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MILITARY STANDARD

FIBER OPTIC TOPOLOGY INSTALLATION STANDARD METHODS FOR NAVAL SHIPS (TESTS)

(PART 6 OF 6 PARTS)

AMSC N/A AREA GDRQ

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FOREWORD

DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND
WASHINGTON, DC 20362-5101

1. This Military Standard is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 05Q42, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

3. This standard provides detailed information and guidance to personnel concerned with the installation of fiber optic topologies on Naval surface ships and submarines. The methods specified herein are not identifiable to any specific ship class or type, but are intended to standardize and minimize variations in installations to enhance the compatibility of the fiber optic topologies of all Naval ships.

4. In order to provide flexibility in the use and update of the installation methods, this standard is issued in seven parts; the basic Standard and six numbered parts as follows:

Part 1 Cables
Part 2 Equipment
Part 3 Cable Penetrations
Part 4 Cableways
Part 5 Connectors and Interconnections
Part 6 Tests

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CONTENTS

1. SCOPE

1.1 Scope. This standard provides detailed methods for testing fiber optic topology (see 3.2) installations.

1.1.1 Applicability. These procedures apply to fiber optic cables, connectors and splices and shall be performed during the installation phases specified. Where there is a conflict between this document and the ship specification or contract, the ship specification or contract shall take precedence. Where ship design is such that the methods herein cannot be implemented, users shall submit new methods or modifications to existing methods to NAVSEA 06KR22 for approval prior to implementation.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

MILITARY

MIL-S-24623/4 - Splice, Fiber Optic, Housing, Fiber.

MIL-C-28876 - Connectors, Fiber Optic, Circular, Plug and Receptacle Style, Multiple Removable Termini, General Specification for.

MIL-T-29504 - Termini, Fiber Optic Connector, Removable, General Specification for.

MIL-C-83522 - Connectors, Fiber Optic, Fixed Single Terminus, Shipboard, General Specification for.

MIL-C-85045 - Cable, Fiber Optic, Shipboard, (Metric) General Specification for.

STANDARDS

MILITARY

DOD-STD-2196 - Glossary, Fiber Optics.

MIL-STD-2042-1 - Fiber Optic Topology Installation Standard Methods for Naval Ships (Cables).

MIL-STD-2042-2 - Fiber Optic Topology Installation Standard Methods for Naval Ships (Equipment).

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Ave, Philadelphia, PA, 1911-5094.)

2.2 Order of precedence. In the event of a conflict between the text of this standard and the references cited herein, the text of this standard shall take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

3.1 General fiber optics terms. Definitions for general fiber optics terms used in this standard are in accordance with DOD-STD-2196. Definitions for other terms as they are used in this standard are given in the following paragraphs.

3.2 Fiber optic topology. The fiber optic topology consists of fiber optic interconnection boxes, trunk and local cables and the connectors and splices used to interconnect the trunk and local cables.

3.3 Concatenated optical link. A concatenated optical link is a link made up of two or more individual cable assemblies connected together in series.

3.4 Trunk cable. A trunk cable is a fiber optic cable that provides a continuous optical path between interconnection boxes. Typically, trunk cables are run in the main cableways and have higher fiber counts per cable than local cables.

3.5 Local cables. A local cable is a fiber optic cable that provides a continuous optical path between an end user equipment and an interconnection box, and is typically not run through the main cableways.

3.6 Optical fiber cable component (OFCC). An OFCC is a buffered fiber augmented with a concentric layer of strength members and an overall jacket.

4. GENERAL REQUIREMENTS

4.1 Test methods. The test methods identified in this standard shall be used to verify the proper operation and performance of the components that make up the fiber optic topology (see 3.2). These tests shall be performed during various phases of installation of the topology, as described in the following paragraphs.

4.1.1 Acceptance tests. Fiber optic cable and associated components shall undergo visual inspection and testing upon receipt at the shipyard. The cable shall be tested while still on the shipping reel to ensure that it is mechanically and optically sound. The associated fiber optic components shall be subjected to visual examination only.

4.1.2 Pre-Installation tests. Visual inspection and testing of the cable shall be conducted just prior to installation in the cableways to verify that it is still mechanically and optically sound.

4.1.3 Installation tests. After the cable is installed in the cableways, the pre-installation tests shall be repeated to verify that fibers were not broken or damaged when the cable was pulled through the cableways. Additional testing shall be conducted subsequent to installation of connectors or splices to ensure that the optical losses induced by these components are within acceptable limits and that the continuity of each fiber between interconnection devices has been maintained.

4.1.4 Post-Installation tests. After all fiber optic topology links have been installed, tests shall be conducted to verify that the end-to-end attenuation of the topology is within acceptable limits.

4.2 Test equipment. The following paragraphs discuss optical test equipment in general terms only. The specific equipment to be used for each test is identified in the individual test methods of section 5.

4.2.1 Optical time domain reflectometer (OTDR). The OTDR is used for :

a. Estimating the attenuation rate of a fiber;

b. Measuring insertion losses in an optical link;

c. Identifying the nature and location of defects in an optical link.

4.2.2 Optical power meter and stabilized light source. The optical power meter and stabilized light source (e.g. portable light, light emitting diode (LED) or laser diode) are used together to make accurate optical transmission loss measurements. Test jumpers are used to couple light from the stabilized source to the optical link under test, and from the fiber path to the power meter. It is imperative that these test jumpers contain the same type of fiber and connectors as the optical link.

4.2.3 Optical loss test set (OLTS). The OLTS combines the optical power meter and stabilized light source (see 4.2.2) into a single unit. The OLTS displays the transmission loss directly by comparing the transmitted optical power level with the optical power level received through the optical link under test.

4.2.4 Optical talk set. The optical talk set is used to establish two-way voice communication over an optical fiber. The talk set can be used to verify optical link continuity and to expedite other tests.

4.2.5 Test jumpers. Test jumpers are required for connecting cable assemblies to test equipment. Typical test jumper configurations are shown in table I. Cable assembly cables shall be in accordance with MIL-C-85045. Terminations shall be in accordance with the following:

a. Single terminus (light duty) connector, MIL-C-83522/16

b. Multiple terminus (heavy duty) connector, MIL-C-28876

c. Connector terminus, MIL-T-29504/14 or /15

d. Splice ferrule, MIL-S-24623/4

The test jumpers used in conjunction with an OTDR should be long enough (typically 165 feet (50 meters)) to compensate for the inability of the OTDR to make accurate measurements on short lengths (less than 165 feet (50 meters)) of fiber.

TABLE I. Test jumper configurations.

CONFIGURATION	TERMINATION TYPE	LENGTH (min) (m)	CABLE TYPE M85045/	TERMINATION 1	TERMINATION 2
A	ST/ST	1	16-01	M83522/16-DNX	M83522/16-DNX
B	ST/SPLICE FERRULE	1	16-01	M83522/16-DNX	M24623/4-01
C	ST/2 CH PLUG	1	15-01	M83522/16-DNX	M28876/7 A12P1M
D	ST/2 CH RECEPT	1	15-01	M83522/16-DNX	M28876/12 A12S1M

TABLE I. Test jumper configurations - continued.

CONFIGURATION	TERMINATION TYPE	LENGTH (min) (m)	CABLE TYPE M85045/	TERMINATION 1	TERMINATION 2
E	ST/4 CH PLUG	1	15-01	M83522/16-DNX	M28876/7 B12P1M
F	ST/4 CH RECEPT	1	15-01	M83522/16-DNX	M28876/12 B12S1M
G	ST/8 CH PLUG	1	13-01	M83522/16-DNX	M28876/7 C11P1M
H	ST/8 CH RECEPT	1	13-01	M83522/16-DNX	M28876/12 C11P1M
I	ST/ST LONG	50	16-01	M83522/16-DNX	M83522/16-DNX
J	ST/SPLICE FERRULE	50	16-01	M83522/16-DNX	M24623/4-01
K	ST/PIN TERMINUS	50	16-01	M83522/16-DNX	M29504/14-01MLC
L	ST/SOCKET TERMINUS	50	16-01	M83522/16-DNX	M29504/15-01MLC
M	ST/BARE FIBER	50	16-01	M83522/16-DNX	N/A

4.2.6 Bare fiber adapters. Bare fiber adapters are required for connecting cables that do not have connectors installed to test equipment. Typically, a bare fiber adapter will have a MIL-C-83522 compatible connector on one end and a holding mechanism for stripped fiber on the other end.

4.3 Test procedures. The following paragraphs discuss test procedures in general terms only. Detailed, step-by-step procedures are presented in paragraph 5.

4.3.1 Visual inspections. In most cases, visual inspections for mechanical damage are accomplished with the naked eye without using a magnifier. In those instances where magnification is required, this requirement is clearly stated in the applicable test procedure.

4.3.2 Cable continuity test. The cable continuity test is a simple test to verify that there is no major damage to or breakage of a fiber. This test can be accomplished with any portable light source, such as a flashlight, or with the optical talk set.

4.3.3 Cable attenuation test. The cable attenuation test quantifies the attenuation of an optical signal over a particular cable length. The attenuation test is intended to be used for testing cables that have no terminations installed, or cables with terminations on only one end, and is performed using an OTDR.

4.3.4 Cable assembly link loss test. The cable assembly link loss test is used to measure the optical losses associated with connectors and splices in an optical link; and to demonstrate that the end-to-end attenuation of a cable assembly is within acceptable limits. The link loss test shall be performed using an optical power meter and stabilized light source, or an OLTS.

4.3.5 Cable topology end-to-end attenuation test. The cable topology end-to-end attenuation test is used to measure the attenuation over a series of concatenated optical links (see 3.3). Typically, this test is performed after interconnection of topology local and trunk cables, and measures the attenuation from one local cable equipment interface to the other. The end-to-end attenuation test shall be performed using an optical power meter and stabilized light source, or an OLTS.

4.4 Safety precautions. The following safety precautions apply:

a. Observe all written safety precautions given in the test procedures of this standard.

b. Observe all warning signs on equipment and all written safety precautions included in the equipment instruction manual.

c. The classification of a laser is based on the ability of the optical beam to cause damage to the eye. Under normal operating conditions, an optical fiber communication system (OFCS) is inherently an eye safe system; but, when an optical fiber connection is broken and optical viewing instruments are used, it is possible that hazardous energy can enter the eye. For this reason four service group hazard classes have been devised to indicate the degree of hazard and required hazard control measures. Refer to ANSI Z136.2 for a full technical definition. The following laser safety precautions shall apply:

(1) Ensure personnel are familiar with the laser degree of hazard and the required control measures.

