

REV	REASON

**OPTIMATE*
MULTIMODE FIBER OPTIC
COUPLERS**

ENGINEERING RELEASE DATE

7-19-91

APPROVAL

SHERRY LOREI

1. INTRODUCTION

This specification covers the requirements for application of AMP* OPTIMATE Multimode Fiber Optic Couplers. These devices are used to split or combine light from one fiber to another without significant loss. Standard coupler designs range from 1 x 2 to 32 x 32 with various packaging, pigtail, fiber size, connector, and metal enclosure options. All couplers are designed for simple installation in cabinets, on panels, walls, or within equipment.

The coupler designs on this document are readily available. Contact the Customer Hotline at the top of this page for assistance regarding design requirements not covered on this document. Refer to Figure 1 for common terms used in describing coupler components.

NOTE

All dimensions in this specification are in millimeters [with inches in brackets]. They have a decimal tolerance of ± 0.13 [.005] and an angle tolerance of $\pm 2^\circ$ unless otherwise specified.

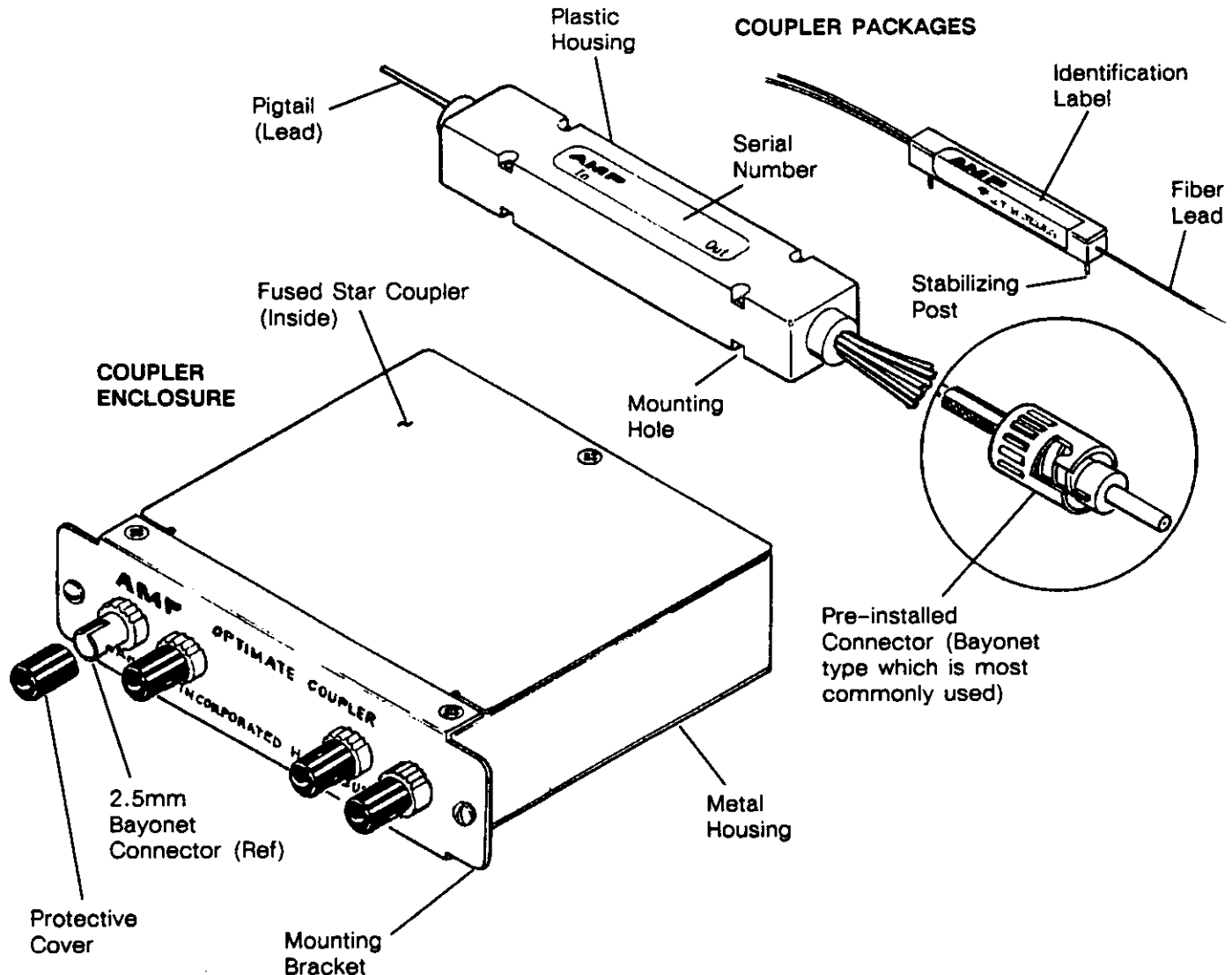


Fig. 1. Product Features

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2. REFERENCE MATERIAL

2.1. Customer Assistance

Reference Part Number 501898-1 and Product Code 7019 are representative numbers that identify AMP OPTIMATE Fiber Optic Multimode Couplers. These numbers are used in the AMP network of customer service to access product application information. This service is provided by your local AMP representative (Field Sales Engineer, Field Application Engineer, etc) or, after purchase, by calling the CUSTOMER HOTLINE number at the top of page 1.

2.2. Engineering Drawings

Customer Drawings for specific products are available from the responsible AMP Engineering Department via the service network. The information contained in the Customer Drawings takes priority if there is a conflict with this specification or with any other technical documentation supplied by AMP Incorporated.

2.3. Product Specifications

AMP Product Specifications provide performance tests for these couplers and the connectors that may be used with them. See Figure 2.

2.4. Instructional Material

AMP Instruction Sheets (IS) are available for termination of the different styles of connectors that may be used with couplers. See Figure 2.

