INCH-POUND

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SUPERSEDING
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25 August 1987

MILITARY SPECIFICATION

TERMINI, FIBER OPTIC CONNECTOR, REMOVABLE, GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for removable crimp and epoxy type fiber optic termini for use in connectors and other fiber optic components (see 6.1). These termini are capable of operating within the temperature ranges as specified (see 3.1).

1.2 Classification.

1.2.1 Application: The application of specific termini shall be defined by the connector in which they are to be used, as specified herein (see 3.8) and in the applicable specification sheet (see 3.1).

1.2.2 Class. Termini covered by this specification shall be of the following classes as specified (see 3.1).

a. Class 1 - Maximum operating temperature +71°C. Minimum operating temperature -46°C.
b. Class 2 - Maximum operating temperature +85°C. Minimum operating temperature -55°C.
c. Class 3 - Maximum operating temperature +105°C. Minimum operating temperature -55°C.
d. Class 4 - Maximum operating temperature +125°C. Minimum operating temperature -55°C.
e. Class 5 - Maximum operating temperature +150°C. Minimum operating temperature -65°C.

1.2.3 Type. Termini covered by this specification shall be of the following types as specified (see 3.1).

a. Type I - Crimp
b. Type II - Adhesive

1.2.4 Style. Termini covered by this specification shall be of the following styles as specified (see 3.1).

a. Style A - Butt
b. Style B - Expanded Beam

1.2.5 Size. The size of the termini shall be defined by the fiber size it can accommodate and the cavity size for which it is intended, as specified herein (see 3.8) and in the individual specification sheet (see 3.1).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander Defense Electronics Supply Center ATTN: DESC-ES 1507 Wilmington Pike Dayton, Ohio 45444-5276, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. The following specifications, standards, and handbooks 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

DOD-F-49291	-	Fiber, Optical, (Metric) General Specification for.
MIL-C-55330	-	Connectors, Electrical and Fiber Optic, Packaging of.
DOD-C-85045	-	Cables, Fiber Optic, (Metric) General Specification for.

(See supplement 1 for list of associated specifications.)

STANDARDS

MILITARY

MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes.
DOD-STD-347	-	Product Assurance Program Requirements for Fiber Optic Component.
MIL-STD-454	-	Standard General Requirements for Electronic Equipment.
MIL-STD-1344	-	Test Methods For Electrical Connectors.
MIL-STD-45662	-	Calibration Systems Requirements.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA RS-359	-	EIA Standard Colors For Color Identification and Coding.
EIA-455-21	-	Mating Durability For Fiber Optic Interconnecting Devices.
EIA-455-34	-	Interconnection Device Insertion Loss Test.

(Application for copies should be addressed to the Electronics Industries Association, 2001 Eye Street, N.W., Washington, DC 20006.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

Aerospace Information Report AIR 1351

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096-0001.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

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2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets or MS standards), the text of this document shall take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheets. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 Qualification. Termini furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list (QPL) at the time of award of contract (see 4.4 and 6.3)

3.2.1 Part or Identifying Number (PIN). The term Part or Identifying Number (PIN) is equivalent to the term (part number, identification number, and type designator) previously used in this specification. The PIN shall not be applied to the termini, except for qualification test samples (see 6.3) until notification has been received from the activity responsible for qualification that the product has been approved for listing on the qualified products list.

3.3 Product assurance requirements. The product assurance requirements of the fiber optic termini furnished under this specification shall be established and maintained in accordance with the procedures and requirements specified in DOD-STD-347 with details as specified in 4.1.2.

3.4 Materials. Materials shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the termini to meet the performance requirement of this specification and the applicable specification sheet (see 3.1). Acceptance or approval of any constituent material shall not be construed as a guarantee of acceptance of the finished product.

3.4.1 General. All materials used shall be nonnutrient to fungus (see requirement 4 of MIL-STD-454). Material shall in no manner interfere with or degrade the fiber optical termination process, terminus cleaning operation or optical junction transmission.