(2) Light generated by light emitting diodes (LED's) and laser diodes may not be visible but is still hazardous to the unprotected eye. Never look into the end of an optical fiber connected to an LED or laser diode and do not examine or stare into broken, severed or disconnected optical cables.

(3) When access panels or doors are removed or opened and the critical viewing distance could exceed 39 inches (100 cm), use means to contain the beam to preclude exposure of nearby personnel.

(4) Do not view the primary beam or a specular reflection from an OFCS with an optical microscope, eye loupe or other viewing instrument. The instrument may create a hazard due to its light gathering capability.

d. Always handle cable carefully to avoid personal injury. The ends of optical fibers are extremely sharp and can lacerate or penetrate the skin or cause permanent eye damage if touched. If the fiber penetrates the skin, it most likely will break off, in which case the extraction of the fiber should be performed by trained medical personnel to prevent further complications.

e. Wash hands after handling bare fibers or performing fiber terminations.

f. Observe all warning signs when handling solvents and epoxies. Become familiar with the first aid instructions for these agents.

5. DETAILED REQUIREMENTS

5.1 Acceptance tests. The acceptance test shall be conducted on all components upon receipt in the yard.

5.1.1 Cable. The tests to be performed on incoming cables will be determined by the cable configurations as follows:

a. Visual inspection, Method 6A1 - all cables

b. Cable attenuation test, Method 6B1 - cables greater than 165 feet (50 m) in length and either without connectors or splice ferrules installed, or with connectors or splice ferrules installed on only one end.

c. Cable assembly link loss test, Method 6C1 - cables with connectors or splice ferrules installed on both ends and all cables less than 165 feet (50 m) in length.

5.1.2 Connectors, splices, and interconnection boxes. All components shall be subjected to the visual inspection of Method 6A1.

5.2 Pre-Installation tests. The pre-installation tests shall be performed just prior to installation of the components on the ship.

5.2.1 Cable. The tests to be performed will be determined by the cable configuration as follows:

a. Visual inspection, Method 6A1 - all cables

b. Cable continuity test, Method 6D1 - all cables

5.2.2 Connectors, splices, and interconnection boxes. All components shall be subjected to the visual inspection of Method 6A1.

5.3 Installation tests. The installation tests shall be performed just after components are installed on the ship.

5.3.1 Cable. The installation tests will be performed in two phases, as follows:

a. Phase 1 - Immediately after the cable is installed in the cableways, repeat the visual inspection, Method 6A1, and the cable continuity test, Method 6D1, on all cables, both terminated and unterminated.

b. Phase 2 - After installation of connectors or splices on the cable such that the cable is terminated on both ends, perform the cable link loss test, Method 6C1.

5.3.2 Connectors, splices, and interconnection boxes. All components shall be subjected to the visual inspection of Method 6A1.

5.4 Post-Installation tests. The post installation tests shall be performed on each link of the fiber optic topology immediately after the link is configured, and shall consist of a visual inspection, Method 6A1 for cables and associated components, and a cable topology end-to-end attenuation test, Method 6E1.

5.5 Test jumper cable selection tests. Before placing test jumper cables into use, they shall be tested in accordance with Method 6F1 and separated into matched sets accordingly. The cables will be marked such that each cable can be readily identified as belonging to a particular set so as to prevent intermixing of cables between sets. This will ensure more accurate readings and repeatability of test measurements over sustained periods of testing.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

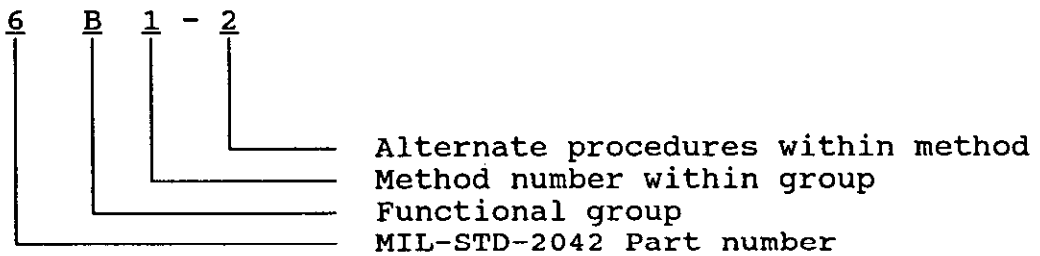
6.1 Intended use. The methods for testing depicted in this standard are intended to ensure the fiber optic topology is properly installed during and after each phase of installation procedures.

6.2 Issue of DODISS. When this standard is used in acquisition, the applicable issue of DODISS must be cited in the solicitation (see 2.1.1).

6.3 Standard method designation. To simplify the usage of this standard, an alpha-numeric designation system was developed to identify and locate a given method. The methods were grouped together by function as follows:

Group A: Visual inspection.
B: Cable attenuation test.
C: Cable assembly link loss test.
D: Cable continuity test.
E: Cable topology end-to-end attenuation test.
F: Test jumper cable selection test

Then the designation system was completed as follows:



Thus, method 6B1-2 identifies the second alternate procedure within method 1 of group B in Part 6 (MIL-STD-2042-6) of MIL-STD-2042.

6.4 Subject term (key word) listing.

Optical power budget
Acceptance tests
Pre-installation tests
Installation tests
Post-installation tests
Visual inspections
Cable continuity test

Cable attenuation test
Cable assembly link loss test
Cable topology end-to-end attenuation test
Safety procedures
Test jumper cable assembly test

Preparing activity:
NAVY - SH
(Project GDRQ-N133)

METHOD 6A1

VISUAL INSPECTION OF FIBER OPTIC COMPONENTS

1. SCOPE.

1.1 Scope. This method describes a procedure for a visual inspection of fiber optic cables and associated topology components.

2. REQUIRED EQUIPMENT AND MATERIALS.

2.1 Safety glasses are required if bare fibers are present.

3. PROCEDURES.

3.1 Safety summary. The following safety precautions shall be observed:

a. Safety glasses shall be worn when handling bare fibers.

b. Do not touch ends of fibers as they may be razor sharp. Wash hands after handling fiber.

3.2 Procedure I. Cable inspection.

NOTE: During handling, cable shall be protected from kinks, twists, crushing, and sharp bends. (More detailed handling procedures are given in Part 1 of this standard.)

Step 1 - Examine documentation to ensure that cable conforms to the requirements of MIL-C-85045 (Acceptance Test only).

Step 2 - Examine cable for the following: (Note: For cable on a reel, examine that portion that can be seen without removing cable from the reel.)

a. Damage - cuts, burnt areas, abrasions, holes, roughened areas, bulges, thin spots, kinks, or wrinkles.

b. Marking - As a minimum, the part number, manufacturer's identification, the words "fiber optic cable", and a four-digit date code (Acceptance Test only).

c. Color code - OFCC jacket colorations should be easily discernable.

3.3 Procedure II. Connector, splice and interconnection box inspection.

Step 1 - Examine documentation to ensure that components conform to the requirements of applicable Military Specifications.

Step 2 - Examine components for the following:

a. Damage - missing or loose parts, dents, cracks, chips, burrs, or peeling or chipping of plating or finish.

b. Marking - As a minimum, part number, manufacturer's identification, and numbering of input/output ports of couplers (Acceptance Test only).

Step 3 - Place component in storage or install, as required.

METHOD 6B1

CABLE ATTENUATION TEST

1. SCOPE.

1.1 Scope. This method describes procedures for performing cable attenuation test on cables 165 feet (50 m) or greater in length and either without connectors or terminations of any type, or with connectors or other terminations installed on only one end.

2. REQUIRED EQUIPMENT AND MATERIALS.

2.1 The equipment and materials in the tables located in the applicable sections of this method shall be used to perform these procedures.

3. PROCEDURES.

3.1 Safety summary. The following safety precautions shall be observed:

a. Safety glasses shall be worn when handling bare fibers.

b. Do not touch ends of fibers as they may be razor sharp. Wash hands after handling fiber.

c. Observe warnings and cautions on equipment and materials.

d. Never look into the end of a fiber connected to a laser source or LED.

3.2 Procedure I. Cable and fiber preparation for test.

3.2.1 The equipment and materials in table 6B1-I shall be used to perform this procedure.

TABLE 6B1-I. Equipment and materials.

DESCRIPTION	QUANTITY
Safety glasses	1
Cable jacket stripping tool (AT&T Comcode 105-114-581 or equal)	1
Kevlar shears (Clauss 86 1/2S or equal)	1
Ruler	1

TABLE 6B1-I. Equipment and materials - continued.

DESCRIPTION	QUANTITY
OFCC strip tool (AT&T Comcode 104-278-478, P/N 700A or equal)	1
Buffer strip tool (K-Miller Tools F/O 103S or equal)	1
Cleaver (AT&T Comcode 103-808-770, P/N 975A or equal)	1
Alcohol bottle with alcohol/2-propanol or equal (sealable type)	1
Wipes (TEXWIPE TX404T or equal)	As required
Canned air (Fisher Scientific Co. Cat. No. 15-232-20 or equal)(or compressed air)	As required

NOTE: During handling, cable shall be protected from kinks, twists, crushing, and sharp bends. (See Part 1 of this standard for more detailed cable handling procedures.)

Step 1 - Using cable stripper, remove approximately 12 inches (305 mm) of outer jacket from unterminated end of cable.

CAUTION: Do not cut or nick OFCC jackets.

Using kevlar shears, carefully remove kevlar strength members and cut off exposed central member, if present.

Step 2 - Remove water blocking material and clean OFCC's with wipe dampened with alcohol and blow dry with air.

Step 3 - Measure and mark OFCC cable jacket approximately 2 inches (50 mm) from end. Using OFCC stripper, remove jacket back to mark.

Step 4 - Separate kevlar strands from buffered fiber and trim strands back to jacket end using kevlar shears.

Step 5 - Measure and mark buffer approximately 1 inch (25 mm) from end.

WARNING: Wear safety glasses when removing buffer to avoid possible eye injury.

Using buffer stripper, remove buffer back to mark. (NOTE: Remove buffer in small sections (approximately 1.5 inch (38 mm)) at a time.)

Step 6 - Remove fiber coating with wipe dampened with alcohol, wiping from end of buffer toward end of fiber, and blow dry with air.

Step 7 - Using one short light stroke with cleaving tool, score fiber close to mark of step 5 above. (NOTE: Do not break fiber with tool.) Pull off fiber with a gentle straight pull. Re-examine. Repeat steps 3 through 7 as required.

Step 8 - Repeat steps 1 through 7 above for all OFCC's in cable bundle.

Step 9 - Repeat steps 1 through 8 above for other end of cable, if no terminations have been previously installed.