OPTIMATE PRODUCT	PRODUCT SPECIFICATION	INSTRUCTION SHEET
Multimode Couplers	108-1284	None
2.5mm Bayonet Connectors (Ceramic Ferrule)	108-45113	IS 6935
2.5mm Bayonet Connectors (Plastic Ferrule)	108-1204	IS 9464
2.5mm Bayonet Connectors (Stainless Steel)	None	IS 9624
2.5mm Threaded Connectors	108-45111	IS 9263
2.0mm Threaded Connectors	108-45110	IS 9402
FSD* (Fixed Shroud Duplex) Connectors	108-1213	IS 9373
FSMA-I Connectors	None	IS 2969
FSMA-I (Mil-C Version) Connectors	MIL-C-83522/2	IS 9253
FSMA-II	108-45016	IS 2969
Simplex	108-45102	IS 9100

Fig. 2. Supporting Documentation

3. REQUIREMENTS

3.1. Storage

The coupler should be kept in the shipping container until ready for use to avoid over-flexing of leads, and/or inadvertent damage to the housing or pre-installed connectors.

3.2. Characteristics (Figure 3)

NOTE

When ordering or discussing a particular coupler, identify the coupler by the terms and description provided in the following text.

Couplers are categorized as packages which have plastic housings, or enclosures which have metal housings. Each coupler has an N x M configuration ("N" equaling the quantity of input fibers and "M" equaling the quantity of output fibers). They are available with five glass fiber sizes: 50/125 μm, 62.5/125 μm, 85/125/ μm, 100/140 μm, and 205/240 μm.

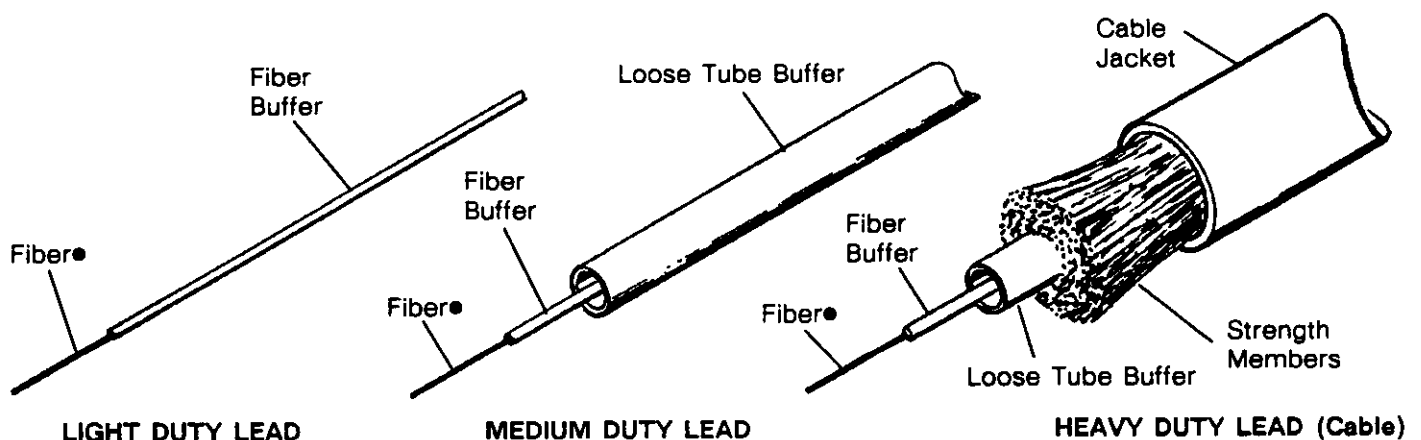
Package couplers are defined with terms such as fiber size, configuration, pigtail (leads), lead length, and connector type. Enclosure couplers are defined with terms such as fiber size, configuration, and connector type.

COUPLER PACKAGE/ENCLOSURE (Size: LxWxH)	COUPLER CONFIGURATION	PIGTAIL (Leads)	STANDARD LEAD LENGTH	CONNECTOR	FIBER SIZE (Core/Cladding)
Miniature Package 53.3x5.8x5.8 [2.1x.23x.23]	up to 8x8	250-μm buffer 500-μm buffer	1.0 m [39.37 in.]	2.5mm Bayonet FSMA-I FSMA-II 2.5mm Threaded 2.0mm Threaded FSD Simplex	50/125 μm 62.5/125 μm 85/125 μm 100/140 μm 205/240 μm
Heavy Duty Package-2 Port 95.5x11.9x9.4 [3.76x.47x.37]	1x2 and 2x2	3.0 mm cable	1.0 m [39.37 in.]		
Heavy Duty Package-Star 107.9x20.3x15.0 [4.25x.80x.59] 134.6x20.8x20.6 [5.30x.82x.81 for 32 ports]	stars larger than 2x2 up to 32x32	500-μm buffer 1.2 mm loose tube	0.5 m [19.69 in.]		
	stars larger than 2x2 up to 16x16	3.0 mm cable	1.0 m [39.37 in.]		
Miniature Metal Enclosure 106.7x100.3x31.7 [4.20x3.95x1.25]	up to 6 total ports	NA	NA		
Compact Metal Enclosure 228.6x127.0x43.2 [9.00x5.00x1.70]	up to 16x16	NA	NA		
Rack Mount Enclosure 483.9x270.3x43.2 [19.05x10.64x1.70] 483.9x270.3x88.2 [19.05x10.64x3.47 for 32 ports]	up to 32x32	NA	NA		

Fig. 3. Characteristics

A. Packages

There are three package sizes: miniature, two-port heavy-duty, and star heavy-duty. Packages designs are available with light duty leads consisting of a buffered fiber, medium duty leads consisting of a buffered fiber with an additional loose tube buffer, and heavy duty leads (cables) consisting of a buffered fiber and a loose tube buffer surrounded by strength members and an outer jacket. See Figure 4. Standard lead lengths are 0.5 m [19.69 in.] and 1.0 m [39.37 in.]. Other lengths can be supplied upon request. See Figure 5 for typical coupler packages.



● Inseparable Core and Cladding

Fig. 4. Leads

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NOTE

Lead strip dimensions, fiber placement, and fiber polishing for each connector type are provided in the instructions packaged with the connector. Instructions for special applications not covered on the instruction sheet are provided in Paragraph 3.6. of this application specification.

1. Miniature Package

The miniature packages are designed for light-duty leads. They feature 4.70 [.185] long posts and are designed to be mounted to pc boards of lesser thickness with tinnerman clips. They can not be heat staked to the panel. Miniature packages may have from 1 to 8 leads (ports) in one or both ends. See Figure 5, View "A" for typical package and mounting dimensions.