3.4.2 Metals. Unless otherwise specified (see 3.1), all termini shall be corrosion resistant types (300 series CRES recommended), or shall be otherwise finished to prevent corrosion during service life under any of the environmental conditions as specified by this document.

3.4.3 Dissimilar metals. Dissimilar metals shall not be used in intimate contact with each other unless suitably finished to prevent electrolytic corrosion. The criteria for the selection and protection of dissimilar metal combinations shall be in accordance with requirement 16 of MIL-STD-454.

3.4.4 Nonmetallic materials. All nonmetallic materials used in the construction of the termini specified by this document shall not be affected by the use of cleaning materials as required by 4.7.4. Nor shall any substance used in the construction of the termini be degraded when operating at the environmental conditions as specified herein.

3.4.4.1 Mercury and radioactive material. Mercury and radioactive material shall not be used in the construction of the termini specified by this document.

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3.4.4.2 Toxic and hazardous products and formulations. Materials used in the termini shall not give off toxic or explosive fumes when exposed to flame. The material shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency.

3.4.4.3 Solvents, adhesives and cleaning agents. No incompatibility shall exist between the materials employed in the fiber to terminus securing or polishing processes, resulting in the degradation of the materials from in-service use or when tested in accordance with the requirements of the temperature life test of 3.7.8.

3.4.4.4 Adhesives (epoxies). Adhesives are not precluded from use in the construction of the termini controlled by this specification. However, the types of adhesives which may be used shall be specifically defined in the individual specificaton sheet for the terminus type (see 3.1). The service life of adhesive materials shall be consistent with the intended useful lifetime of the connector. The intended use of the epoxies is to terminate the fiber to the termini.

3.4.4.5 Sealing compounds. Sealing compounds which may flow at the maximum upper storage temperature specified herein, or crack at the minimum lower storage temperature specified herein shall not be used.

3.5 Design and construction. Termini shall be of the design, construction, and physical dimensions as specified (see 3.1).

3.5.1 Optical termini. Optical terminus dimensions shall be as specified (see 3.1). The mating ends of these termini shall be shaped to prevent gouging of the insert during engagement. The terminus design shall preclude damage to the terminus retention device or to the sealing members during insertion or removal of a terminus. No terminus damage shall result from inserting termini into or removing termini from the connector with the tool specified for insertion or removal. The terminus shall terminate fibers with the properties, dimensions and dimensional tolerance specified (see 3.1).

3.5.1.1 Dummy termini. Dummy termini shall be as specified (see 3.1). Requirements for retention, insertion and removal, and environmental sealing of the dummy termini shall be equivalent to those for the in-service optical termini.

3.5.2 Terminus insertion and removal methods. Optical terminus insertion shall be accomplished by inserting the terminus through the inserts of the connector mating halves and by locking it in place. The individual termini shall be positively retained in the connector when installed with the terminus insertion tool and shall be capable of being removed without terminus or insert damage when using the terminus removal tool. Requirements for these tools shall be as specified (see 3.1).

3.5.3 Finishes. Peeling or chipping of the allowable plating or finishes, galling of mating parts, nicks, burrs, or other surface blemishes shall not be permitted.

3.5.4 Interchangeability and intermateability. Termini shall be as specified (see 3.1), to insure interchangeability and intermateability.

3.5.4.1 Interchangeability. All termini having the same PIN shall be physically and functionally interchangeable without need for modification of such items.

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3.5.4.2 Intermateability. All termini of the same PIN shall be intermateable with their counterpart termini.

3.6 Optical performance requirements. The optical performance requirements of 3.6.1 through 3.6.2 shall be used to monitor the effects of the inspection requirements as specified in 3.7 as applicable.

3.6.1 Insertion loss. When measured in accordance with 4.6.1, the maximum in accordance with terminated pair under all conditions shall be 2.0 dB (see 3.1).