3.3 Procedure II. Method 6B1-1 Cable attenuation test for cables 165 feet (50 m) or greater in length.

3.3.1 The equipment and materials in table 6B1-II shall be used to perform this procedure.

TABLE 6B1-II. Equipment and materials.

DESCRIPTION	QUANTITY
Safety glasses	1
Test jumper (Configuration M of table I in this part of this standard)	As required
Bare fiber adapters	As required
Calibration cable (known length greater than 100 meters)	1
Optical time domain reflectometer (OTDR) (Tektronix mainframe TEKTFP2 or equal)	1

TABLE 6B1-II. Equipment and materials - continued.

DESCRIPTION	QUANTITY
Alcohol bottle with alcohol/2-propanol or equal (sealable type)	1
Wipes (TEXWIPE TX404T or equal)	As required
Canned air (Fisher Scientific Co. Cat. No. 15-232-20 or equal)(or compressed air)	As required

NOTES: 1. These procedures were developed from EIA/TIA-455-60 (FOTP 60) "OTDR MEASUREMENT OF FIBER OR CABLE ATTENUATION USING AN OTDR."

2. Ensure test equipment calibration is current.

3. Use wipe dampened with alcohol to clean all adapters/connectors and blow dry with air before making connections.

Step 1 - **WARNING:** Do not look into the end of a fiber connected to an LED or laser diode. Light may not be visible but can still damage the eye.

Following OTDR manufacturer's instructions, energize OTDR. If cable group index is not known, proceed to step 2. If group index is known, proceed to step 9.

Step 2 - Install proper optical module (wavelength and fiber type) in OTDR. Connect calibration cable to OTDR.

Step 3 - Enter required parameters, except group index, from vendor's data in accordance with the OTDR manufacturer's instructions.

Step 4 - Adjust and place cursor at beginning of trace to obtain distance coordinate z_1 (see figure 6B1-1).

Step 5 - Place second cursor at end of trace to obtain distance coordinate z_2.

Step 6 - Adjust group index scale until difference (z_2-z_1) equals length of calibration cable.

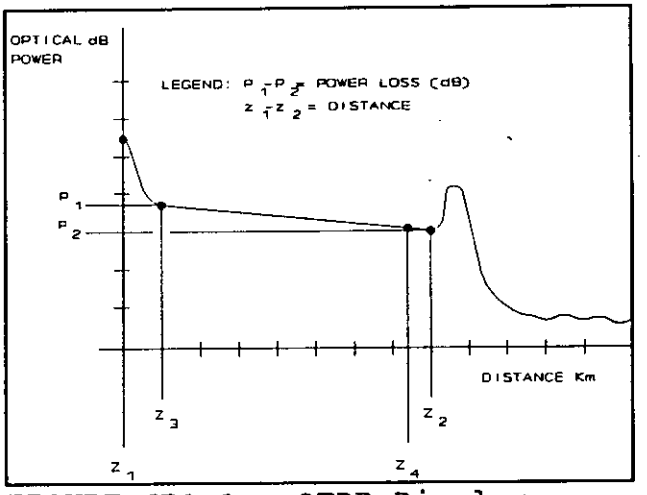


FIGURE 6B1-1. OTDR Display - (typical).

Step 7 - Disconnect calibration cable from OTDR.

Step 8 - Identify applicable test cable configuration (see table I in this part of this standard) and select appropriate test jumper or adapter from table 6B1-III. Connect cable under test to OTDR using applicable view on figure 6B1-2.

TABLE 6B1-III. Test jumpers and adapters.

TERMINATION TO BE CONNECTED TO OTDR	REQUIRED JUMPER CONFIGURATION	APPLICABLE VIEW FIGURE 6B1-2
Bare fibers	N/A	1
M83522	A	2
M24623	B	3
M28876 2 CH PLUG	C	4
M28876 2 CH RECEPT	D	4
M28876 4 CH PLUG	E	4
M28876 4 CH RECEPT	F	4
M28876 8 CH PLUG	G	4
M28876 8 CH RECEPT	H	4

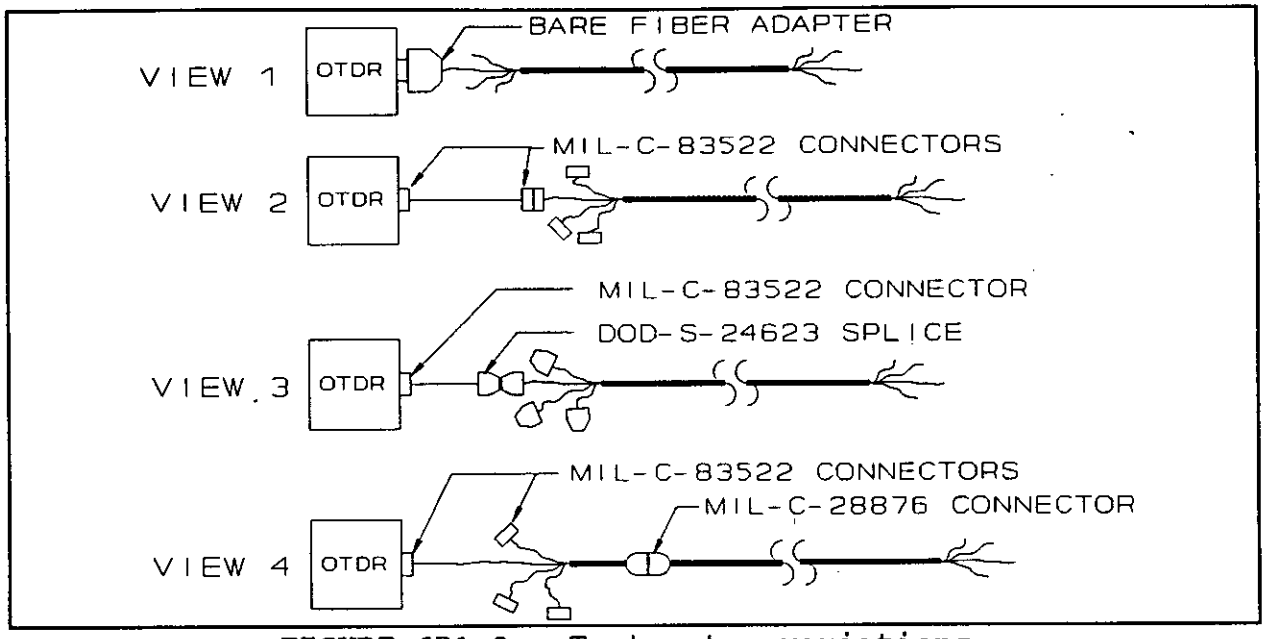


FIGURE 6B1-2. Test setup variations.

Step 9 - Adjust and place cursor at beginning (z_1) and end (z_2) of trace (see figure 6B1-3). Record fiber length and confirm that measured length matches length of cable under test.

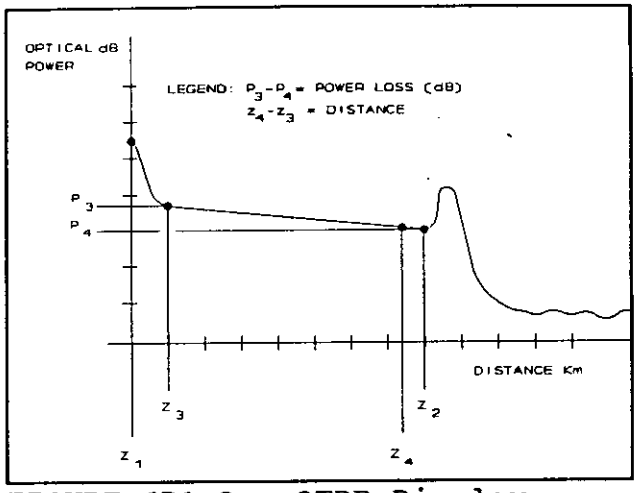


FIGURE 6B1-3. OTDR Display - (typical).

Step 10 - Adjust and place cursor at beginning (z_3) and end (z_4) of linear portion of trace (see figure 6B1-3). Record attenuation in dB. Calculate attenuation (B) in dB/km using the following equation:

$$B = \frac{P_3 - P_4}{z_4 - z_3}$$

Step 11 - Repeat steps 11 and 12 above for all fibers in cable.

Step 12 - Disconnect cable under test from OTDR and connect opposite end of cable under test to OTDR.

Step 13 - Repeat steps 9 through 12 for all fibers in cable.

Step 14 - Cable is considered satisfactory if maximum measured loss for each fiber does not exceed vendor's loss data by greater than 1 dB/km, or maximum allowable attenuation specified in applicable component specification. (NOTE: If maximum measured loss for a fiber exceeds the above values or if loss data measured from both directions does not agree within 0.5 dB/km, the cable may have been damaged.)

Step 15 - If cable is not going to be installed in cableways within 48 hours, end seal in accordance with Method 1A1 in Part 1 of this standard.

METHOD 6C1

CABLE ASSEMBLY LINK LOSS TEST

1. SCOPE.

1.1 Scope. This method describes procedures for performing a cable assembly link loss test on cables that have connectors or other terminations installed on both ends. (NOTE: It may be necessary to install temporary connectors on cables to perform this test (see 5.1.1 of this Part).)

2. REQUIRED EQUIPMENT AND MATERIALS.

2.1 The equipment and materials in the tables located in the applicable sections of this method shall be used to perform these procedures.

3. PROCEDURES.

3.1 Safety summary. The following safety precautions shall be observed:

a. Safety glasses shall be worn when handling bare fibers.

b. Do not touch end of fibers as they may be razor sharp. Wash hands after handling fiber.

c. Observe warnings and cautions on equipment and materials.

d. Never look into the end of a fiber connected to a laser source or LED.

3.2 Procedure I. Cable assembly preparation for test. Cable assemblies terminated in connectors require no additional preparation prior to performing Procedure II (see 3.3.). Cable assemblies terminated in splice ferrules require the completion of a temporary splice in order to test for link loss. The splice procedures herein are abbreviated; a more detailed description is given in Method 2D1 in Part 2 of this standard.

3.2.1 The equipment and materials in table 6C1-I shall be used to perform this procedure.

TABLE 6C1-I. Equipment and materials.

DESCRIPTION	QUANTITY
Splice alignment clip tool (AT&T Comcode 104-030-523, P/N 994A or equal)	1
Splice alignment sleeve (AT&T Comcode 105-205-686 or equal)	As required
Splice alignment tool (AT&T Comcode 104-407-499, P/N 1011B or equal)	1
Index matching gel (AT&T Comcode 402-698-302, P/N 8955 or equal)	As required

NOTES: 1. During handling, cable shall be protected from kinks, twists, crushing and sharp bends. See Part 1 of this standard for more detailed cable handling procedures.