2. Two-Port Heavy-Duty Package

These packages are available with medium and heavy duty leads. They feature two leads (ports) at one end and one or two at the other. They can be mounted to panels of any thickness with self-tapping screws. See Figure 5, View "B" for typical package and mounting dimensions.

3. Star Heavy-Duty Package

These packages are available with medium and heavy duty leads. They may have from 1 to 32 leads (ports) in one or both ends. They can be mounted to panels of any thickness with self-tapping screws. See Figure 5, View "C" for typical package and mounting dimensions.

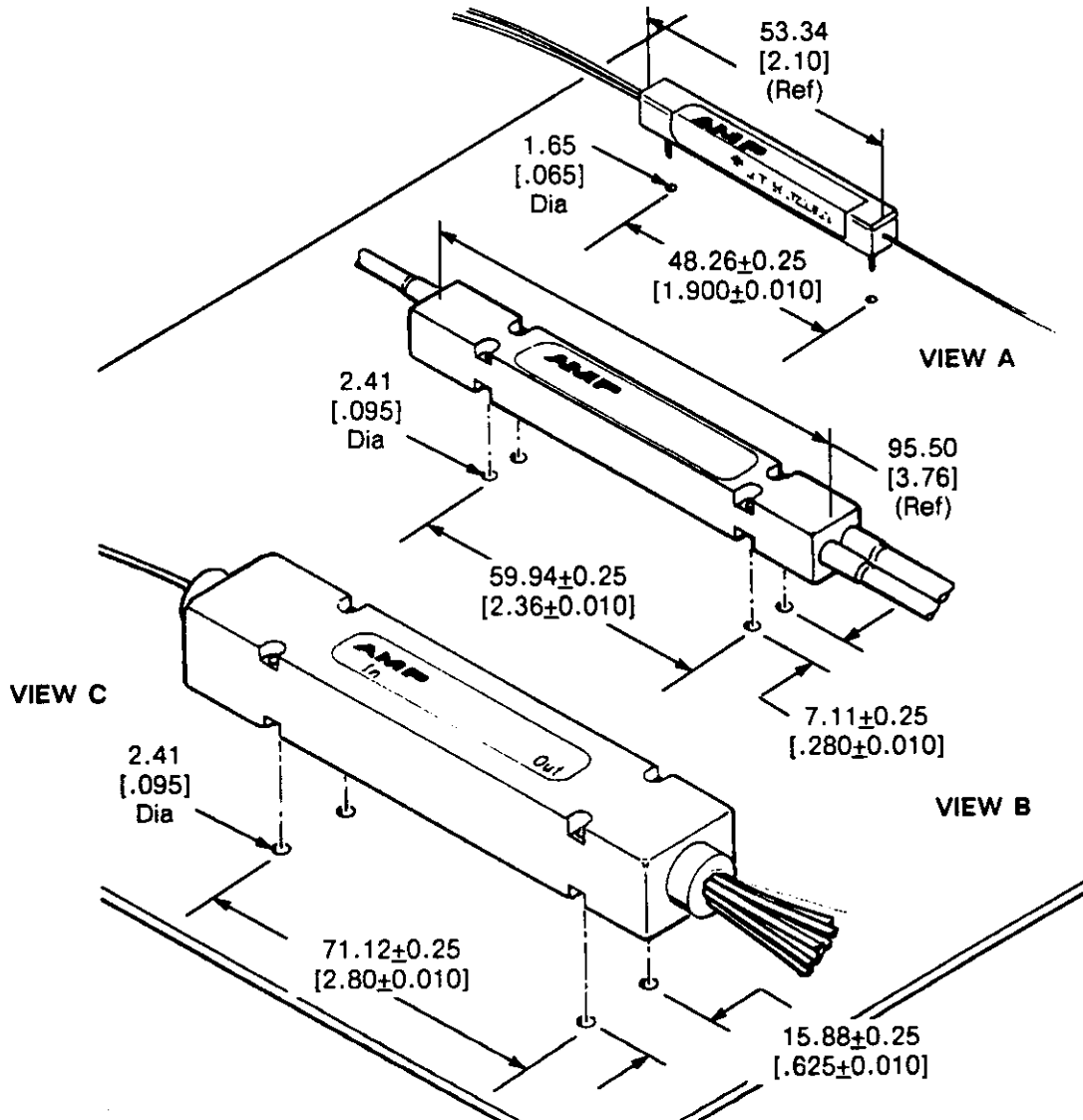


Fig. 5. Coupler Packages

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B. Enclosures

Three types and sizes of enclosures are available: miniature, compact, and rack-mount. Each enclosure has a quantity of connectorized input/output ports. Care must be taken when selecting the location and the mounting position of the enclosure to ensure that there will be access to the connectors.

1. Miniature Enclosure

Miniature enclosures are the smallest in physical size and quantity of ports (6 maximum). They have mounting flanges designed for AMP Wall and Rack Mount Distribution Enclosures, but can be mounted in any panel with space to support them. See Figure 6, View "A" for typical enclosure and mounting dimensions.

2. Compact Enclosure

Compact enclosures are the median size and may accommodate 32 ports (4 x 4 through 16 x 16). They have two 8-32 threaded inserts for mounting them to a panel. See Figure 6, View "B" for typical enclosure and mounting dimensions.

3. Rack-Mounted Enclosure

Rack-mounted enclosures are the largest and may accommodate 64 ports (4 x 4 through 32 x 32). They have mounting flanges at both ends with two holes in each, and are designed for rack and panel mount applications. The flanges can be moved to the back of the enclosure. See Figure 6, View "C" for typical enclosure and mounting dimensions.

