

METRIC

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COMMERCIAL ITEM DESCRIPTION

FUSION SPLICER AND CLEAVER, OPTICAL FIBER

The General Services Administration has authorized the use of this commercial item description for all federal agencies.

1. SCOPE. This commercial item description (CID) covers the general requirements for an optical fiber fusion splicer capable of performing splices with the following attributes: superior optical performance, high reliability, field-ready, and compatible with both loose tube and tight buffered multimode and singlemode optical fiber. This CID also covers the general requirements for an optical fiber cleaver with the following attributes: high precision cleaver, high reliability, field-ready, and compatible with both loose tube and tight buffered multimode and singlemode fiber. The optical fiber fusion splicer and optical fiber cleaver are intended for commercial/industrial applications.

2. CLASSIFICATION.

2.1 Fusion splicer equipment configurations. The configurations defined for the splicer are as listed in TABLE I.

TABLE I. Splicer configurations

Configuration	Description
A	Fusion splicer, multi-axis/core alignment, high precision cleaver, fiber clamps, fixed mount

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3. SALIENT CHARACTERISTICS.

3.1 Physical The fusion splicing tools supplied to this CID and splices made with those tools shall have the following characteristics.

3.1.1 Splice Dimensions: The fusion splicing tools shall be capable of completing a splice in accordance with MIL-PRF-24623/6 with an exposed glass length not to exceed 24.0 mm (see figure 1).

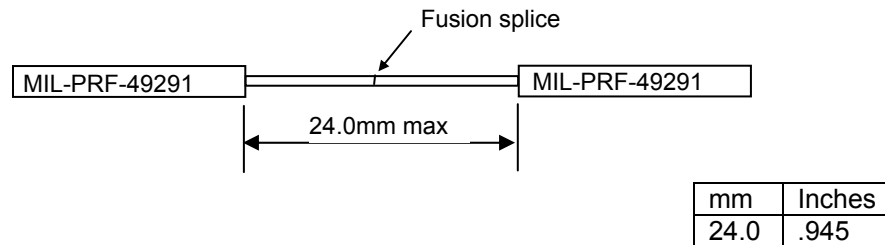


FIGURE 1. Interface dimensions.

3.1.2 Equipment:

3.1.2.1 Dimensions: The self-contained multi-axis/core alignment splicing unit shall not exceed 280 cubic inches (4588.4 cubic cm).

3.1.2.2 Weight: Weight of the fusion splicer shall not exceed 6.8 pounds (3.5 kg), (including batteries).

3.1.3 Equipment Construction:

3.1.3.1 Packaging shall protect critical components from environment hazards and handling.

3.1.3.2 Workmanship. When visually inspected, fusion splicer shall be uniform in quality.

3.1.4 Interchangeability. All fusion splicing tools and accessories of the same design (such as the same part number and configuration) shall be physically and functionally interchangeable without need for modification of such items or of the mating equipment. All cleaving tools of the same design (such as the same part number and configuration) shall be physically and functionally interchangeable without need for modification of such items or of the mating equipment.

3.2 Splice protection sleeve heater. The fusion splicer shall be equipped with a device capable of shrinking fiber protection sleeves that are in accordance with MIL-PRF-24623/6.

3.3 Splicer tensile test: Equipment shall be capable of applying 0.45lbf (2 N) \pm 3% of load (23.7 kpsi on 125 μ m fiber) to completed bare fiber splice for no less than 1 second after splicing without relocating the splice.

3.4 Optical fiber compatibility

Fusion splicing tools shall be compatible with optical fiber that is in accordance with the following optical fiber dimensions:

- a. Coating diameter: 100 μ m to 1,000 μ m (.004 to .039 inches)
- b. Cladding diameter: 80-150 μ m (.003 to .006 inches)
- c. Core diameter: 5.8 μ m - 100 μ m (.0002 to .004 inches)

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3.5 Splice Performance

3.5.1 Splice loss performance. The equipment shall be capable of creating defect free splices with insertion loss measurements that do not exceed the insertion loss requirements listed in TABLE II for the fibers indicated under laboratory conditions when tested in accordance with TIA/EIA-455-34. For multimode splices, initial insertion loss shall be measured using both overfilled and restricted (70/70) launch conditions. For multimode splices, the insertion loss requirement is specified for and verified using a 62.5/125 micron fiber size.

TABLE II. Insertion loss

	Homogeneous <u>1/</u>	Heterogeneous <u>2/</u>
M49291 /7 (SMF)		
Typical	0.02 dB	0.05 dB
Mean	0.03 dB	0.08 dB
Max	0.10 dB	0.15 dB
M49291 /6 (MMF)		
Typical	0.01 dB	0.02 dB
Mean	0.03 dB	0.05 dB
Max	0.05 dB	0.08 dB

Notes: 1/ Homogeneous splices are defined as those between identical fibers (cut from the same reel) with the core eccentricity of <0.4 micron.