3.6.2 Optical discontinuity. The optical terminus shall not cause any discontinuities in signal transmission due to its configuration, material, or construction. The test procedure used shall be submitted to the qualification activity (see 4.6.2).

3.7 Inspection requirements. The inspection requirements specified in 3.7.1 through 3.7.14 shall be performed as required by 4.7.1 through 4.7.14 and adhere to the optical performance requirements of 3.6.

3.7.1 Size. When examined in accordance with 4.7.1, the dimensions and dimensional tolerances for these termini shall be as specified (see 3.1).

3.7.2 Weight. When tested in accordance with 4.7.2, the weight of the termini shall be as specified (see 3.1).

3.7.3 Identification marking. When tested in accordance with 4.7.3, the termini shall be marked as specified in 1.2.1, 3.8, or as specified (see 3.1). All marking characters on any surface of the termini shall be identifiable.

3.7.4 Terminus cleaning. After cleaning the terminus in accordance with 4.7.4, the optical insertion loss of 3.6.1 and the marking requirements of 3.7.3 shall be met.

3.7.5 Circular runout. When measured as specified in 4.7.5, designated surfaces must be within the total runout tolerance specified (see 3.1).

3.7.6 Terminus retention. When tested in accordance with 4.7.6 and subjected to axial loads of 22 pounds, termini shall be retained in their inserts and not exceed .015 (0.38 mm) displacement. Spring loaded termini may deflect more than .015 (0.38 mm) but must return to within .015 inch of original position after load is removed. This requirement applies only to termini with retention mechanisms.

3.7.7 Terminus engagement and separation force. When specified in the applicable specification sheet and tested in accordance with 4.7.7, the terminus engagement and separation force shall be within the limits specified (see 3.1).

3.7.8 Temperature life. When tested in accordance with 4.7.8, termini subjected to these specified accelerated aging exposures shall not exhibit visual evidence of dimensional change, opening of seals, cracking or crazing of components or finishes, identification marking impairment, fusion or seizure of mating parts or other effects detrimental to terminus operation. Termini shall be connectorized and mated.

3.7.9 Thermal shock. When tested in accordance with 4.7.9, a post-test visual examination of the tested termini shall reveal no fiber breakage within the terminus, no evidence of test-induced dimensional change, no apparent loss of seal capability, no surface or identification marking impairment and no damage detrimental to the operation of the termini. Termini shall be connectorized and mated.

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3.7.10 Tensile strength. When tested in accordance with 4.7.10, the minimum axial load required to separate the fiber from the terminus either by pulling the fiber out of the terminus or breaking the fiber within the terminus, shall be not less than 690 MPa.

3.7.11 Mating durability. When tested in accordance with 4.7.11, the termini shall show no evidence of defects detrimental to the mechanical or optical performance when subjected to 500 complete mating and unmating cycles, unless otherwise specified (see 3.1).

3.7.12 Physical shock. When tested as specified in 4.7.12, the termini shall show no evidence of broken, loose, deformed or displaced parts, cracks, chips or other damage which would result in a degradation of optical or mechanical performance. There shall be no optical discontinuity (see 3.6.2) and the insertion loss shall not exceed the limits in 3.6.1. Termini shall be connectorized and mated.

3.7.13 Vibration. When tested as specified in 4.7.13, the termini shall show no evidence of broken, loose, deformed or displaced parts, cracks, chips or other damage which would result in a degradation of optical or mechanical performance. There shall be no optical discontinuity (see 3.6.2) and the insertion loss shall not exceed the limits in 3.6.1. Termini shall be connectorized and mated.

3.7.14 Salt spray (corrosion). When tested as specified in 4.7.14, mated termini shall withstand 48 hours, unless otherwise specified (see 3.1), of salt spray conditioning. Following the test, visual inspection shall reveal no condition that would result in mechanical or optical performance degradation of the termini. Termini shall be connectorized and mated.