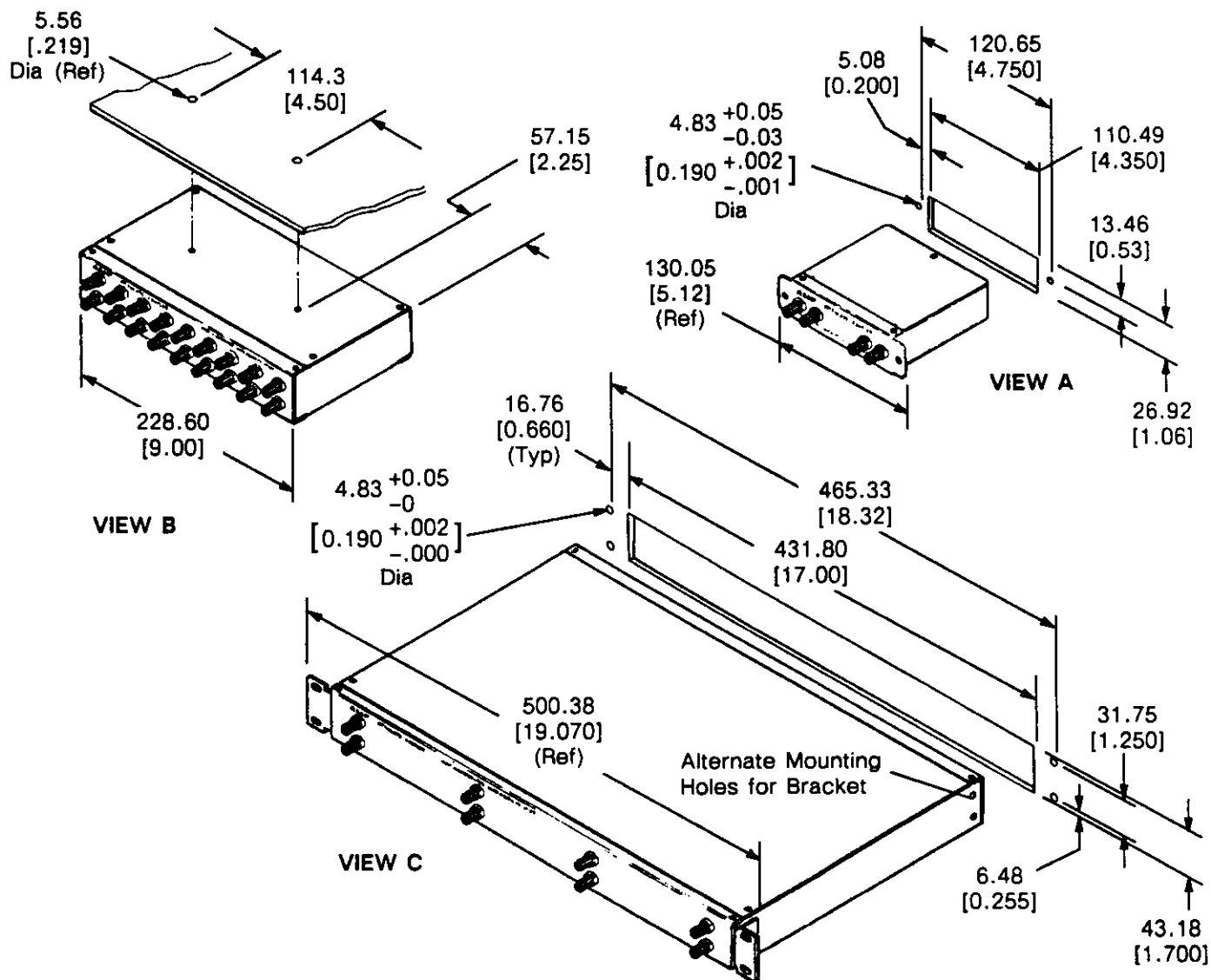


Fig. 6. Coupler Enclosures

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3.3. Insertion Loss and Uniformity Values

A. Unconnectorized Assemblies

The maximum allowable insertion loss and uniformity values in dB for available couplers without connectors are provided in Figure 7.

COUPLER CONFIGURATION	MAXIMUM INSERTION LOSS (dB)	MAXIMUM UNIFORMITY (dB)	COUPLER CONFIGURATION	MAXIMUM INSERTION LOSS (dB)	MAXIMUM UNIFORMITY (dB)
2 x 2	4.0	0.75	1 x 2	4.0	0.5
3 x 3	6.5	1.0	1 x 3	6.0	0.75
4 x 4	8.0	1.0	1 x 4	7.5	1.0
5 x 5	9.0	1.0	1 x 5	8.0	1.0
6 x 6	10.0	1.5	1 x 6	9.0	1.0
7 x 7	11.0	1.5	1 x 7	10.0	1.0
8 x 8	11.5	1.5	1 x 8	11.0	1.0
10 x 10	13.0	2.0	1 x 10	12.0	2.0
12 x 12	14.0	2.0	1 x 12	13.0	2.0
16 x 16	15.5	2.5	1 x 16	15.0	2.0
20 x 20	16.5	3.0	1 x 20	15.5	2.5
24 x 24	17.5	3.0	1 x 24	16.5	2.5
32 x 32	19.0	3.0	1 x 32	18.0	2.5

Fig. 7. Unconnectorized Coupler Loss and Uniformity

B. Connectorized Assemblies

The dB loss for a coupler with connectors is equal to the combined loss for the unconnectorized coupler (Figure 7) and the loss for the connector (Figure 8). The uniformity of a connectorized coupler assembly may change, depending on connector variability.

CONNECTOR	TYPICAL CONNECTOR LOSS (dB)
2.5mm Bayonet - ceramic	0.6 dB
2.5mm Bayonet - stainless steel	
2.5mm Bayonet - plastic	1.0 dB
FSMA-I (905 style)	1.5 dB
FSMA-II (906 style)	
FSMA-I (MIL-C Version)	
Fixed Shroud Duplex (FSD)	0.6 dB
2.5mm Threaded (FC)	0.4 dB
2.0mm Threaded (D4)	
Simplex	1.5 dB

Fig. 8. Connector Loss

3.4. Test and Inspection Report

A test and inspection report is included with each coupler. It provides exclusive identification for the coupler (i.e. part number, coupler/fiber/connector types, serial number, etc). The report gives the dB insertion loss values for each input to output port combination. Each port number on the report corresponds to the labeled numbers on the coupler. The maximum port-to-port loss and uniformity values for the entire matrix are also given. A typical report for a 4 x 4 coupler is shown in Figure 9.