2/ Heterogeneous splices are defined as those between fibers which are nominally the same type, but taken from random reels or sources with no control for fiber parameters within nominal manufacturing tolerances.

3.5.2 Return Loss. When tested in accordance with TIA-455-107, the minimum return loss for Single-Mode shall be 65 dB per splice.

3.5.3 Fiber splice dynamic strength: Independent of the capacity of the splicer for self-test, the splices without sleeve protection made with the equipment shall survive a tensile test in accordance with TIA/EIA-455-28 (2.5% strain rate, 0.5m gage length) and meet the following requirement: Minimum dynamic strength shall be ≥ 45 kpsi (310 Mpa). Splices made using the equipment and containing sleeve protection must be able to meet the tensile strength requirements in MIL-PRF-24623/6.

3.6 Common characteristics:

3.6.1 Interface

3.6.1.1 Equipment: Shall have a monitor and control panel for input/output.

3.6.1.2 The monitor shall have contrast/brightness adjustment and shall be visible in direct sunlight. Objective: Monitor and control unit can be separated or arranged to reduce splicing system size within the specified working volume.

3.6.1.3 Controls: User controls shall be legible and interface shall be in simple everyday language.

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3.6.2 Software Functions:

3.6.2.1 Alignment: The equipment shall automatically align the optical fibers and perform the splice without the need for user intervention. The alignment accuracy shall be such that the splice meets the performance requirements of 3.5.

3.6.2.2 Self-test mode: Splicer shall have an automatic self-diagnostic test to confirm basic operational check.

3.6.2.3 Splice Programs: The equipment shall have pre-set programs to splice MIL-PRF-49291 fiber types that are within the optical fiber compatibility requirements identified in section 3.4 and the equipment shall control access to programs for creation and modification/updates of the fusion splicing programs.

3.6.2.4 Pass/Fail assessment: Splicer shall be capable of programming/storing optical loss criteria according to commercial and military standards as Pass/Fail test criteria for the estimated loss. Optical loss test criteria shall be editable as standards evolve. Pass/Fail indicators shall be provided.

3.6.2.5 Arc power compensation: Splicer shall automatically compensate arc power for environmental conditions, fiber type, or electrode wear with the user intervention being limited to loading prepared optical fibers such as through arc melt-back method.

3.6.2.5.1 Electrode Counter: Equipment using electrodes for generating the arc shall maintain a count of arc discharges with respect to the current set of electrodes for maintenance purposes.

3.6.2.6 Error Detection: The equipment shall inspect the fibers/splice and halt the splicing process, without user intervention, if a condition has been detected, prior to the arc or after the arc, by the equipment that will not yield splice performance in accordance with the requirements of section 3.5 listed herein. If the splice has already been completed and an error is detected a clear message will be provided to the user that the splice does not meet the splice performance requirements of section 3.5.

3.6.2.7 Insertion Loss Estimation due to Splice: Equipment shall be capable of automatically estimating the quality of each fusion splice, reporting the estimate to the user, and warning the user of splices estimated to be defective. Loss estimation shall meet the following requirements:

Measured Loss \leq 0.15 dB: 90% of all splices made, for loss range specified, shall have estimates that fall in a range within +/- 0.03 dB of measured loss.

Measured Loss $>$ 0.15 dB: 90% of all splices made, for loss range specified, shall have estimates that fall in a range within +/- 25 % of measured loss.

3.6.2.8 Power conservation: The equipment shall have automatic power conservation features that are activated after a period of inactivity with the equipment. The period of time shall be user configurable.

3.6.2.9 Power Level Indicator: The equipment shall provide the user with information regarding the remaining power level in the battery.

3.6.3 Data management

3.6.3.1 Data Storage: The equipment shall be capable of storing at least 2000 splice results with real time and date stamps. Capability of adding an alphanumeric identifier to the data set shall be provided.

3.6.3.2 Data transfer/printing: The equipment shall have the capability of uploading test data to a computer.

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3.6.3.3 Computer interface. The unit shall have a computer interface for exchanging data with a computer workstation operating Microsoft Windows 98 (or later) and NT 4.0 (or later) operating system. The interface shall be either RS232 or USB. Software to exchange and display data and computer interface drivers required to interface the computer to the equipment shall be provided with the equipment.

3.7 Power

3.7.1 AC operation: Shall operate over voltage range of 100 to 240V (50/60 Hz). Equipment shall be operable from both grounded and ungrounded power supplies.

3.7.2 DC battery: Rechargeable batteries shall afford portable operation of the assembled unit (splicer and battery). Size and weight requirements (see 3.1.2.1 and 3.2.2.2) of the assembled unit shall be met. Rechargeable batteries shall be provided for portable operation. Batteries shall either permit attachment to or be contained within the splicer shell and meet the size and weight requirements specified herein. The rechargeable battery provided shall be capable of performing the number of splices identified in section 3.7.2.1, including heat cycle, following a maximum recharge time of 4 hours. A battery option should be available that allows the use of COTS batteries.