Step 1 - **CAUTION:** Opening sleeve too much may damage sleeve.

Adjust splice alignment clip tool, insert tool into splice alignment sleeve and open alignment sleeve.

Step 2 - Dip tip of ferrule on cable under test into index matching gel, then slide ferrule into sleeve until tip is about centered.

Step 3 - Dip tip of ferrule on test jumper into gel and slide ferrule into other side of sleeve (see figure 6C1-1). Adjust alignment tabs to face gap in sleeve and push both ferrules together to make contact. Remove tool from sleeve.

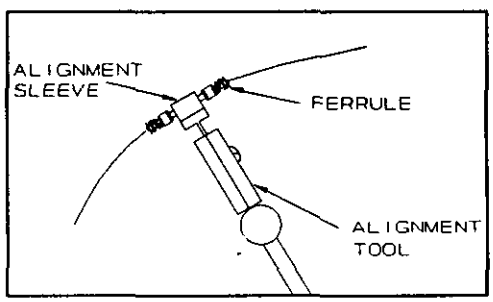


FIGURE 6C1-1. Insert ferrules into alignment sleeve.

Step 4 - Insert alignment tabs into slots on alignment tool (see figure 6C1-2). Rotate ferrule(s) as required to align. If cable is terminated in ferrules on both ends, repeat steps 1 through 4 above for opposite end; otherwise, install test jumper on opposite end.

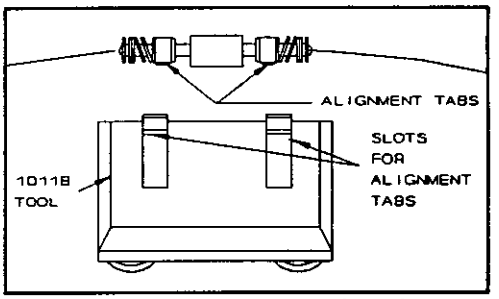


FIGURE 6C1-2. Aligning tabs.

Step 5 - Proceed to 3.3 below.

3.3 Procedure II. Method 6C1-1 power meter cable assembly link loss test.

3.4.1 The equipment and materials in table 6C1-II shall be used to perform this procedure.

TABLE 6C1-II. Equipment and materials.

DESCRIPTION	QUANTITY
Test reference cable	1
Test jumper cables	As required
Light source (3M Photodyne source driver 9XT and source module 1700-1300-T or equal for multimode fiber) or Light source (3M photodyne source driver 9XT and source module 1720SM1310-T or equal for single mode fiber)	1
Power meter (3M Photodyne detector driver 22XLC and detector module model 585 or equal)	1
Alcohol bottle with alcohol/2-propanol or equal (sealable type)	1
Wipes (TEXWIPE TX404T or equal)	As required
Canned air (Fisher Scientific Co. Cat. No. 15-232-20 or equal)(or compressed air)	As required
Protective caps (plastic)	As required

TABLE 6C1-II. Equipment and materials - continued.

DESCRIPTION	QUANTITY
End seals (in accordance with part 1 of this standard)	As required

NOTES: 1. Ensure test equipment calibration is current.

2. Use wipe dampened with alcohol to clean adapters/connectors and blow dry with air before making connections.

Step 1 - Record length of cable from vendor's data or as measured.

Step 2 - **WARNING:** Do not look into the end of a fiber connected to an LED or laser diode. Light may not be visible but can still damage the eye.

Connect test reference cable (configuration A in table I in this part of this standard) between light source and power meter, energize both and record power at meter (P_1) (see figure 6C1-3).

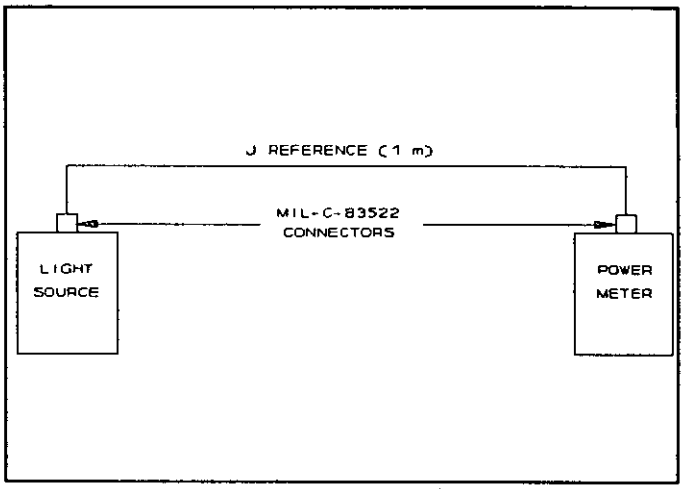


FIGURE 6C1-3. Connecting reference cable.

NOTE: The time delay between measurement of P_1 and P_2 shall be kept to a minimum to prevent inaccurate readings. Also, the repeatability of test measurements can be improved by adding an additional jumper between the light source and reference cable or test jumper interface.

Step 3 - Identify test cable configuration (see table I in this part of this standard) and select applicable test jumpers from table 6C1-III, and connect test cable to light source and power meter as shown in the applicable view of figure 6C1-4.

Note: For cables with single terminus connectors, the reference cable should be used as J_1.

TABLE 6C1-III. Test jumpers.

TERMINATION AT LIGHT SOURCE	SOURCE JUMPER (J_1) CONFIGURATION	TERMINATION AT POWER METER	POWER METER JUMPER (J_2) CONFIGURATION	VIEW FIG. 6C1-4
M83522	A	M83522	A	1
M83522	A	M24623	B	2
M83522	A	M28876 2 CH PLUG	C	3
M83522	A	M28876 2 CH RECEPT	D	3
M83522	A	M28876 4 CH PLUG	E	3
M83522	A	M28876 4 CH RECEPT	F	3
M83522	A	M28876 8 CH PLUG	G	3
M83522	A	M28876 8 CH RECEPT	H	3
M24623	B	M83522	A	4
M24623	B	M24623	B	5
M24623	B	M28876 2 CH PLUG	C	6
M24623	B	M28876 2 CH RECEPT	D	6
M24623	B	M28876 4 CH PLUG	E	6
M24623	B	M28876 4 CH RECEPT	F	6

TABLE 6C1-III. Test jumpers - continued.

TERMINATION AT LIGHT SOURCE	SOURCE JUMPER (J_1) CONFIGURATION	TERMINATION AT POWER METER	POWER METER JUMPER (J_2) CONFIGURATION	VIEW FIG. 6C1-4
M24623	B	M28876 8 CH PLUG	G	6
M24623	B	M28876 8 CH RECEPT	H	6
M28876 2 CH PLUG	C	M83522	A	7
M28876 2 CH PLUG	C	M24623	B	8
M28876 2 CH PLUG	C	M28876 2 CH PLUG	C	9
M28876 2 CH PLUG	C	M28876 2 CH RECEPT	D	9
M28876 2 CH RECEPT	D	M83522	A	7
M28876 2 CH RECEPT	D	M24623	B	8
M28876 2 CH RECEPT	D	M28876 2 CH PLUG	C	9
M28876 2 CH RECEPT	D	M28876 2 CH RECEPT	D	9
M28876 4 CH PLUG	E	M83522	A	7
M28876 4 CH PLUG	E	M24623	B	8
M28876 4 CH PLUG	E	M28876 4 CH PLUG	E	9
M28876 4 CH PLUG	E	M28876 4 CH RECEPT	F	9
M28876 4 CH RECEPT	F	M83522	A	7

TABLE 6C1-III. Test jumpers - continued.

TERMINATION AT LIGHT SOURCE	SOURCE JUMPER (J_1) CONFIGURATION	TERMINATION AT POWER METER	POWER METER JUMPER (J_2) CONFIGURATION	VIEW FIG. 6C1-4
M28876 4 CH RECEPT	F	M24623	B	8
M28876 4 CH RECEPT	F	M28876 4 CH PLUG	E	9
M28876 4 CH RECEPT	F	M28876 4 CH RECEPT	F	9
M28876 8 CH PLUG	G	M83522	A	7
M28876 8 CH PLUG	G	M24623	B	8
M28876 8 CH PLUG	G	M28876 8 CH PLUG	G	9
M28876 8 CH PLUG	G	M28876 8 CH RECEPT	H	9
M28876 8 CH RECEPT	H	M83522	A	7
M28876 8 CH RECEPT	H	M24623	B	8
M28876 8 CH RECEPT	H	M28876 8 CH PLUG	G	9
M28876 8 CH RECEPT	H	M28876 8 CH RECEPT	H	9

Step 4 - Record power at meter (P_2). Deenergize light source and power meter.

Step 5 - Calculate cable link loss using following formula and record results:

$$B_{CA} = (P_1 - P_2)$$

Where: B_{CA} = Total cable assembly link loss in dB
P_1 = Reference power in dBm
P_2 = Test power in dBm

Step 6 - Identify connectors/splices by type and proceed to 3.5 below.