KAPTRON Incorporated, A Subsidiary of AMP Incorporated
 2525 East Bayshore
 Palo Alto, CA 94303

TEST AND INSPECTION REPORT

Customer: Customer	Part Number 502402-3
Your street	Coupler Type ... 4 X 4
Your Place, USA	Fiber Type 62.5/125 um
	Coupler ID 12345678
	Date 1/30/91
Serial # : -1430K0191	Connector Type.. 2.5mm bayonet
	Tested By S. Lorei

Comments: Loss values include 1 connector pair.

PORT TO PORT INSERTION LOSS MATRIX: (dB)

Output	----	Input Port # 1	-----	R/Unif.
Ports:	----		-----	0.4
1-8	7.9 7.6 7.5 7.7			
Output	----	Input Port # 2	-----	R/Unif.
Ports:	----		-----	0.9
1-8	7.9 7.9 7.1 7.0			
Output	----	Input Port # 3	-----	R/Unif.
Ports:	----		-----	0.6
1-8	7.8 7.2 7.8 7.4			
Output	----	Input Port # 4	-----	R/Unif.
Ports:	----		-----	0.4
1-8	7.9 7.6 7.5 7.5			

Overall Uniformity 0.9 dB
 Max Port to Port Loss ... 7.9 dB

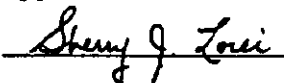
Approved & Passed


Fig. 9. Sample Test and Inspection Report

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3.5. Connectors

Packages and enclosures can be terminated with any of seven standard connector designs: 2.5mm bayonet, FSMA-I (type 905), FSMA-II (style 906), FSD, 2.5mm threaded, 2.0mm threaded, and Simplex. The 2.5mm bayonet connector is the most commonly used connector type. See Figure 10.

CAUTION

Coupler packages can be supplied with terminated leads, or you may purchase the coupler packages and connectors separately to make assemblies as needed. If you choose the latter, detailed instructions for each connector type are packaged with the connector. However, we can not overemphasize the need for the assembly person to be highly trained and skilled in the use of fiber optics. AMP can not accept responsibility for terminations made outside of our facility.

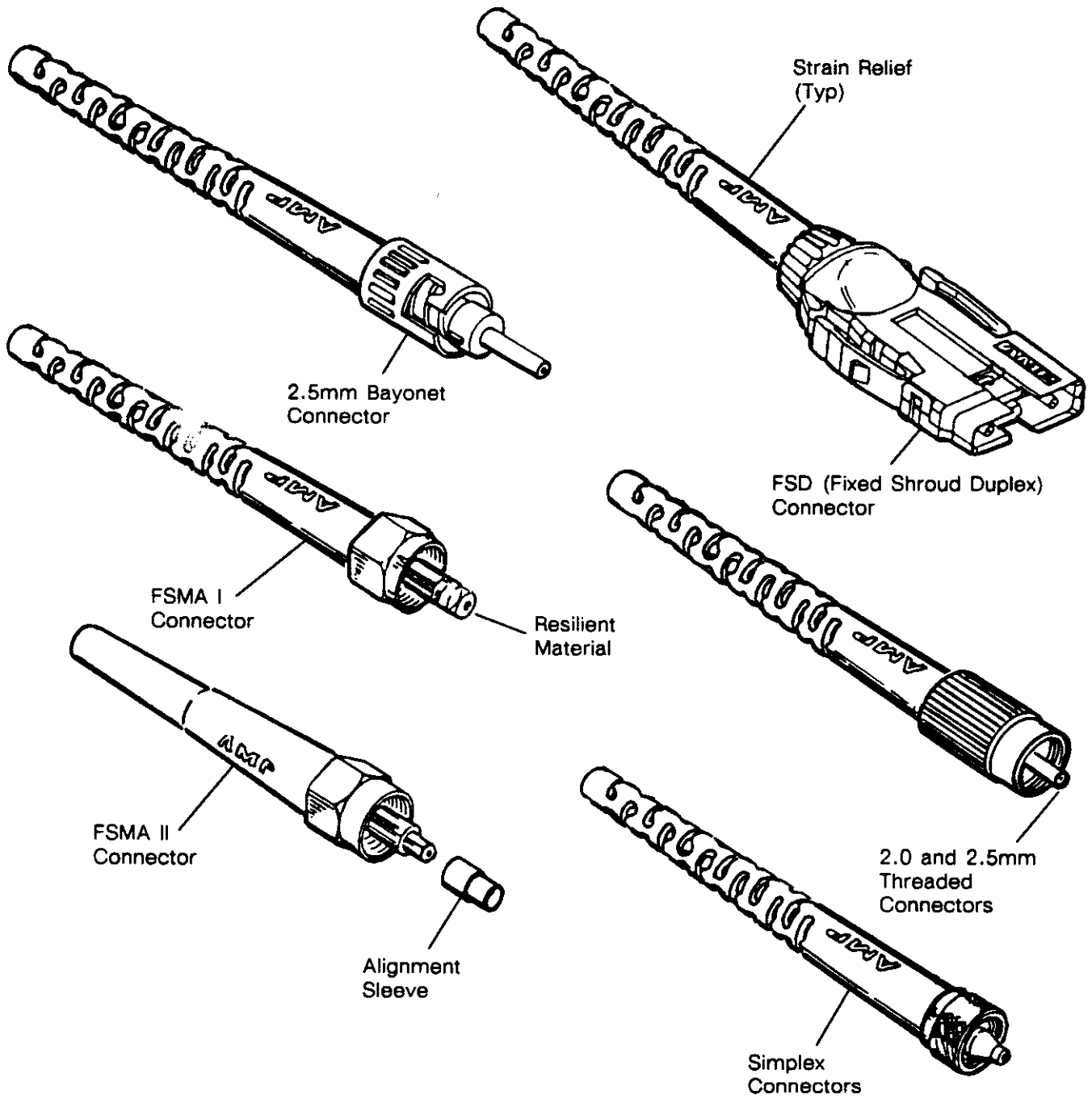


Fig. 10. Connectors

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3.6. Special Assembly Procedures

Procedures for terminating 3 mm loose tube cable and 1.2 mm loose tube buffer leads vary from those used for standard cable assemblies. The procedure for terminating them is the same as described on the instruction sheets packaged with the connectors, except for the stripping and positioning of the lead in the connectors. The procedures that are different from those provided on the instruction sheet are *italicized* in the following subparagraphs A and B.