3.7.2.1 Battery Lifetime Requirements: Equipment shall meet following minimum operations under the condition specified.

Battery Lifetime with heat shrink protector @ 0 °C	50 Splices
Battery Lifetime with heat shrink protector @ 22.5 °C	80 Splices

3.7.3 Lithium batteries: In accordance with MIL-PRF-28800, lithium batteries are prohibited without prior authorization. Requests for approving the use of lithium batteries, including those encapsulated in integrated circuits, is required.

3.8 Environmental & Mechanical Performance

3.8.1 Altitude: The splicer shall be capable of performing splices in accordance with the requirements of 3.5 on 125 micron fibers at the following altitude extremes: 0 to 4000m.

3.8.2 Storage Condition: The splicer shall be capable of performing splices in accordance with 3.5 after the following environmental exposures:

- a. -40 °C for 24 hours, uncontrolled humidity
- b. 71 °C for 24 hours, 95%RH

3.8.3 Vibration: The splicer shall meet the requirement R4-107 from Telcordia GR-765 "Single Fiber Single-Mode Optical Splices and Splicing Systems" and perform splices in accordance with 3.5 of this specification after the test.

3.8.4 Shock: The splicer shall meet the requirements R4-105 from Telcordia GR-765 "Single Fiber Single-Mode Optical Splices and Splicing Systems" and perform splices in accordance with section 3.5 of this specification after the test.

3.8.5 Operating Condition: The splicer shall be capable of performing splices in accordance with 3.5 during the following environmental exposures:

- a. -10 °C, uncontrolled humidity
- b. 55 °C, uncontrolled humidity
- c. 38 °C, 75%RH

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3.8.6 Operating Orientation: The splicer shall be capable of performing splices in accordance with Section 3.5 in physical orientations ranging from -45 degrees minimum to +45 degrees minimum of a vertical orientation.

3.9 Operation

3.9.1 Setup time: The equipment setup time shall not exceed 15 minutes.

NOTE: Equipment setup time includes all necessary actions prior to performing first permanent splice.

3.9.2 Splice time: Newly certified operator should be able to complete and protect a splice that meets all of the performance requirements outlined herein within a 15-minute timeframe adaptable to the fibers and cables specified in this document.

3.9.3 Splicer Time: The fusion splicer shall be capable of performing pre-screening, alignment, arcing, and post-screening (including estimation) in less than 20 seconds.

3.9.4 Heater Time: The fusion splicer shall be capable of shrinking fiber protection sleeves that are in accordance with MIL-PRF-24623/6 in less than 50 seconds.

3.9.5 Working volume: Splicing system should be optimized for use in difficult-to-reach locations, in confined workspaces or openings, and where visibility is limited. Working volume shall be 525 cubic inches (8603.2 cubic cm) max.

Note: A working volume of less than 441 cubic inches (7226.7 cubic cm) is desired.

3.9.6 Cable preparation length: Equipment shall not require more than 4.5 inches (114.3 mm) of cable jacket to be removed from either of the cables being spliced.

3.10 Safety

3.10.1 The splicer shall have an interlocked protective cover that shall not allow arcing to occur when the protective cover is in the open position.

3.10.2 The splicing system shall meet UL requirements for low voltage safety.

3.11 Maintainability

3.11.1 Cleaning. Cleaning operations shall not degrade the performance of the fusion splicer. Optical lenses and mechanical hardware shall be accessible to facilitate cleaning. Disassembly of the splicer shall not be required for cleaning. Special cleaning tools or chemicals shall not be required.

3.11.2 Field maintenance. Fusion splicer shall not require special tooling for field maintenance operations.

3.11.3 Replacement parts

3.11.3.1 Electrodes: Electrodes shall be easily replaceable using standard tools.

3.11.3.2 Electrode life: Electrodes shall have a service life of at least 1000 splices and shall not require maintenance or cleaning during that time.

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3.11.3.3 Cleaver life: Cleaver shall have a service life of at least 1,000 cleaves per blade position and shall not require maintenance during that time.

3.11.3.4 Service interval: The service interval shall be 12 months minimum. At the end of this interval, the equipment shall be within splice loss performance (3.5.1) and insertion loss estimation (3.6.2.7) requirements specified herein. Manufacturer shall submit data to confirm compliance with these requirements.

3.11.3.5 Service life: The service life shall be no less than 10 years based on part availability, replacement parts shall be available for no less than 7 years.

3.12 Cleaver

3.12.1 High Precision Cleaver: A high precision cleaver shall be provided with the splicing equipment and it shall be of the same type used to perform the splice in accordance with section 3.5.