3.8 PIN construction. Each terminus shall be identified by four distinct color bands indicating the TICC as specified herein (see 3.1, 3.9, and appendix A). The PIN shall be as specified in the military specification sheets (see 3.1), but shall be defined in the following format:

M29504/01	-XXX
Basic specification and specification sheet	Dash number (TICC code see 3.1, 3.9, and appendix A)

3.9 Marking. Removable termini shall be permanently and legibly marked with the manufacturer's symbol or trademark and the TICC bands (see figure 1). Unless otherwise specified (see 3.1), markings shall remain legible after tests. Flaking of the color bands in the crimp indenter area (type 1 only) is acceptable provided the color of the bands are still identifiable.

3.9.1 Manufacturer's symbol or trademark. The manufacturer's symbol or trademark shall be marked as shown on figure 1, unless otherwise specified (see 3.1), or on the fiber barrel side of the shoulder. The manufacturer's symbol or trademark shall be listed in the SAE Standard AIR 1351.

3.9.2 TICC bands. Each digit of the TICC (see 1.2.1) shall be designated on the terminus by a color band in accordance with the following:

0 - Black	4 - Yellow	7 - Violet
1 - Brown	5 - Green	8 - Gray
2 - Red	6 - Blue	9 - White
3 - Orange		

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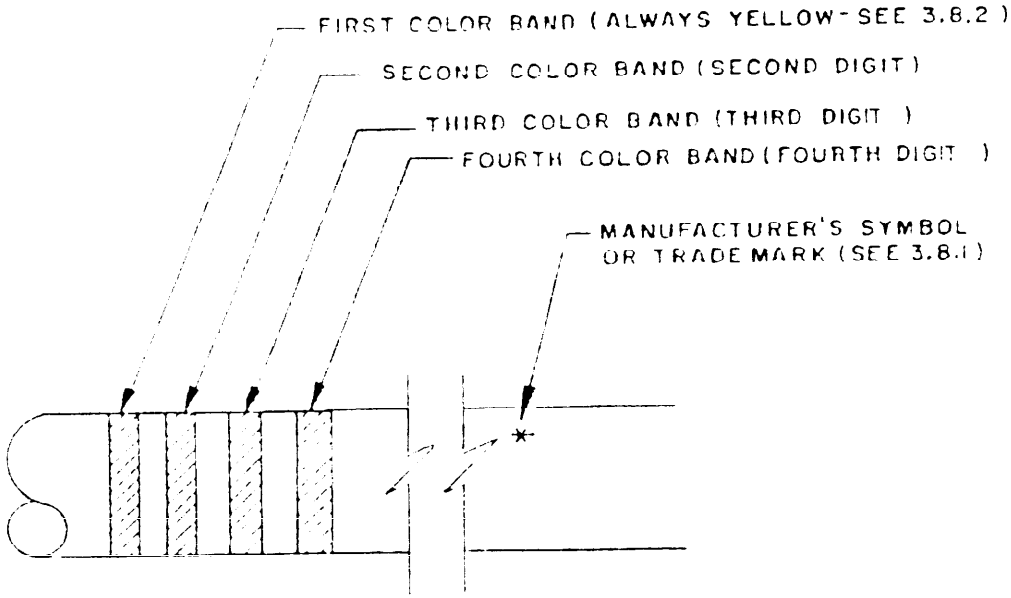

FIGURE 1. Termini identification color coding (TICC).

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The first color band shall always be yellow in color which indicates fiber optic termini and shall always be assigned a numerical value of four. Color for color bands shall be in accordance with EIA RS-359. Unless otherwise specified (see 3.1), colors shall remain within the specified limits during testing.

3.10 Workmanship. Termini shall be processed in such a manner as to be uniform in quality and shall be free from foreign material and burrs or sharp corners that might damage the connector or affect mating of the termini.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examination and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Product assurance program. A product assurance program shall be established and maintained in accordance with DOD-STD-347. Evidence of such compliance shall be verified by the qualifying activity of this specification as a prerequisite for qualification and continued qualification.

