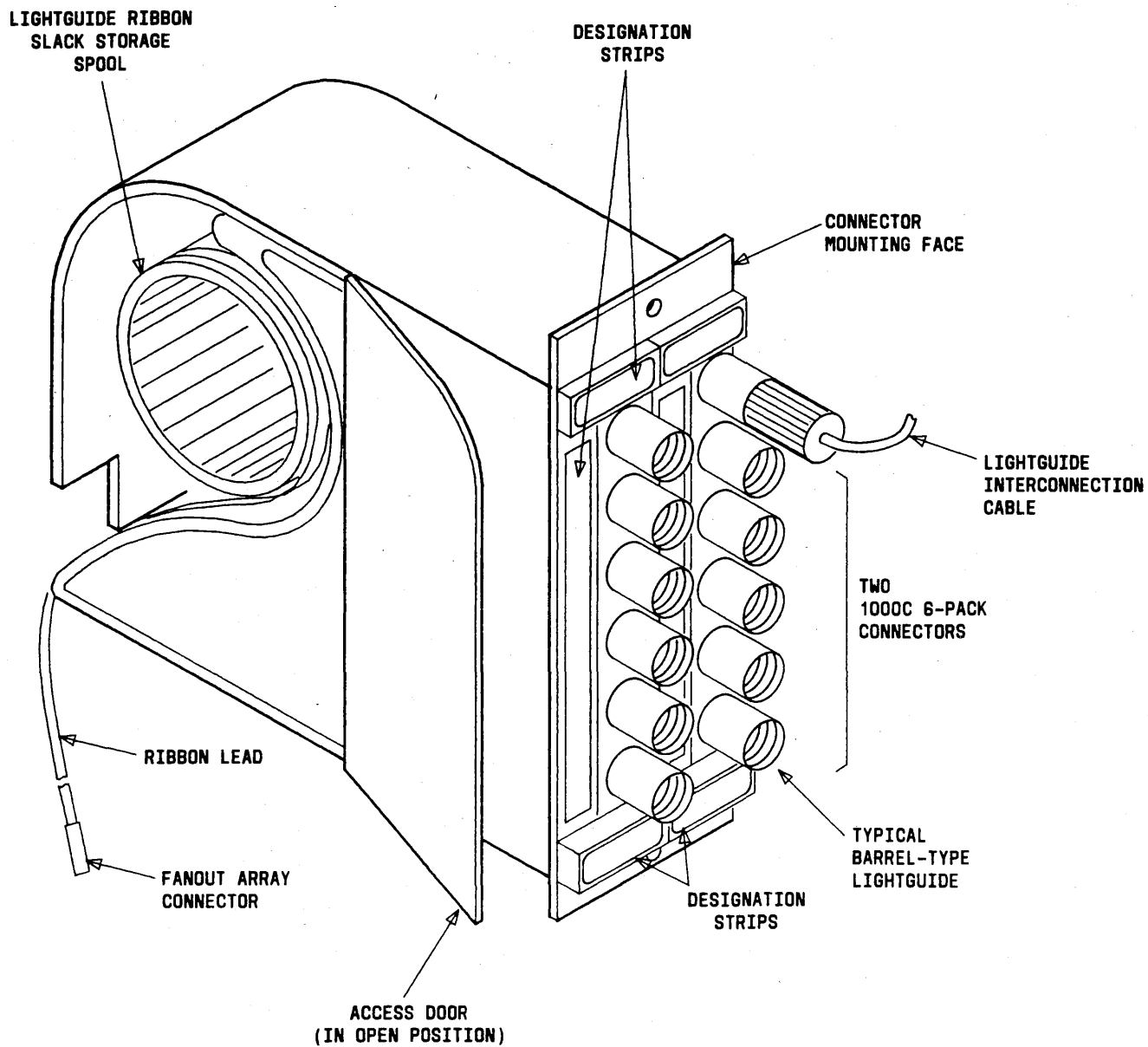


Fig. 14—3-Type Fanout With Two 1000C (6-Pack) Connectors

NOTES:

- | 1. DESIGNATION | HOUSING COLOR |
|----------------|---------------|
| 1001A | BLACK |
| 1011A | YELLOW |
2. EITHER CONNECTOR MAY BE USED WHEN LIGHTWAVE PROPAGATES FROM SINGLE MODE TO MULTIMODE CONNECTION.