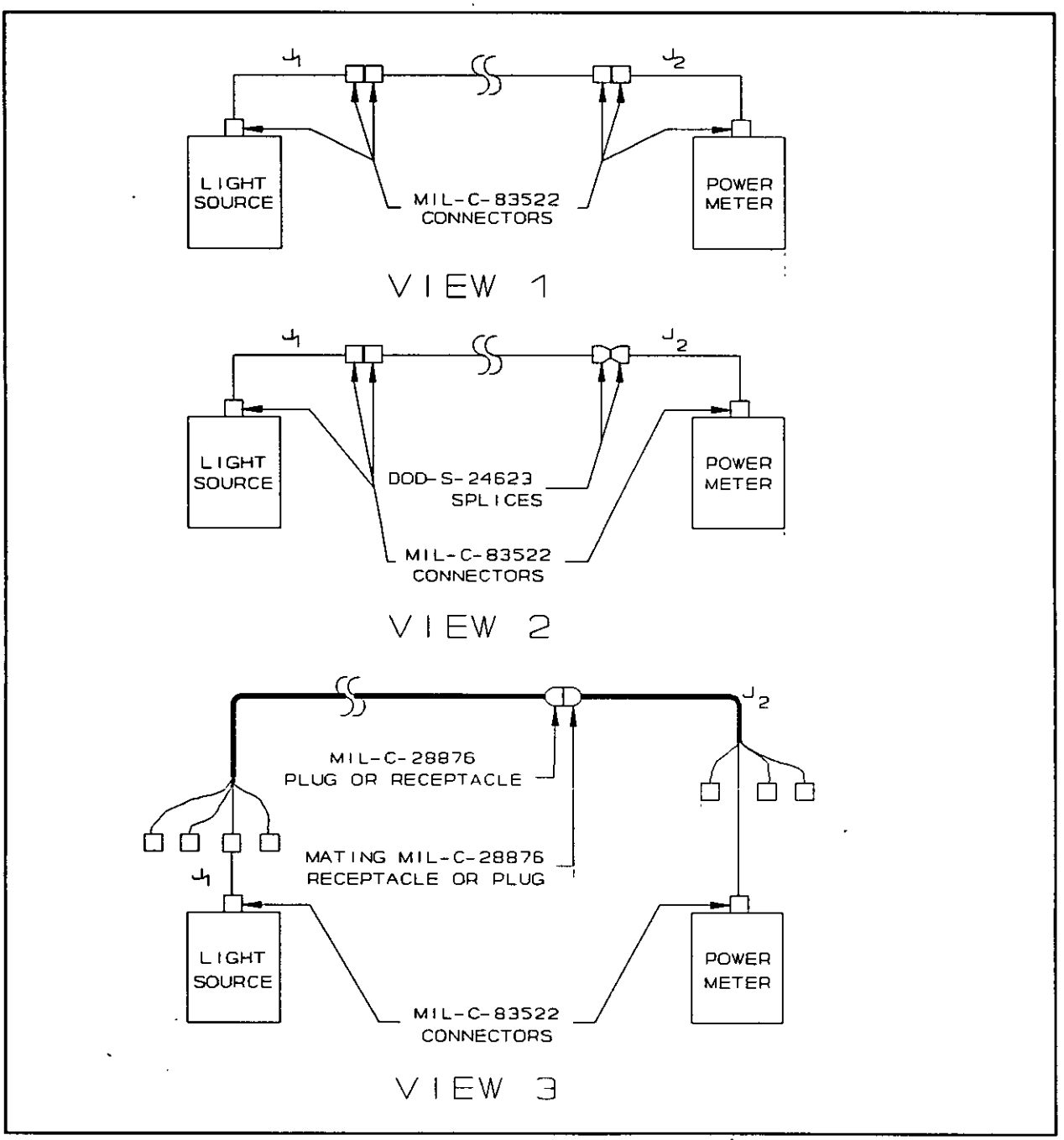


FIGURE 6C1-4. Test setup options.

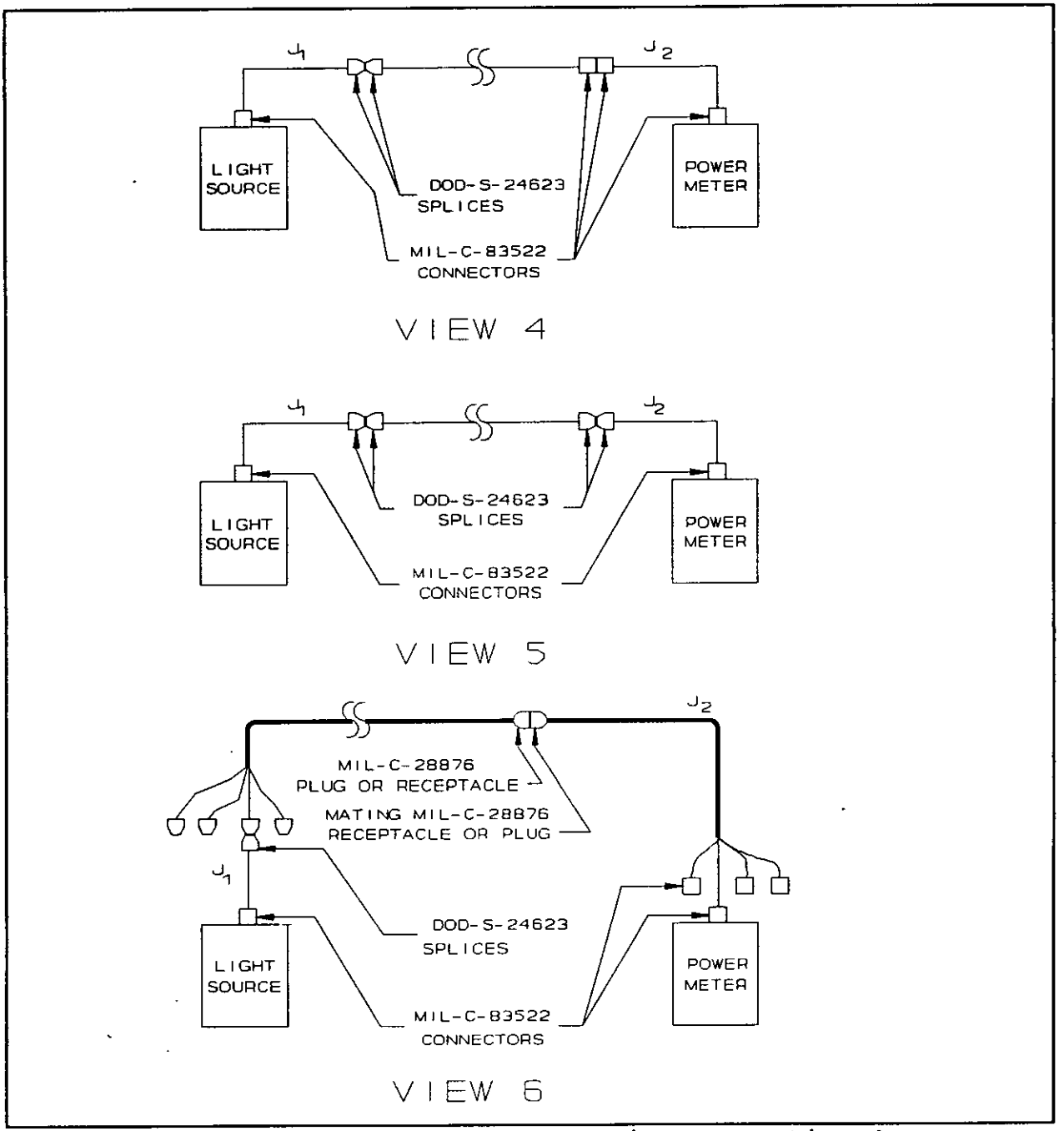


FIGURE 6C1-4. Test setup options - continued.

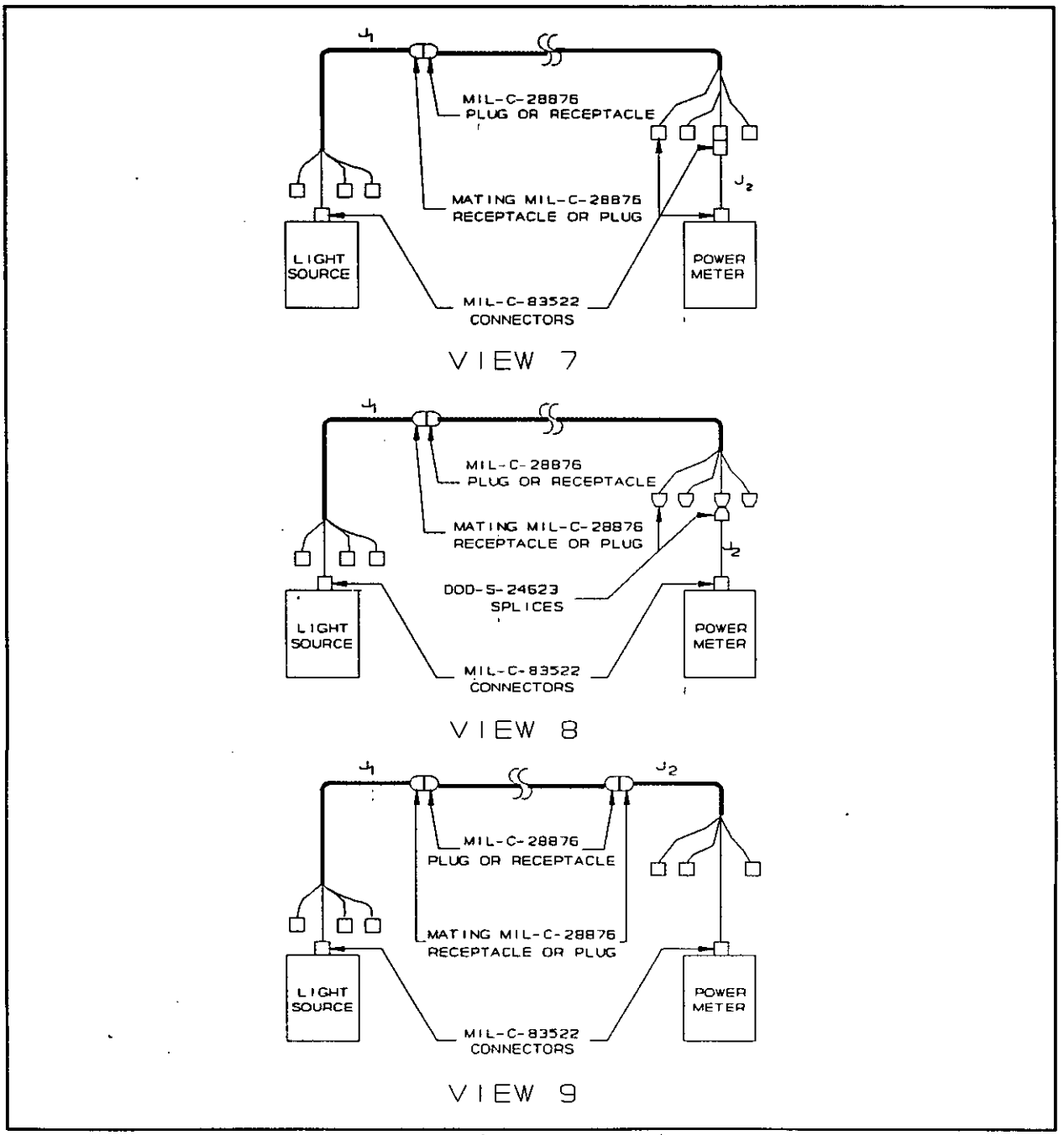


FIGURE 6C1-4. Test setup options - continued.

3.5 Calculations.

NOTE: If this test is part of Acceptance Test, proceed to step 1 below. If this test is part of Pre-Installation or Installation Test, proceed to step 2 below.

Step 1 - Cable assembly is considered satisfactory if measured loss is equal to or less than vendor's recorded loss. If measured loss is greater than vendor's loss, proceed to step 2 below.

Step 2 - Compare the recorded loss to the maximum allowable loss. For topology trunk cables, the maximum allowable loss is calculated from the component loss values specified in table 6C1-IV. For system specific or topology local cables, the maximum allowable loss for the system is the loss specified on the system drawings. Cable assembly is considered acceptable if recorded loss is equal to or less than allowable loss. If recorded loss is acceptable, proceed to step 4 below. If recorded loss is greater than allowable loss, proceed to step 3 below.