4.1.3 Test equipment and inspection facilities. Provision for test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection(s) shall be the responsibility of the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662 and as specified herein.

4.1.4 Assembly plants. Assembly plants shall be listed on, or approved for listing on, the applicable qualified products list. The qualified terminus manufacturer shall certify that the assembly plant is approved for the distribution of the manufacturer's parts. The assembly plant shall use only piece parts supplied by the qualified terminus manufacturer. No testing other than visual examination is required of certified piece parts obtained from the qualified terminus manufacturer, except when there is cause for rejection. All assemblies produced at the assembly plant shall be subjected to examination of the product to assure that the assembly process conforms with that established at the qualified manufacturing plant. Quality control requirements, including Government inspection surveillance, shall be the same as required for the qualified termini manufacturer.

4.1.5 Test report. The size, type, and manufacturer's name and PIN of the terminus shall be included in the qualification test report.

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4.2 Inspections.

4.2.1 Classification of inspection. The inspections specified herein are classified as follows:

a. Materials inspection (see 4.3).

b. Qualification inspection (see 4.4).

c. Quality conformance inspection (see 4.5).

4.2.2 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the following ambient conditions: Termini shall be installed in a standard qualified connector if the test requires.

Temperature:	+25°C ±10°C (+25°C ±1°C for controlled ambient).
Relative humidity:	45 percent - 75 percent (50 percent ±5 percent for controlled ambient).
Atmospheric pressure:	650 - 800 millimeters of mercury.

4.3 Materials inspection. Materials inspection shall consist of certification supported by verifying data that materials used in fabricating the delivered fiber optic termini are in accordance with the requirements of 3.4 and as specified (see 3.1).

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.3) on sample units produced with equipment and procedures normally used in production. This inspection shall consist of performing the inspections and optical test specified in table I, in the sequence shown therein, on the qualification test samples specified in 4.4.1.

4.4.1 Test samples. Fiber optic terminus samples complying with the specified requirements (see 3.1) shall be submitted for qualification. The manufacturer shall provide a counterpart terminus for each terminus subjected to qualifying tests requiring mating assemblies. The counterpart termini provided for this purpose shall be new, previously qualified termini or new termini submitted for qualification testing. Manufacturers not producing mating termini shall submit data substantiating that tests were performed with qualified counterpart termini. For those tests specifying the use of mated termini, optical and mechanical test assessment shall be made using the assigned counterpart termini for those test measurements as required.

4.4.1.1 Sample size. Unless otherwise directed by the qualifying agency (see 6.3), test samples of 60-pin termini and 60-mating socket termini of each PIN for which qualification is desired shall be selected at random.

4.4.1.2 Sample preparation. Unless otherwise specified, termini shall be terminated as required with the applicable fiber sizes indicated as specified in the specification sheet. Fiber type shall be in accordance with DOD-F-49291.

4.4.2 Inspection routine. Terminus samples shall be tested in accordance with the sequence of table I. Optical tests shall be made as specified in table I.

4.4.3 Qualification rejection. Qualification approval will not be granted if any of the termini being tested according to table I fail to meet the requirements of 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, and 3.9.

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4.4.4. Retention of qualification. To retain qualification, the contractor shall forward to the qualifying activity at 18-month intervals a summary of groups A and B. At 36-month intervals a group C report shall be submitted. The qualifying activity shall establish the initial reporting date. The report shall consist of:

a. A summary of the results of the tests performed for inspection of product for delivery (groups A and B), indicating as a minimum, the number of lots that have passed, and the number that have failed, and the group which they failed. The results of tests of all reworked lots shall be identified and accounted for.

b. A summary of the results of the tests performed for periodic inspection (group C), including the number of failures. The summary shall include results of all periodic inspection tests performed and completed during the 36-month period. If the summary of the test results indicate nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.