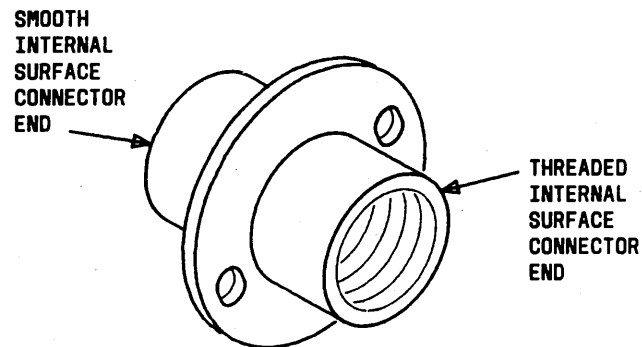
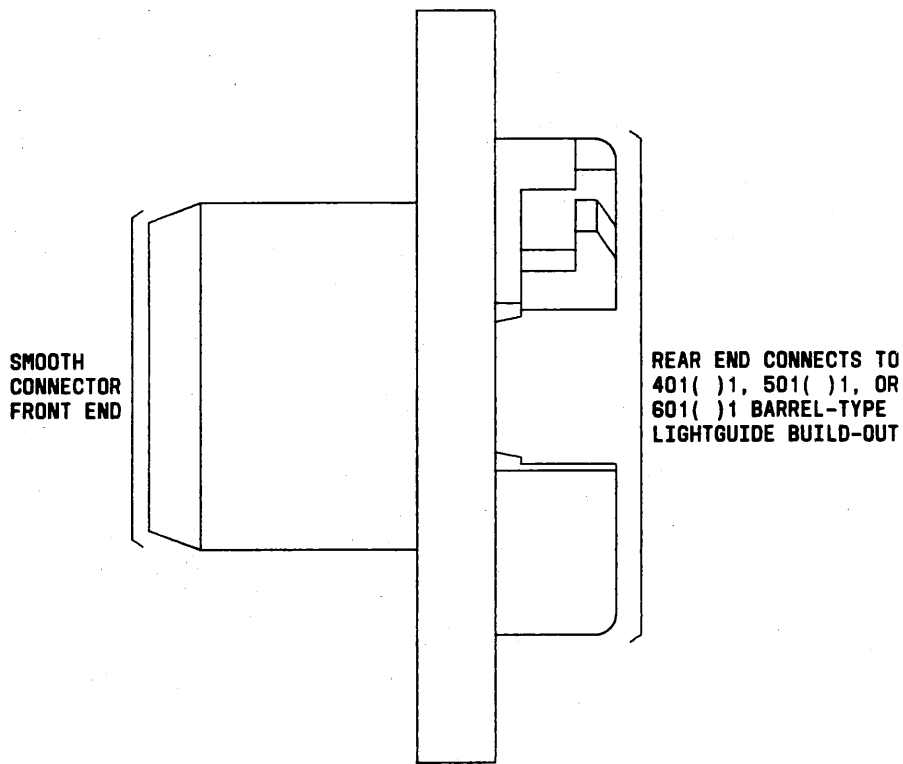
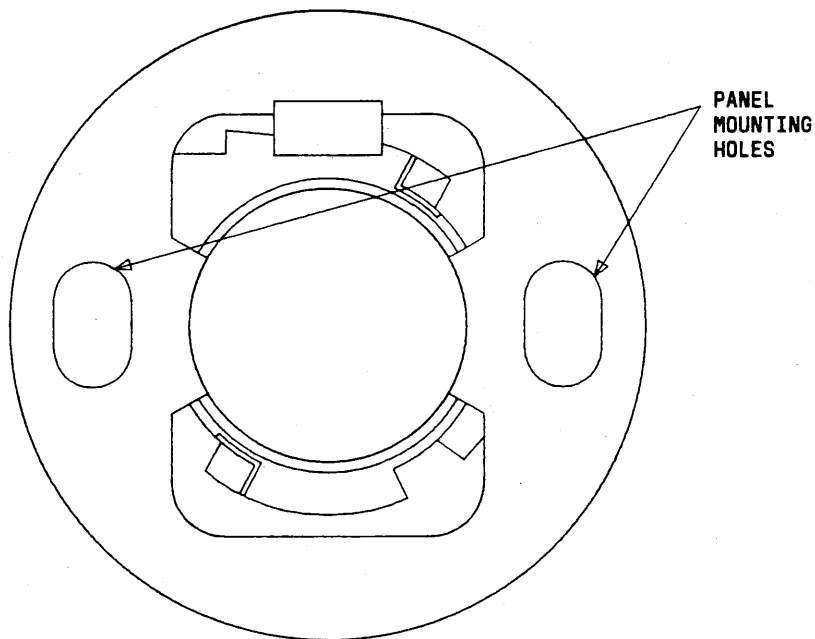