DANGER

The fiber end must be trimmed after the connector is installed and the epoxy is cured. Fibers can easily penetrate skin if handled improperly. Always wear safety glasses when working with fibers and dispose of cutoff fibers in a safe container. A recommended method of handling a trimmed end is to fold a piece of masking tape over it before removal.

A. 3 mm Loose Tube Lead with Strength Members (See Figure 11)

NOTE

We recommend terminating these leads with 2.5mm Bayonet, FSMA, 2.5mm and 2.0mm Threaded Connectors. If some other type of connector is desired, call the AMP Customer Hotline at the top of page 1 for assistance.

1. Strip the outer jacket and trim the strength members according to the instructions packaged with the connector.
2. *Trim the loose tube buffer, so that it is even with the outer jacket end.*

NOTE

When trimming loose piece buffer be careful not to nick or damage the fiber inside of it.

3. Strip the fiber buffer to the length specified on the instructions packaged with the connector. ***We recommend the use of a chemical stripper to minimize pulling force on the coupler package.***
4. Refer to the instruction sheet packaged with the connector and apply the epoxy on the fiber accordingly.
5. Insert the fiber into the connector and slide the eyelet over the connector support sleeve. Using the instructions packaged with the tool, locate and crimp the eyelet accordingly.
6. ***Carefully and firmly grip the fiber and gently pull it straight out the front of the connector until bottomed.***
7. Continue with the instructions packaged with the connector.

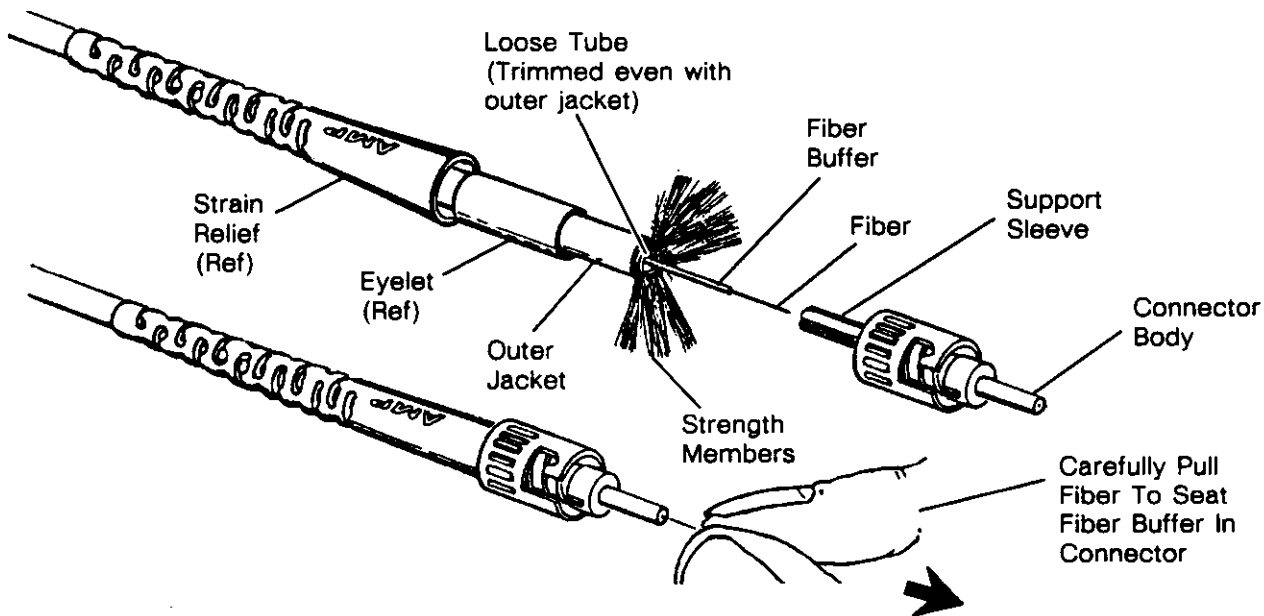


Fig. 11. 3 mm Loose Tube Lead

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B. 1.2mm Loose Tube Buffer with No Strength Members (See Figure 12)

NOTE

We recommend terminating leads of this type with 2.5mm Bayonet and FSMA Connectors. If some other type of connector is desired, call the AMP Customer Hotline at the top of page 1 for assistance.

1. Refer to the instructions packaged with the connector to determine the strip length of the fiber buffer. Trim the loose tube buffer slightly more than the strip length specified for the fiber buffer.

NOTE

When trimming loose piece buffer be careful not to nick or damage the fiber inside of it.

2. Strip the fiber buffer to the specified length. We recommend the use of a chemical stripper to minimize pulling force on the coupler package.

NOTE

The loose tube buffer must be short enough to allow the fiber buffer to seat in the connector and long enough that the loose tube buffer itself will start entry into the connector support sleeve.

3. Refer to the instruction sheet packaged with the connector and apply the epoxy on the fiber accordingly.
4. Insert the fiber into the connector ferrule and the loose tube buffer into the connector support sleeve. Then carefully and firmly grip the fiber and gently pull it straight out the front of the connector ferrule until bottomed.
5. Make sure the fiber remains bottomed in the connector ferrule while the epoxy (applied in Step 3) cures.
6. Continue with the instructions packaged with the connector.