Failure to submit the report within 30 days after the end of each 18-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 18-month period that the inspection data indicates failure of the qualified product to meet the requirements of this specification.

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during two consecutive reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit the qualified product to testing in accordance with the qualification inspection requirements.

4.4.4.1 Termini. For termini used in qualified connectors, the tests may be conducted during the regularly scheduled retention of qualification testing with the applicable connector undergoing retention of qualification.

4.4.5 Qualification by similarity. The extent of qualification testing by similarity shall be determined by the qualified products list evaluating activity.

4.5 Quality conformance inspection. Quality conformance inspection shall consist of the inspection and optical tests specified for group A inspection (table II), group B inspection (table III), group C inspection (table IV), and packaging inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A and group B inspections.

4.5.1.1 Inspection lot. An inspection lot shall consist of all termini of the same P/N produced under essentially the same conditions, and offered for inspection at one time.

4.5.1.1.1 Sample unit. A sample unit shall be selected at random from the inspection lot.

4.5.1.1.2 Sample size. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality level (AQL) shall be 1 percent for major defects and 4 percent for minor defects. Major and minor defects shall be as defined in MIL-STD-105.

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4.5.1.1.3 Sample unit preparation. Termini shall be fully terminated using the fiber and cable specified in DOD-F-49291 and DOD-C-85045, respectively. Termination shall be accomplished in accordance with the termini manufacturer's instructions.

4.5.1.1.4 Specimen. A specimen shall be a sample unit prepared in accordance with 4.5.1.1.3.

4.5.1.2 Group A inspection. Group A inspection shall consist of the inspections and optical tests specified in table II, in the order listed.

4.5.1.2.1 Visual examination (group A inspection). Each terminus shall be visually examined for completeness, workmanship, and identification requirements. Attention shall be given to those assemblies that require a gasket to determine the condition of the gasket. Gaskets missing, twisted, buckled, kinked, or damaged in any way shall be cause for rejection.

4.5.1.2.2 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality level (AQL) shall be 1 percent for major defects and 4 percent for minor defects. Major and minor defects shall be as defined in MIL-STD-105.

4.5.1.2.3 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection in accordance with MIL-STD-105. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.5.1.2.4 Disposition of sample units. Sample units that have failed any of the group A inspection tests may be reworked to correct defects if possible and subjected to group A inspection again. Sample units that pass all tests of group A inspection may be delivered on the purchase order or contract or tested to group B inspection (see 4.5.1.3). Units that have not been corrected shall not be delivered on any order even though the inspection lot submitted is accepted.

4.5.1.3 Group B inspection. Group B inspection shall consist of the inspections and optical tests as specified in table III, in the order shown, and shall be made on sample units which have been subjected to and have passed the group A inspection.

4.5.1.3.1 Sampling plan. Sample units of the same PIN as presently qualified shall be selected and reported on every 18 months.

4.5.1.3.2 Failures. If one or more sample units fail to pass group B inspection, the sample shall be considered to have failed.

4.5.1.3.3 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct defects, or screen out the defective units and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection in accordance with MIL-STD-105. Such lots shall be separate from new lots and shall be clearly identified as reinspected lots.

4.5.1.3.4 Disposition of sample units. Sample units may be used for group C inspection or delivered on the contract or purchase order only if the following requirements are met:

a. The lot is accepted.

b. The sampling unit passed group B inspection, or the sample unit failed group B inspection but was reworked and successfully retested to group B requirements.

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TABLE I. Qualification inspection.