Fig. 15—1001A or 1011A Lightguide Connector



A. SIDE VIEW



B. REAR VIEW

Fig. 16—1001C Lightguide Connector

NOTES:

- | 1. DESIGNATION | HOUSING COLOR |
|----------------|---------------|
| 1002A | BLACK |
| 1012A | YELLOW |
2. EITHER CONNECTOR MAY BE USED WHEN LIGHTWAVE PROPAGATES FROM SINGLE-MODE TO MULTIMODE FIBER.

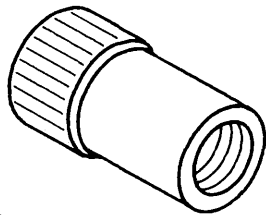


Fig. 17—1002A or 1012A Lightguide Connector

NOTES:

- | 1. DESIGNATION | HOUSING COLOR |
|----------------|---------------|
| 1003A | BLACK |
| 1013A | YELLOW |
2. EITHER CONNECTOR MAY BE USED WHEN LIGHTWAVE PROPAGATES FROM SINGLE MODE TO MULTIMODE FIBER.

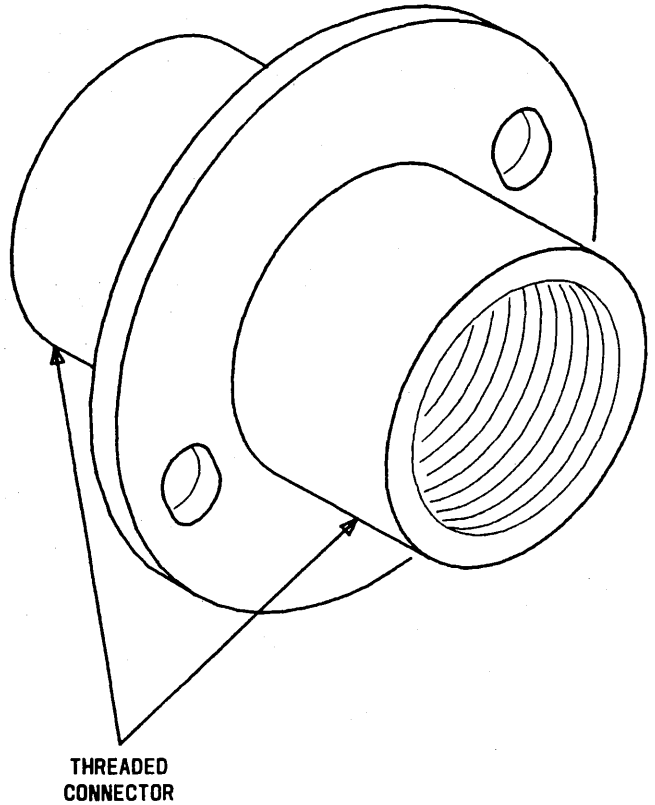


Fig. 18—1003A or 1013A Lightguide Connector

NOTES:

1. CONNECTOR DESIGNATION	HOUSING COLOR
1003A	BLACK
1013A	YELLOW

EITHER CONNECTOR MAY BE USED WHEN LIGHTWAVE PROPAGATES FROM SINGLE MODE TO MULTIMODE CONNECTION.