TABLE 6C1-IV. Component maximum allowable loss.

Component	Single mode	Multimode
Cable	1.0 dB/km	2.0 dB/km
Single terminus (light duty) connector	1.0 dB	1.0 dB
Multiple terminus (heavy duty) connector	1.0 dB	1.0 dB
Mechanical splice	0.2 dB tuned 0.6 dB untuned	0.2 dB tuned 0.6 dB untuned

Step 3 - If recorded loss is 0.5 dB or more above allowable loss, reject cable. If loss is less than 0.5 dB above allowable loss, disconnect and clean all connections and retest. If loss is still unacceptable, replace test jumpers, successively and retest. If loss is still unacceptable, reterminate or replace defective components.

Step 4 - If cable is not going to be installed in cableways within 48 hours, install protective caps or end seal in accordance with Method 1A1 in Part 1 of this standard.

METHOD 6D1

CABLE CONTINUITY TEST

1. SCOPE.

1.1 Scope. This method describes a procedure for performing a cable continuity test on cables with or without connectors or terminations of any type.

2. REQUIRED EQUIPMENT AND MATERIALS.

2.1 The equipment and materials in table 6D1-I shall be used to perform this procedure.

TABLE 6D1-I. Equipment and materials.

DESCRIPTION	QUANTITY
Safety glasses	1
Flashlight (or equivalent)	1
Optical intercom (Force Inc. 2587SB-MCST or equal)	1
Alcohol bottle with alcohol/2-propanol or equal (sealable type)	As required
Wipes (TEXWIPE TX404T or equal)	As required
Canned air (Fisher Scientific Co. Cat. No. 15-232-20 or equal)(or compressed air)	As required

3. PROCEDURE.

3.1 Safety summary. The following safety precautions shall be observed:

a. Safety glasses shall be worn when handling bare fibers.

b. Do not touch ends of fibers as they may be razor sharp. Wash hands after handling fiber.

c. Observe warnings and cautions on equipment and materials.

d. Never look into the end of a fiber connected to a laser source or LED.

3.2 Procedure.

Step 1 - Establish communications, if required, using optical intercom or other available communication equipment.

Step 2 - Using wipe dampened with alcohol, clean fibers on both ends of cable and blow dry with air.

Step 3 - Using flashlight or equivalent, shine light in each fiber and verify light is present at opposite end.

Step 4 - Repeat step 3 above, shining light from opposite direction.

METHOD 6E1

CABLE TOPOLOGY END-TO-END ATTENUATION TEST

1. SCOPE.

1.1 Scope. This method describes a procedure for performing a cable topology end-to-end attenuation test to ensure the attenuation losses of the topology is within acceptable limits.

2.REQUIRED EQUIPMENT AND MATERIALS.

2.1 The equipment and materials in table 6E1-I shall be used to perform this procedure.

TABLE 6E1-I. Equipment and materials.

Description	Quantity
Power meter (3M Photodyne detector driver 22XLC and detector module model 585 or equal)	1
Light source (3M Photodyne source driver 9XT and source module 1700-1300-T or equal for multimode fiber) or Light source (3M Photodyne source driver 9XT and source module 1720SM1310-T or equal for singlemode fiber)	1
Test reference cables	As required
Test jumper cables	As required
Test adapters	As required
Alcohol bottle with alcohol/2-propanol or equal (sealable type)	1
Wipes (TEXWIPE TX404T or equal)	As required
Canned air (Fisher Scientific Co. Cat. No. 15-232-20 or equal)(or compressed air)	As required

3. PROCEDURE.

3.1 Safety summary. The following safety precautions shall be observed:

a. Safety glasses shall be worn when handling bare fibers.

b. Do not touch end of fibers as they are razor sharp. Wash hands after handling fiber.

c. Observe warnings and cautions on equipment and materials.

d. Never look into the end of a fiber connected to a laser source or LED.

NOTES: 1. Ensure test equipment calibration is current.

2. Use wipe dampened with alcohol to clean adapters/connectors and blow dry with air before making connections.

3.2 Procedure.

Step 1 - **WARNING:** Do not look into the end of a fiber connected to an LED or laser diode. Light may not be visible but can still damage the eye.

Connect test reference cable (configuration A in table I in this part of this standard) between light source and power meter, energize both and record power at meter (P_1) (see figure 6E1-1).

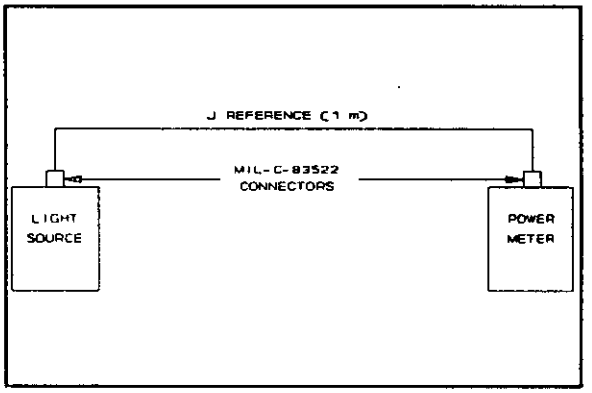


FIGURE 6E1-1. Connecting reference cable.

NOTE: The time delay between measurement of P_1 and P_2 shall be kept to a minimum to prevent inaccurate readings. Also, the repeatability of test measurements can be improved by adding an additional jumper between the light source and the reference cable or test jumper interface.

Step 2 - Identify applicable test link configuration based on link interface to topology (see table I in this part of this standard) and select appropriate test jumper from table 6E1-II. Connect topology link to power meter and light source using applicable view in figure 6E1-2. (NOTE: For cables with single terminus connectors, the reference cable should be used as J_1.)

TABLE 6E1-II. Test jumper configurations.

TERMINATION AT LIGHT SOURCE	SOURCE JUMPER (J_1) CONFIGURATION	TERMINATION AT POWER METER	POWER METER JUMPER (J_2) CONFIGURATION	VIEW FIG. 6E1-2
M83522	A	M83522	A	1
M83522	A	M24623	B	2
M83522	A	M28876 2 CH PLUG	C	3
M83522	A	M28876 2 CH RECEPT	D	3
M83522	A	M28876 4 CH PLUG	E	3
M83522	A	M28876 4 CH RECEPT	F	3
M83522	A	M28876 8 CH PLUG	G	3
M83522	A	M28876 8 CH RECEPT	H	3
M24623	B	M83522	A	4
M24623	B	M24623	B	5
M24623	B	M28876 2 CH PLUG	C	6
M24623	B	M28876 2 CH RECEPT	D	6
M24623	B	M28876 4 CH PLUG	E	6
M24623	B	M28876 4 CH RECEPT	F	6
M24623	B	M28876 8 CH PLUG	G	6
M24623	B	M28876 8 CH RECEPT	H	6
M28876 2 CH PLUG	C	M83522	A	7

TABLE 6E1-II. Test jumper configurations - continued.

TERMINATION AT LIGHT SOURCE	SOURCE JUMPER (J_1) CONFIGURATION	TERMINATION AT POWER METER	POWER METER JUMPER (J_2) CONFIGURATION	VIEW FIG. 6E1-2
M28876 2 CH PLUG	C	M24623	B	8
M28876 2 CH PLUG	C	M28876 2 CH PLUG	C	9
M28876 2 CH PLUG	C	M28876 2 CH RECEPT	D	9
M28876 2 CH RECEPT	D	M83522	A	7
M28876 2 CH RECEPT	D	M24623	B	8
M28876 2 CH RECEPT	D	M28876 2 CH PLUG	C	9
M28876 2 CH RECEPT	D	M28876 2 CH RECEPT	D	9
M28876 4 CH PLUG	E	M83522	A	7
M28876 4 CH PLUG	E	M24623	B	8
M28876 4 CH PLUG	E	M28876 4 CH PLUG	E	9
M28876 4 CH PLUG	E	M28876 4 CH RECEPT	F	9
M28876 4 CH RECEPT	F	M83522	A	7
M28876 4 CH RECEPT	F	M24623	B	8
M28876 4 CH RECEPT	F	M28876 4 CH PLUG	E	9
M28876 4 CH RECEPT	F	M28876 4 CH RECEPT	F	9
M28876 8 CH PLUG	G	M83522	A	7

TABLE 6E1-II. Test jumper configurations - continued.

TERMINATION AT LIGHT SOURCE	SOURCE JUMPER (J_1) CONFIGURATION	TERMINATION AT POWER METER	POWER METER JUMPER (J_2) CONFIGURATION	VIEW FIG. 6E1-2
M28876 8 CH PLUG	G	M24623	B	8
M28876 8 CH PLUG	G	M28876 8 CH PLUG	G	9
M28876 8 CH PLUG	G	M28876 8 CH RECEPT	H	9
M28876 8 CH RECEPT	H	M83522	A	7
M28876 8 CH RECEPT	H	M24623	B	8
M28876 8 CH RECEPT	H	M28876 8 CH PLUG	G	9
M28876 8 CH RECEPT	H	M28876 8 CH RECEPT	H	9

Step 3 - Record power at meter (P_2). Deenergize light source and power meter.

Step 4 - Calculate cable topology link loss using following formula and record results:

$$B_{TL} = (P_1 - P_2)$$

Where: B_{TL} = Total cable topology link loss in dB
P_1 = Reference power in dBm
P_2 = Test power in dBm

Step 5 - If recorded loss is 1 dB or greater than the system specified allowable link loss, repair or replace faulty component as required. If link loss is less than 1 dB above specified allowable link loss, disconnect and clean all connections and retest. If link loss is still unacceptable, replace test jumpers and retest. If link loss is still unacceptable reterminate or replace defective components.