3.12.2 Cleave Angle: The cleaver shall meet the requirements of Cleave Angle Distribution and Cleave Angle Maximum in accordance with TR-NWT-000264.

3.13 Accessories

3.13.1 Transit case. A protective hard carrying case shall be provided for transporting the equipment. The case shall be capable of accommodating the equipment, accessories, consumables, electrodes, and the operation manual.

3.13.2 Technical manual: A use and installation manual (operator's manual) shall be provided with each piece of equipment. A maintenance and servicing manual shall be provided with all appropriate levels of maintenance; unit operational verification, module level (cleaver blade), and component level (electrode). The technical manual shall be provided in both printed and electronic formats. The printed format shall otherwise be normally provided. A statement of copyright release for reproduction of the technical manual for government use shall be provided.

3.14 Materials.

3.14.1 Nonmetallic materials. Nonmetallic materials shall not be affected by the use of alcohol based cleaning solutions.

3.14.2 Toxic and hazardous products and formulations. The materials used shall have no adverse effect on the health of personnel when used for the intended purpose.

3.14.3 Radioactive materials. Radioactive materials shall not be used.

3.15 Marking Fusing splicing tools supplied to this CID shall be marked with the manufacturer's (MFR's) standard commercial PIN and serial number (NOTE: The part number marked on the unit pack shall be the CID PIN.) Markings shall be legible and permanent.

4. REGULATORY REQUIREMENTS. The offeror/contractor is encouraged to use recovered materials to the maximum extent practicable, in accordance with 23.403 of the Federal Acquisition Regulation (FAR).

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7.3 Source of documents.

FEDERAL REGULATIONS

FAR - Federal Acquisition Regulations (FAR)

(Copies of this document are available online at <http://www.acquisition.gov/comp/far/index.html> or from the U. S. Government Printing Office, 732 North Capital Street, NW, Washington, DC 20401-0001).

DEPARTMENT OF DEFENSE SPECIFICATION

- MIL-PRF-24623/6 - Splice, Fusion, Fiber Optic Cable, Protector.
- MIL-PRF-28800 - Test Equipment for Use With Electrical and Electronic Equipment, General Specification for.
- MIL-PRF-49291 - Fiber Optical, (Metric) General Specification for.
- MIL-PRF-85045 - Cables, Fiber Optics (Metric), General Specification for.

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or www.assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robins Avenue, Building 4D, Philadelphia, PA 19111-5094).

Other Publications

Electronic Industries Alliance (EIA)

- TIA-455-28 - Measuring Dynamic Strength and Fatigue Parameters of Optical Fibers by Tension.
- TIA/EIA-455-34 - Interconnection Device Insertion Loss Test.
- TIA-455-107 - Determination of Component Reflectance or Link/System Return Loss Using a Loss Test Set.

(Copies of these documents are available online at www.eia.org or from the Electronic Industries, 2500 Wilson Boulevard, Arlington, VA 22201-3834)

Telcordia Technologies

- GR-765 - Single Fiber Single-Mode Optical Splices and Splicing Systems
- TR-NWT-000264 - Generic Requirements for Optical Fiber Cleavers

(Copies of these documents are available online at <http://www.telcordia.com> or Telcordia Customer Service Piscataway, NJ 08854-4156 1.800.521.2673 (USA and Canada), 1.732.699.5800 (worldwide), 1.732.336.2559 (FAX))

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

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7.4 Ordering data. Purchasers should specify the following:

- a. CID document number, revision, and CID PIN.
- b. Product conformance provisions.
- c. Packaging requirements.
- d. Quantity and type of fusion splicing tools required.

7.5 Storage. Fusion splicing tools performance may be impacted upon extended exposure to dirty environments. Storage of fusion splicing tools in the storage case provided is recommended.

7.6 Commercial products. As part of the market analysis and research effort, this CID was coordinated with manufacturers of commercial products. For a list of manufacturers known to meet the requirements of this CID, see the Navy Recommended Fiber Optic Components Parts List web site at, <https://fiberoptics.nswc.navy.mil>. (NOTE: This information should not be considered as a list of approved manufacturers or be used to restrict procurement to only those manufacturers).

7.7 Government users. To acquire information on obtaining these fusion splicers from the Government inventory system, contact Defense Supply Center, Columbus, ATTN: DSCC-FMXB, P.O. Box 3990, Columbus, OH 43218-3990, or telephone (614) 692-1636.

7.8 Key Words.

Cleaver
Fusion Splicer
Optical Fiber

Custodians:
Army - CR
Navy - SH
Air Force - 11
DLA - CC

Preparing activity:
Navy - SH

Agent
DLA - CC

Review Activities:
Air Force - 13, 19, 93, 99

(Project 6099-2006-002)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://assist.daps.dla.mil>.