2. CABLE DESIGNATION	CABLE SHEATH COLOR
LA1A-A	ORANGE
LL1A-A	GREY (SLATE)
LS1A-A	YELLOW
LT1A-A	ORANGE

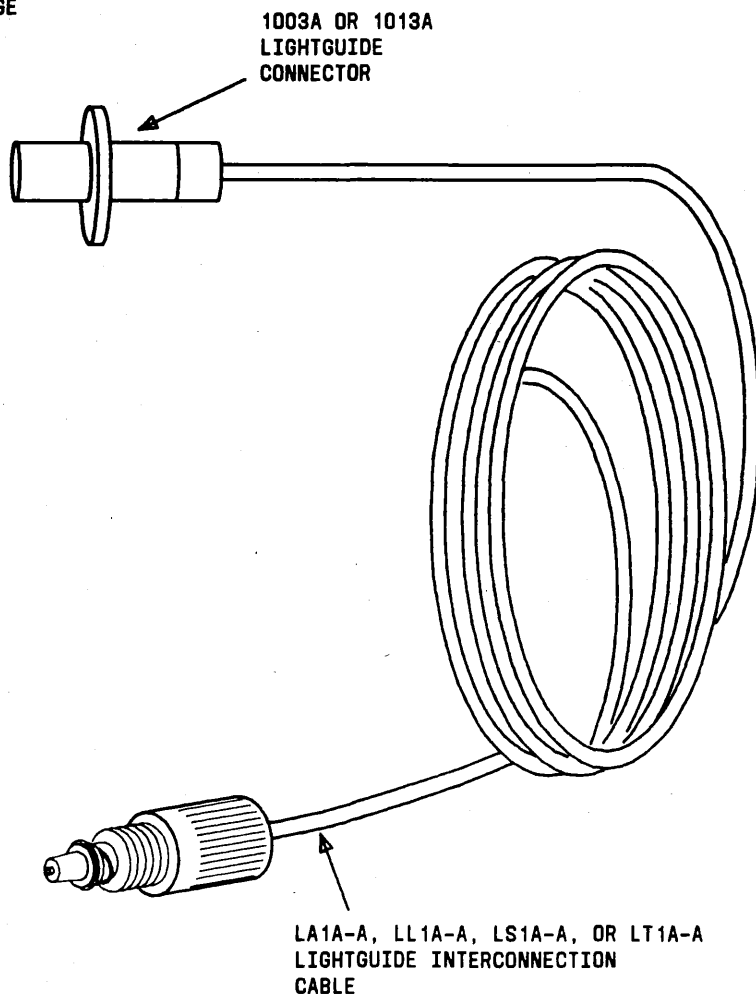


Fig. 19—1003A or 1013A Lightguide Connector, With Typical Interconnection Cable