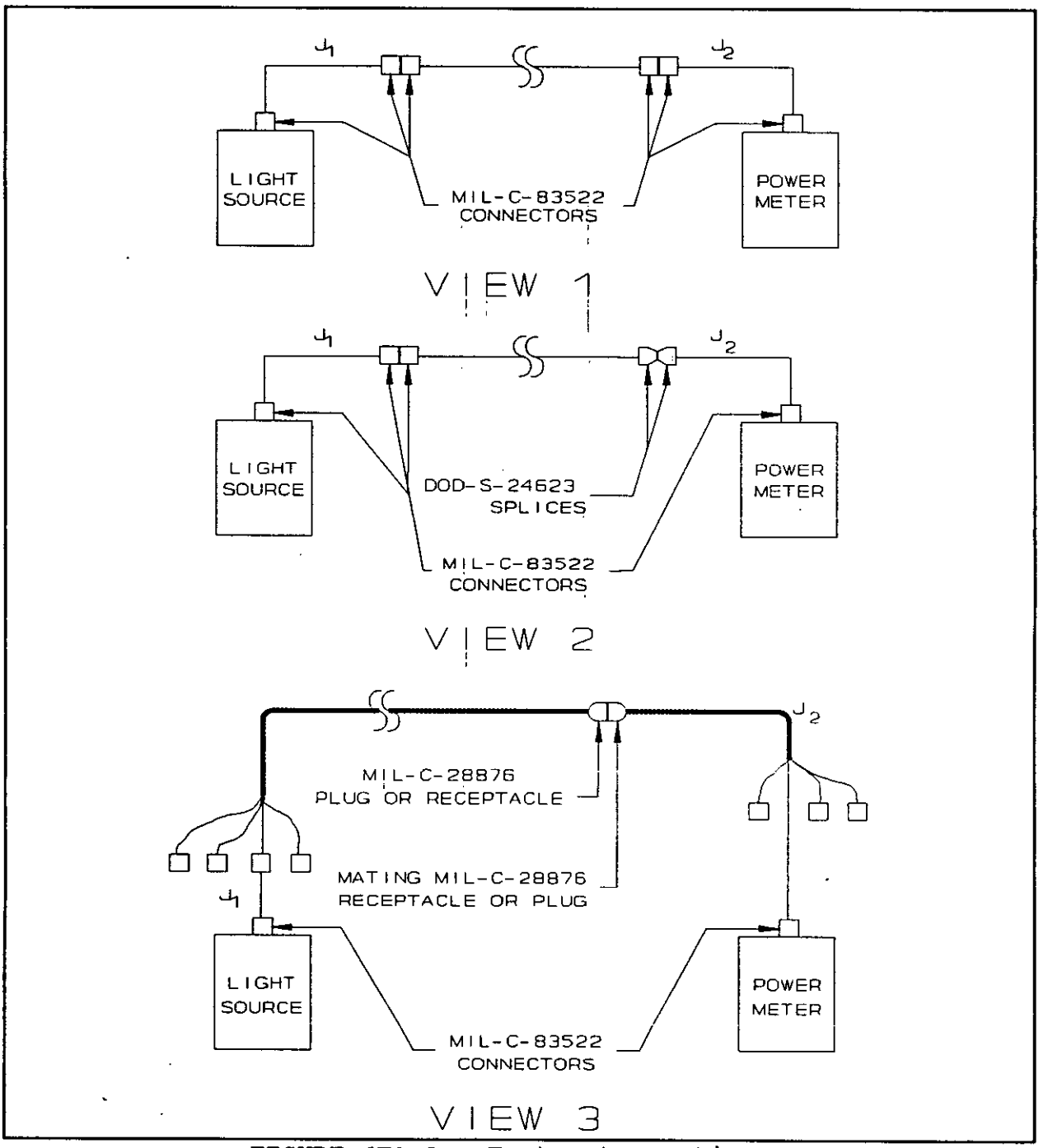


FIGURE 6E1-2. Test setup options.

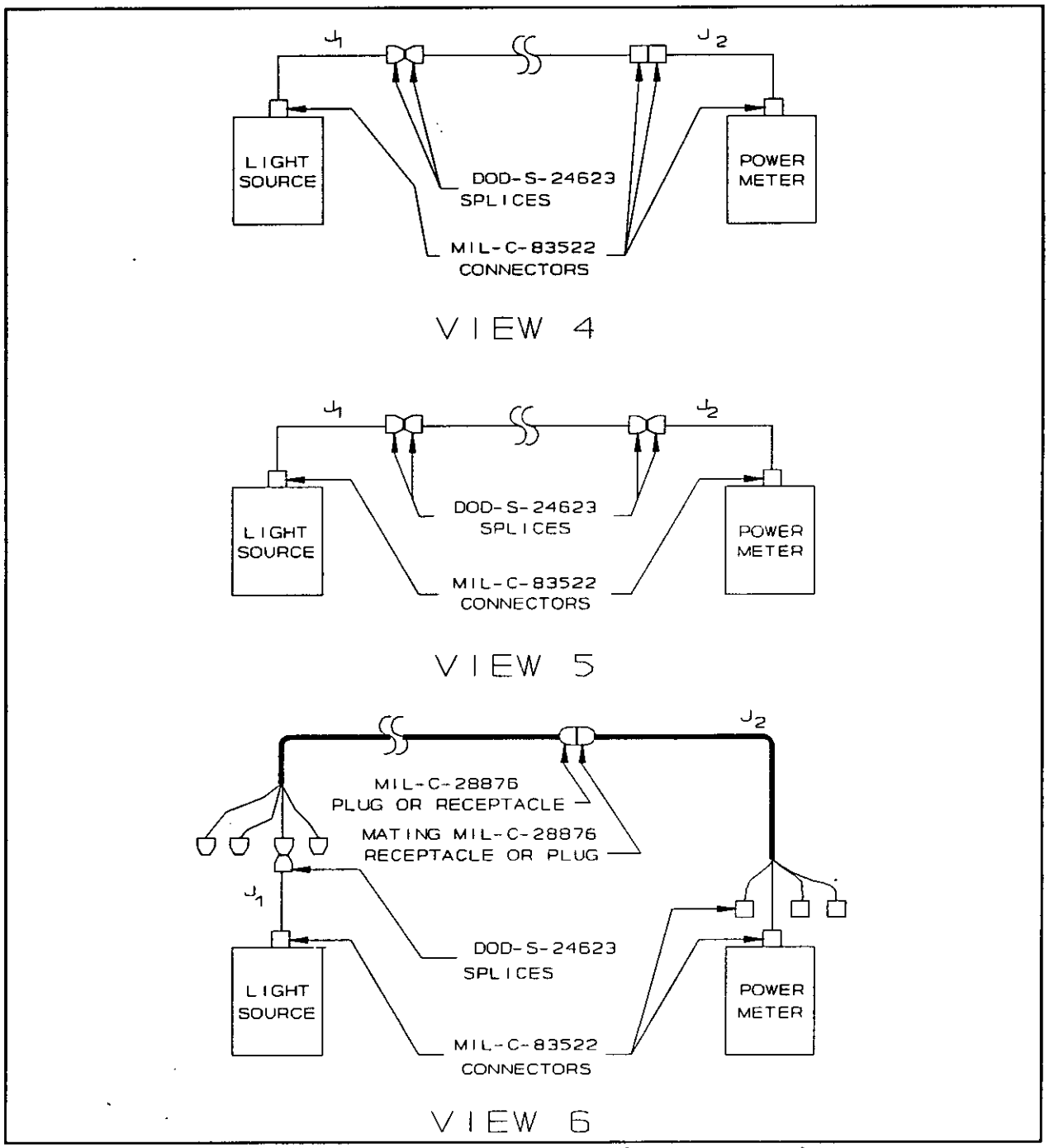


FIGURE 6E1-2. Test setup options - continued.

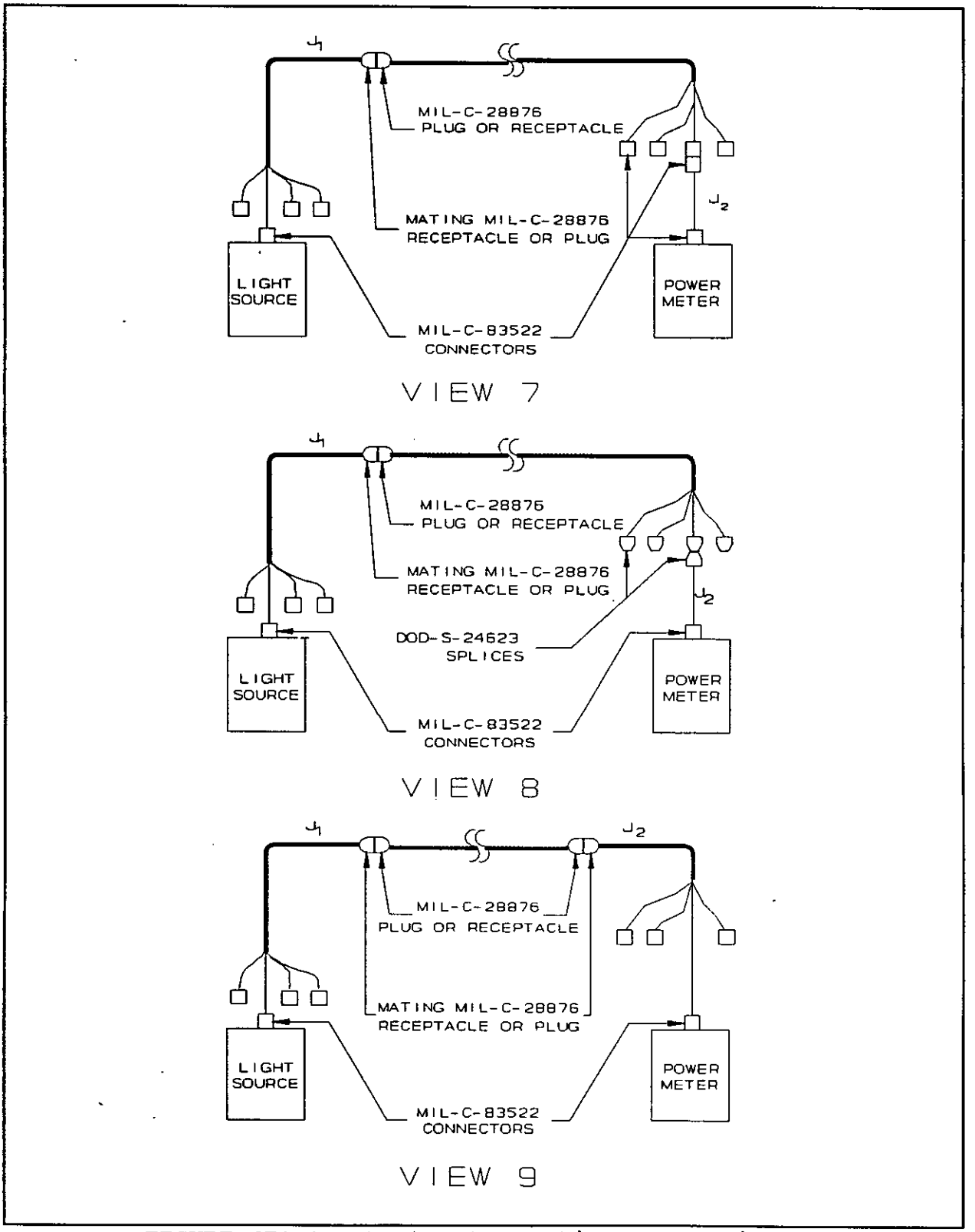


FIGURE 6E1-2. Test setup options - continued.