Inspection	Optical tests		Requirement paragraph	Test method paragraph
	Insertion loss (3.6.1)	Optical discontinuity 1/ (3.6.2)		
Group I				
Examination of product				
Physical conformance				
Size			3.7.1	4.7.1
Weight			3.7.2	4.7.2
Circular runout			3.7.5	4.7.5
Identification marking			3.7.3	4.7.3
			3.8	4.8
Workmanship			3.9	4.9
Insertion loss	X 2/		3.6.1	4.6.1
Optical discontinuity		X 1/	3.6.2	4.6.2
Examination of product				
Group II				
Examination of product				
Temperature life	a 3/		3.7.8	4.7.8
Terminus retention			3.7.6	4.7.6
Terminus engagement and separation force			3.7.7	4.7.7
Terminus cleaning	a		3.7.4	4.7.4
Identification marking			3.7.3	4.7.3
Examination of product				
Group III				
Examination of product				
Thermal shock			3.7.9	4.7.9
Physical shock	a	d 1/	3.7.12	4.7.12
Vibration	d 3/	d 1/	3.7.13	4.7.13
Tensile strength			3.7.10	4.7.10
Mating durability	a 4/		3.7.11	4.7.11
Identification marking			3.7.3	4.7.3
Examination of product				
Group IV				
Examination of product				
Mating durability	a 4/		3.7.11	4.7.11
Termini engagement and separation force			3.7.7	4.7.7
Salt spray			3.7.14	4.7.14
Terminus cleaning	a		3.7.4	4.7.4
Identification marking			3.7.3	4.7.3
Examination of product				

1/ To be determined.
2/ X - Indicates that this test applies.
3/ d - Indicates performance test to be accomplished before, during, and after inspection test.
a - Indicates performance test to be accomplished before and after inspection test.
4/ The performance test should also be performed after every 100 complete mating and unmating cycles.

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TABLE II. Group A inspection.

Inspection	Optical tests		Requirement paragraph	Test method paragraph
	Insertion loss (3.6.1)	Optical discontinuity 1/ (3.6.2)		
Examination of product				
Size			3.7.1	4.7.1
Weight			3.7.2	4.7.2
Workmanship			3.9	4.9
Termini engagement and separation force			3.7.7	4.7.7
Identification marking			3.7.3	4.7.3
Examination of product				

1/ To be determined.

TABLE III. Group B inspection.

Inspection	Optical tests		Requirement paragraph	Test method paragraph
	Insertion loss (3.6.1)	Optical discontinuity 1/ (3.6.2)		
Examination of product				
Circular runout			3.7.5	4.7.5
Terminus retention			3.7.6	4.7.6
Terminus engagement and separation force			3.7.7	4.7.7
Tensile strength			3.7.10	4.7.10
Terminus cleaning	a 2/		3.7.4	4.7.4
Identification marking			3.7.3	4.7.3
Examination of product				

1/ To be determined.

2/ a - Indicates performance test to be accomplished before and after inspection test.

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TABLE IV. Group C inspection.

Inspection	Optical tests		Requirement paragraph	Test method paragraph
	Insertion loss (3.6.1)	Optical discontinuity 1/ (3.6.2)		
Group I (six samples)				
Examination of product				
Circular runout			3.7.5	4.7.5
Physical shock test	a 2/	d 2/	3.7.12	4.7.12
Vibration test procedures for fiber optic connecting devices	a	d	3.7.13	4.7.13
Tensile strength			3.7.10	4.7.10
Temperature life	a		3.7.8	4.7.8
Thermal shock			3.7.9	4.7.9
Identification marking			3.7.3	4.7.3
Examination of product				
Group II (six samples)				
Examination of product				
Mating durability for fiber optic connecting devices	a		3.7.11	4.7.11
Salt spray			3.7.14	4.7.14
Terminus cleaning	a		3.7.4	4.7.4
Identification marking			3.7.3	4.7.3
Examination of product				

1/ To be determined.
2/ d - Indicates performance test to be accomplished before, during, and after inspection test
a - Indicates performance test to be accomplished before and after inspection test.

Sample units not meeting criteria a and b shall not be delivered on the contract or purchase order, or used for group C inspection.