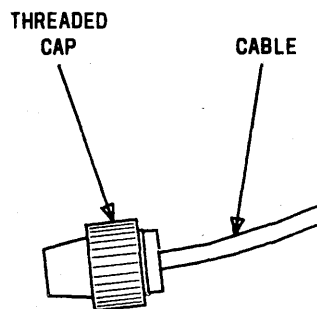


Fig. 20—1005A Lightguide Connector Plug

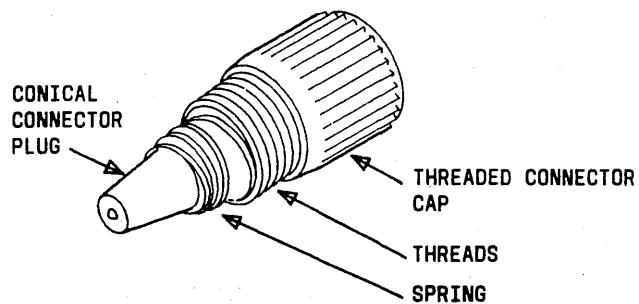


Fig. 21—1006A Lightguide Connector Plug

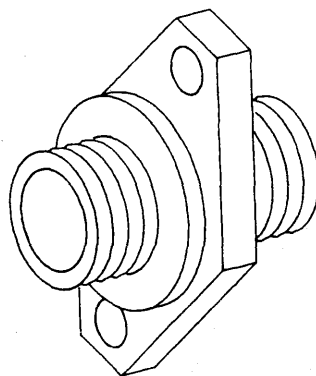


Fig. 22—1007A Lightguide Connector