METHOD 6F1

TEST JUMPER CABLE SELECTION TEST

1. SCOPE.

1.1 Scope. This method describes procedures for performing a test jumper cable selection test on test jumpers that have connectors or other terminations installed on both ends.

2. REQUIRED EQUIPMENT AND MATERIALS.

2.1 The equipment and materials in the tables located in the applicable sections of this method shall be used to perform these procedures.

3. PROCEDURES.

3.1 Safety summary. The following safety precautions shall be observed:

a. Safety glasses shall be worn when handling bare fibers.

b. Do not touch end of fibers as they may be razor sharp. Wash hands after handling fiber.

c. Observe warnings and cautions on equipment and materials.

d. Never look into the end of a fiber connected to a laser source or LED.

3.2 Procedure.

3.2.1 The equipment and materials in table 6F1-I shall be used to perform this procedure.

TABLE 6F1-I. Equipment and materials.

DESCRIPTION	QUANTITY
Test reference cable (configuration A in table I in this part of this standard)	1
Test jumper cables 1 m length (ST on both ends with each end labeled A or B)	Minimum of 20
Test jumper cables 1 m length (ST to socket terminus)	Minimum of 20

TABLE 6F1-I. Equipment and materials - continued.

DESCRIPTION	QUANTITY
Test jumper cables 1 m length (ST to pin terminus)	Minimum of 20
Test jumper cables 1 m length [ST to splice ferrule]	Minimum of 20
Light source (3M Photodyne source driver 9XT and source module 1700-1300-T or equal for multimode fiber) or Light source (3M Photodyne source driver 9XT and source module 1720SM1310-T or equal for single mode fiber)	1
Power meter (3M Photodyne detector driver 22XLC and detector module model 585 or equal)	1
Alcohol bottle with alcohol/2-propanol or equal (sealable type)	1
Wipes (TEXWIPE TX404T or equal)	As required
Canned air (Fisher Scientific Co. Cat. No. 15-232-20 or equal)(or compressed air)	As required
Protective caps (plastic)	As required
ST adapter (single mode)	1
ST termination type power meter adapter	1
Single socket terminus power meter adapter	1
Single pin terminus power meter adapter	1
Splice ferrule termination type power meter adapter	1

NOTES: 1. Ensure test equipment calibration is current.

2. Use wipe dampened with alcohol to clean adapters/connectors and blow dry with air before making connections.

3. Steps 2 through 9 shall be performed for each jumper to be evaluated. Identify and label all jumpers to be evaluated.

Step 1 - Select a test jumper.

Step 2 - **WARNING:** Do not look into the end of a fiber connected to an LED or laser diode. Light may not be visible but can still damage the eye.

Connect test reference jumper between light source and power meter, energize both and record power at meter (P_1) (see figure 6F1-1).
Disconnect reference jumper from power meter.

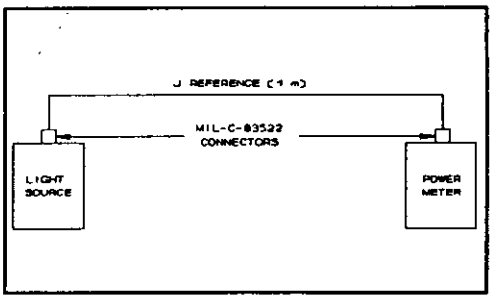


FIGURE 6F1-1. Connecting reference cable.

NOTES: 1. The time delay between measurement of P_1 and P_2 shall be kept to minimum to prevent inaccurate readings.

2. The reference jumper to light source connection between measurement of P_1 and P_2 shall not be disturbed to prevent inaccurate readings.

Step 3 - Connect test jumper to reference jumper using single-mode ST adapter and to the power meter using applicable power meter adapter head (see figure 6F1-2).

Step 4 - Record power at meter (P_2).

Step 5 - Calculate test jumper loss using following formula

$$B_{TJ} = (P_1 - P_2)$$

Where: B_{TJ} = Test Jumper Loss in dB
P_1 = Reference power in dBm
P_2 = Test power in dBm

Step 6 - Record test jumper loss along with test jumper termination type and identification.

Step 7 - Repeat step 2 through step 6 10 times for the selected test jumper. Use wipe dampened with alcohol to clean adapters/connectors and blow dry with air before making each connection.

NOTE: The test jumpers with ST-type terminations on both ends are tested in each direction as shown in views 1 and 2 of figure 6F1-2.

Step 8 - Select another test jumper and repeat steps 2 through 7. Continue until all test jumpers have been measured.

3.3 Calculations.

Step 1 - Calculate a mean loss for each test jumper using the following formula and record results:

$$\mu_{TJ} = \frac{1}{10} x \sum_{n=1}^{10} B_{TJn}$$

Where: μ_{TJ} = Mean test jumper loss in dB
B_{TJn} = Test jumper loss for measurement n in dB

NOTE: For ST to ST jumpers calculate the mean loss for each direction.

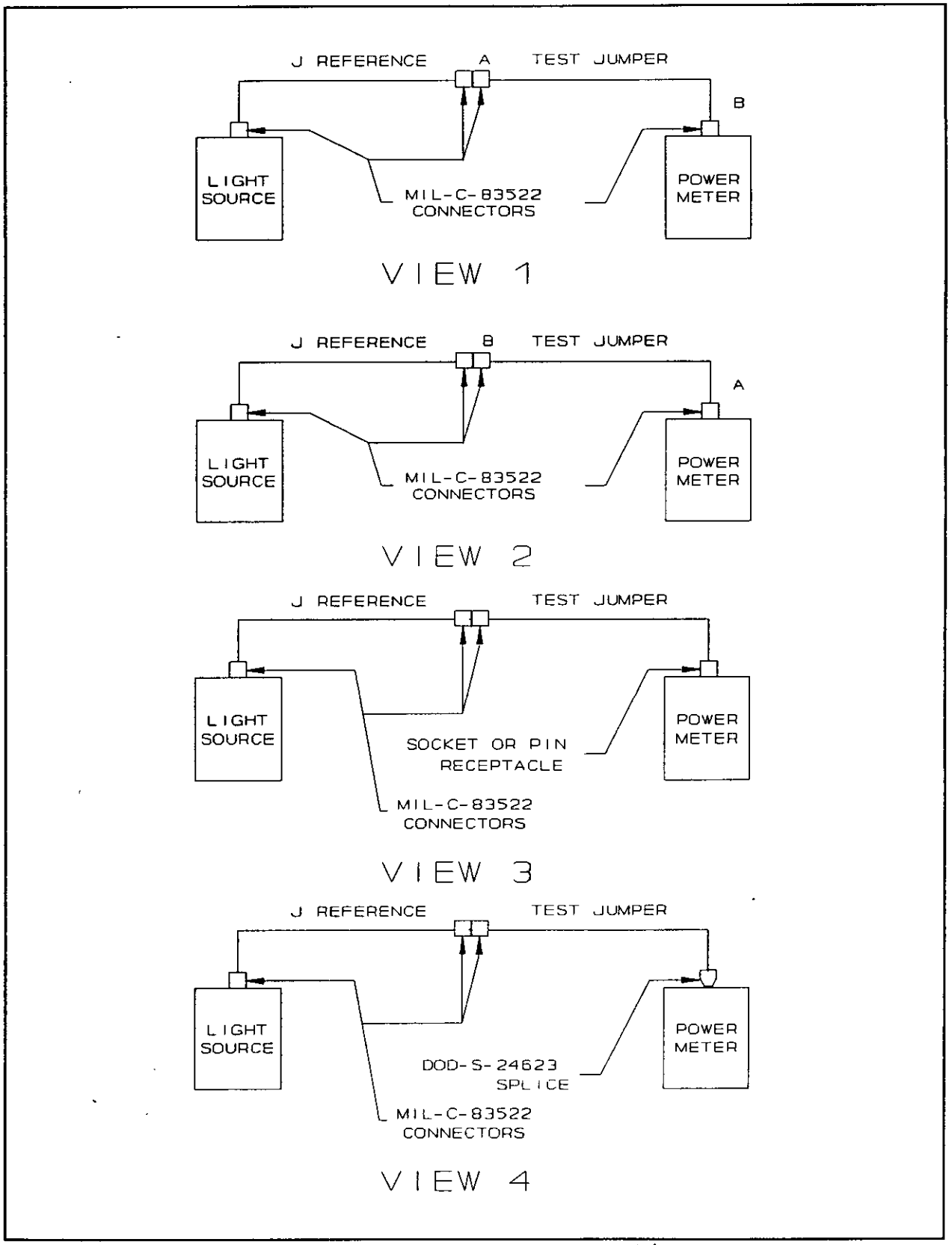


FIGURE 6F1-2. Test setup options.

Step 2 - Calculate a standard deviation of measured loss for each test jumper using the following formula and record results:

$$\sigma_{TJ}=\sqrt{\frac{\sum_{n-1}^{10}(B_{TJn}-\mu_{TJ})}{9}}$$

Where: σ_{TJ}= Standard deviation of test jumper loss in dB

Note: For ST to ST jumpers calculate the standard deviation for each direction.

Step 3 - A test jumper is considered satisfactory if the mean loss is less than 1 dB. If the mean loss is equal to or greater than 1 dB, remove the test jumper from the jumper set.

Step 4 - A test jumper is considered satisfactory if the standard deviation is less than 0.05 dB. If the standard deviation is equal to or greater than 0.05 dB remove the test jumper from the jumper set.

Step 5 - Calculate the total mean loss of the jumper set (include both directions for jumpers with ST's on both ends) using the following formula and record results.

$$TML=\frac{1}{n}x\sum_{i-1}^{n}\mu_{TJ}$$

Where: TML = Total mean loss of the jumper set
μ_{TJ} = Mean loss of each remaining jumper
n = Total number of jumpers in the jumper set (each direction should be separately counted for ST -ST jumper)

Step 6 - Calculate the mean loss deviation from the total mean loss for all test jumpers, including each direction for jumpers with ST connectors on each end, using the following formula and record results:

$$\alpha=|TML-\mu_{TJ}|$$

Where: α = absolute difference of the TML and the mean loss for each test jumper.

Step 7 - A test jumper is considered satisfactory if α is less than or equal to 0.1 dB. Remove any test jumper from the set for which $\alpha > 0.1$ dB.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
	MIL-STD-2042-6(SH)	930707

3. DOCUMENT TITLE
FIBER OPTIC TOPOLOGY INSTALLATION STANDARD METHOD FOR NAVAL SHIPS

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

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c. ADDRESS (Include Zip Code) Commander, SEA 03Q42 Naval Sea Systems Command 2531 Jefferson Davis Hwy Arlington, VA 22242-5160	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340