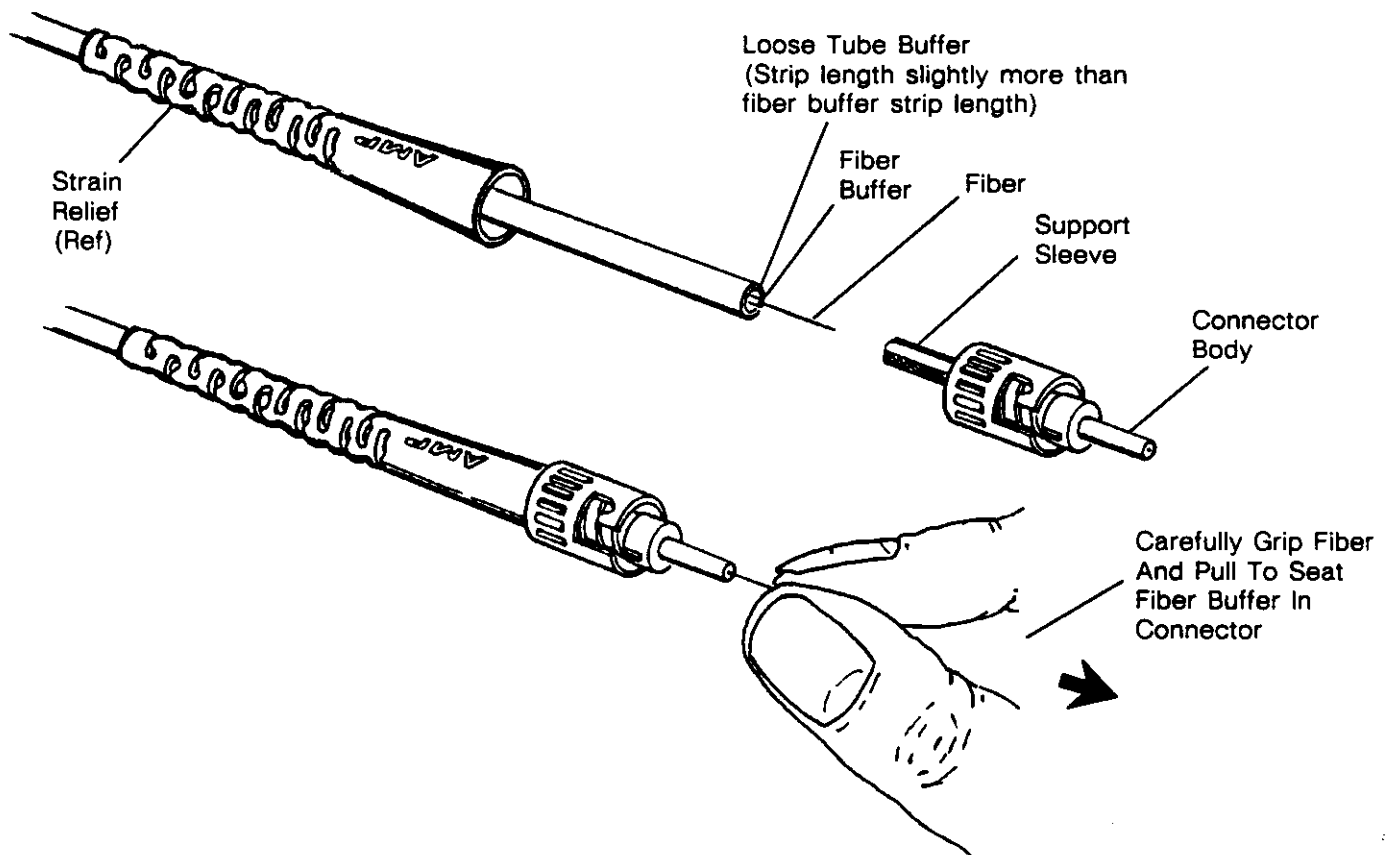


Fig. 12. 1.2 mm Loose Tube Buffer

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3.7. Mounting Hardware for Couplers

The smallest coupler package has stabilizing posts that are designed to be held in place with a commercially available tinnerman clip. All other plastic couplers can be mounted with commercially available hardware such as self-tapping screws, machine screws and nuts, rivets, or other suitable hardware.

The coupler enclosures with mounting flanges can be secured to a panel with commercially available machine screws and nuts, rivets, or other suitable hardware. The compact metal enclosures with threaded inserts are secured to mounting panel with 8-32 machine screws. See Figure 13.