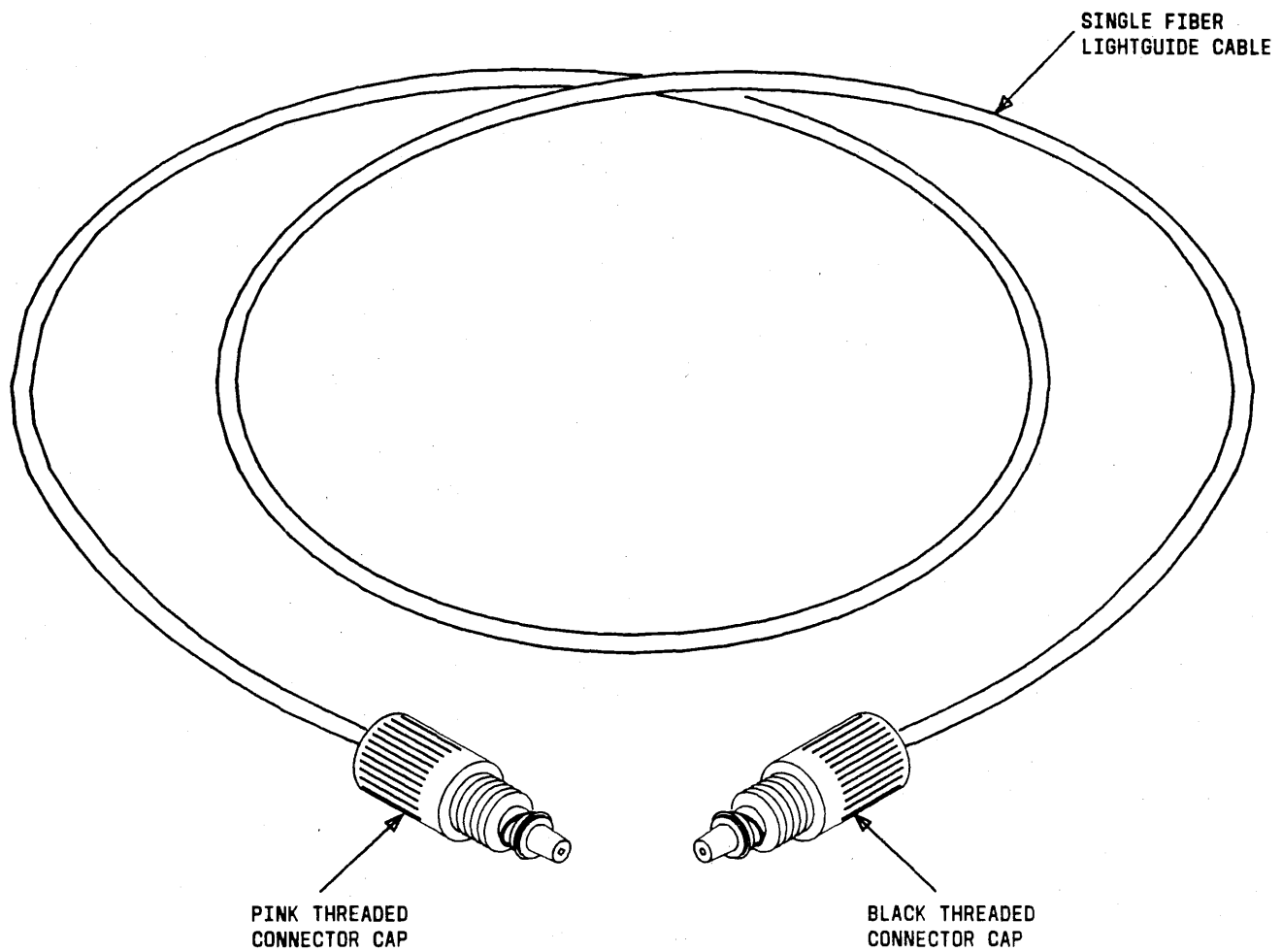


Fig. 23—LA1A-D Cable-Type Lightguide Build-Out

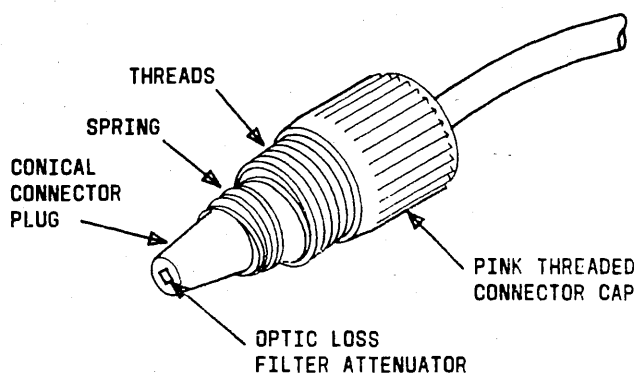


Fig. 24—Modified Pink Connector Plug of LA1A-D Cable-Type Lightguide Build-Out