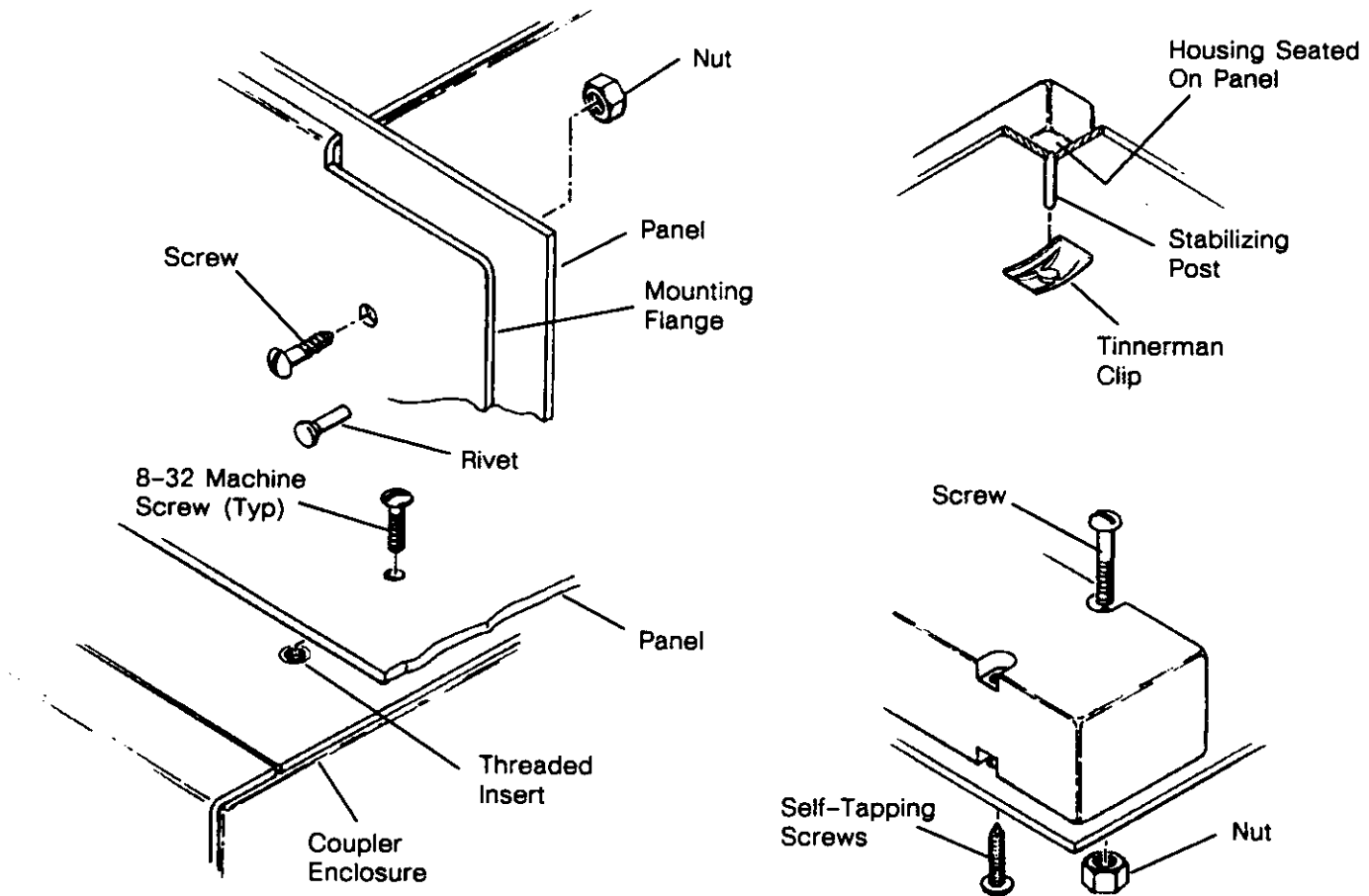


Fig. 13. Mounts

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3.8. Fiber Bend Radius

Fibers can be formed into a rather tight circle without damage; however, bends can increase attenuation and decrease tensile strength. We recommend that bend radius should be no less than 10 times the lead diameter.

3.9. Pigtail Identification Labels

Labels are attached to all pigtails with more than one input or output lead. The labels will correspond with the coupler port number specified on the coupler test and inspection report referenced in Figure 9.

4. TOOLING

The only tooling needed to install couplers is that which is needed to secure the hardware to the panel. If installing connectors to coupler packages, refer to the instructions packaged with connectors for application tooling.

5. VISUAL AID

The following illustration shows typical applications of AMP OPTIMATE Multimode Fiber Optic Couplers and calls out the conditions that production personnel should check to ensure a good installation. For dimensional inspection, refer to the details in the preceding pages of this specification.

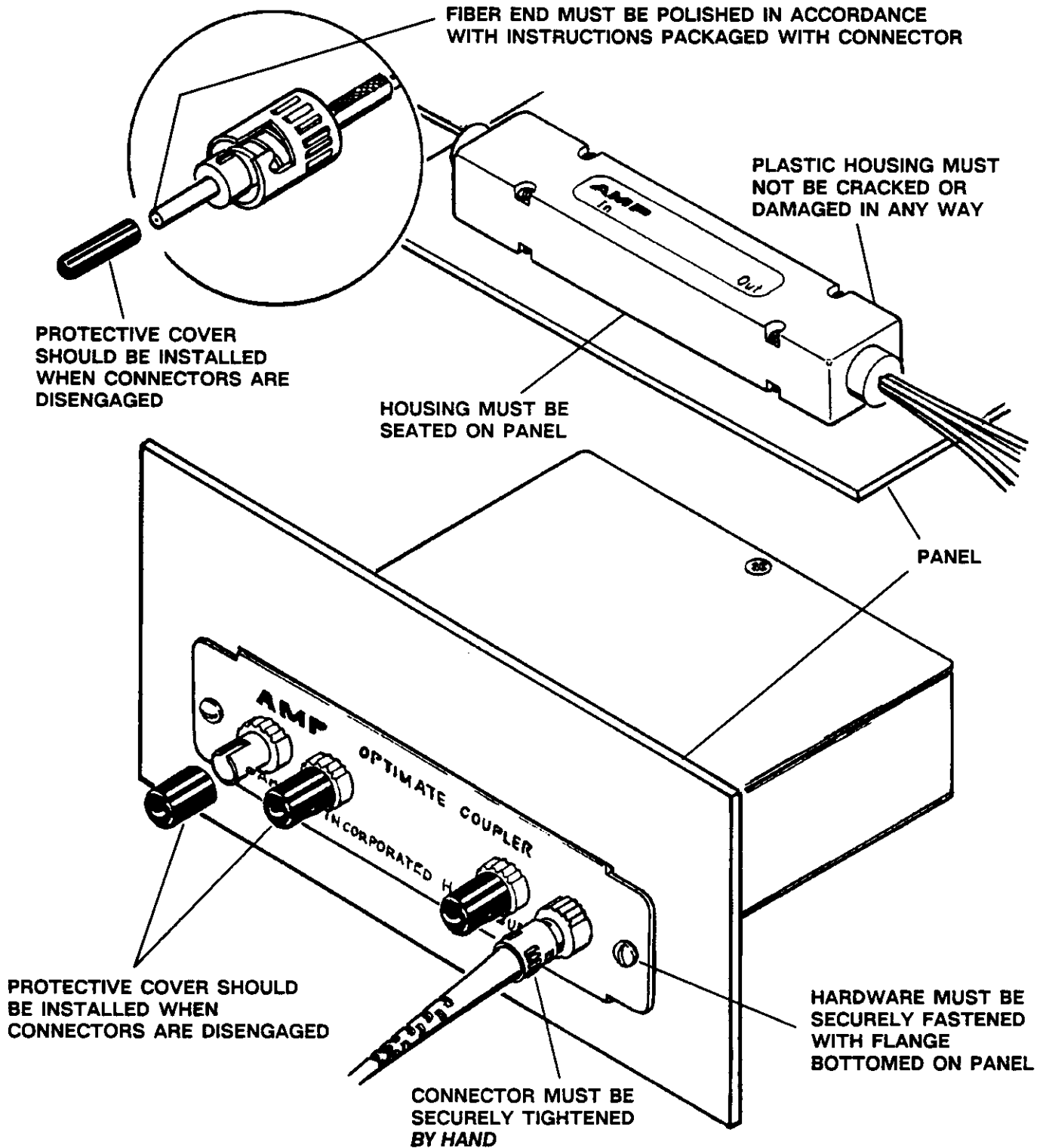


FIG. 14. VISUAL AID