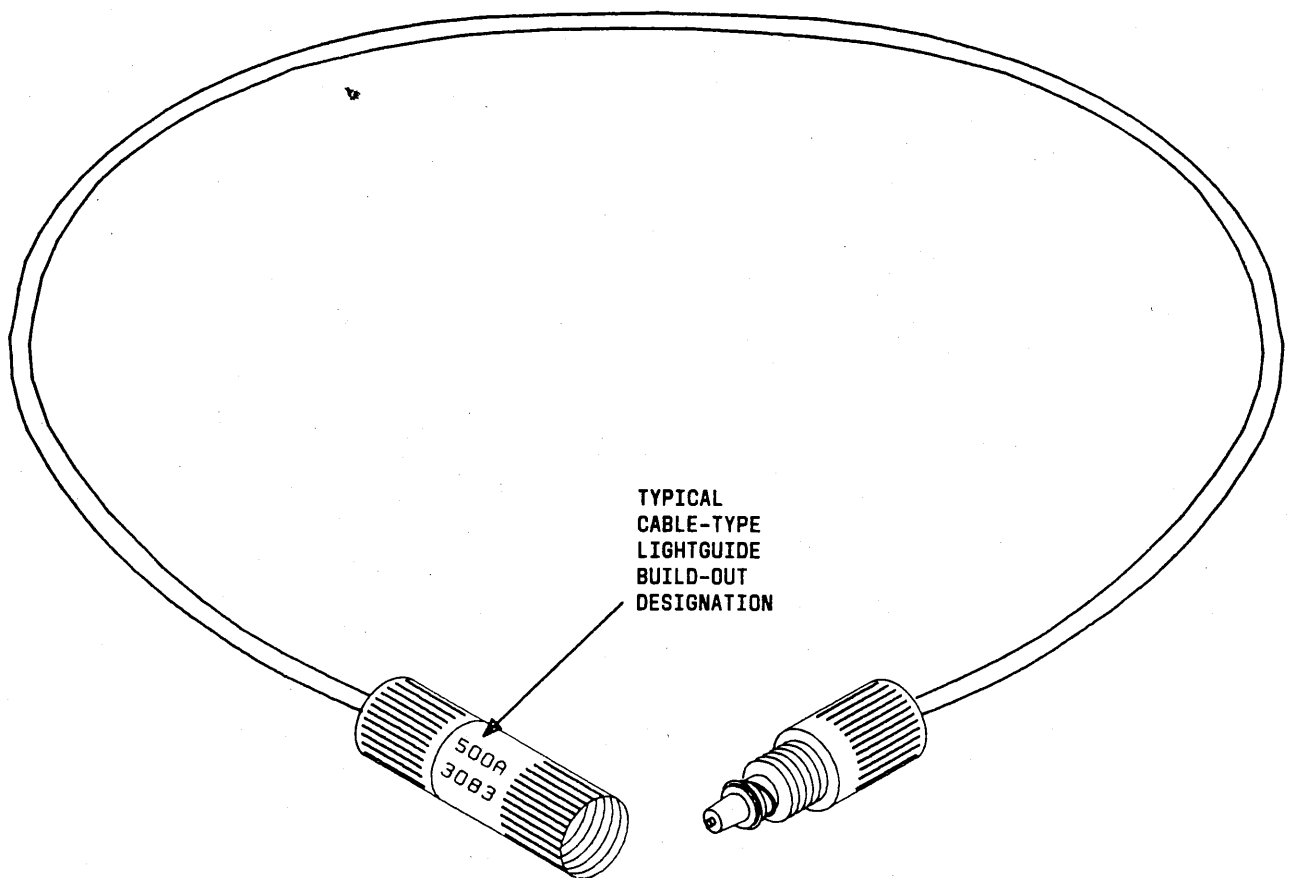


Fig. 25—Typical 400(), 500(), or 600() Cable-Type Lightguide Build-Out

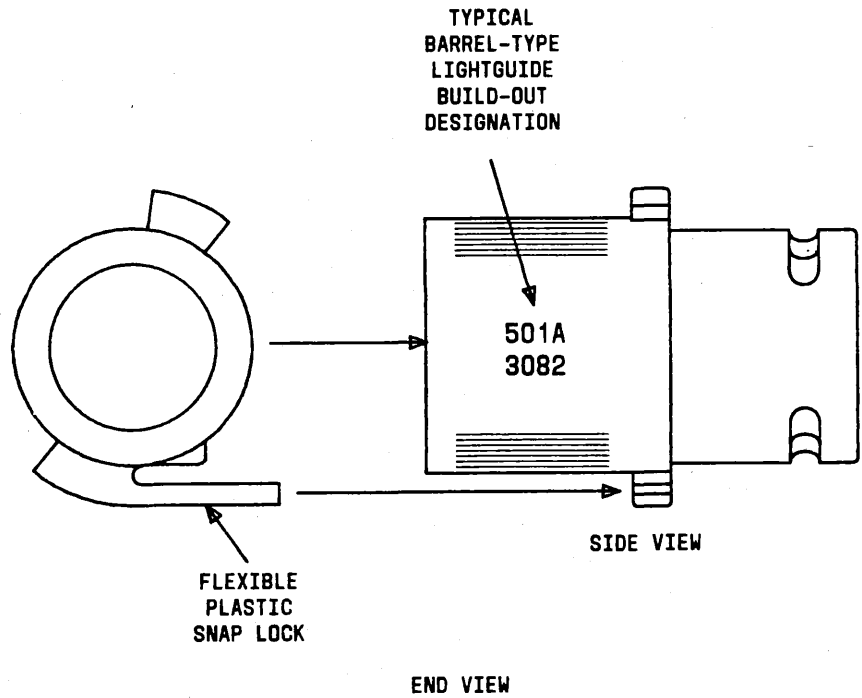


Fig. 26—Typical 401(), 501(), or 601() Barrel-Type Lightguide Build-Out