4.5.2 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.5.2.1), delivery of products which have passed group B inspection shall not be delayed pending the results of these periodic inspections.

4.5.2.1 Group C inspection. Group C inspection shall consist of the tests specified in table IV in the order shown. Group C inspection shall be performed on sample units of each style and selected from inspection lots which have passed groups A and B inspections. Group C inspection sample shall be representative of production.

4.5.2.1.1 Sampling plan. Every 36 months, termini sample units which have passed group A and group B inspection shall be selected in sufficient quantity to provide six samples in accordance with applicable test group.

4.5.2.1.2 Failures. If one or more specimen or sample unit fails to pass group C inspection, the sample shall be considered to have failed.

4.5.2.1.3 Disposition of sample units. Sample units which have been subjected to group C inspection shall not be delivered on the contract or purchase order.

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4.5.2.1.4 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which are manufactured under essentially the same conditions, with essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all tests and examinations or the test which the original sample failed, at the option of the Government). Groups A and B inspections may be reinstituted; however, final acceptance and shipment shall be withheld until the group C inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity.

4.5.3 Inspection of packaging. The sampling and inspection of the preservation, packing, and container marking shall be in accordance with the requirements of MIL-C-55330.

4.6 Optical conformance test methods. Cladding mode stripping devices shall be used when making optical measurements. The mode stripper shall be installed in the test circuit between the source and the termini unless otherwise specified.

4.6.1 Insertion loss. Insertion loss shall be tested in accordance with method A of EIA-455-34 (FOTP-34), unless otherwise specified (see 3.6.1 and 3.1).

4.6.2 Optical discontinuity. Test procedures for optical discontinuity shall be submitted to the qualifying activity at the time of request for authorization to qualify (see 3.6.2).

4.7 Inspection methods.

4.7.1 Size. Each of the dimensions specified (see 3.1) for the termini shall be measured using calibrated measuring devices with the precision and accuracy appropriate for the tolerances specified (see 3.1 and 3.7.1).

4.7.2 Weight. The terminus shall be weighed using calibrated scales having the range, precision and accuracy appropriate for the tolerances specified (see 3.1 and 3.7.2).

4.7.3 Identification marking. Identification markings on termini shall be visually examined and measured for conformance with the requirements of 3.7.3.

4.7.4 Terminus cleaning. The optical face of each terminus shall be cleaned according to the instructions supplied by the manufacturer. (The terminus may be removed from its operational position and alignment sleeve removed to facilitate cleaning, see 3.7.4).

4.7.5 Circular runout. Termini shall be tested in accordance with appendix B of this specification (see 3.7.5).

4.7.6 Terminus retention force. Applicable unmated connector samples shall be tested in accordance with method 2007 of MIL-STD-1344. Termini shall be subjected to axial compressive loads applied to the front face of the terminus tending to push the terminus to the rear of the connector. Care must be exercised in the design of the terminus plunger mechanism to not physically touch the optical face. Axial loads shall be applied up to the maximum load specified herein (see 3.7.6).

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4.7.7 Terminus engagement and separation force. Sockets shall be mounted in a suitable fixture for applying gradually increasing loads for the engagement and separation of the specified test pins and in accordance with method 2014 of MIL-STD-1344. The test pins shall be inserted a minimum of 0.7 L (see figure 2). A maximum diameter test pin shall be inserted and removed from each socket termini. The engagement force shall be measured during insertion. A minimum diameter test pin shall be inserted and removed from each socket termini and the separation force shall be measured during removal (see 3.7.7).

4.7.8 Temperature life. Mated termini shall be subjected to a temperature test condition 3 unless otherwise specified (see 3.1), and test time condition D in accordance with method 1005 of MIL-STD-1344. The change in insertion loss shall be measured during and after the test (see 3.7.8). Termini shall be connectorized and mated.

4.7.9 Thermal shock. Termini (mated and unmated) shall be tested in accordance with test condition A of method 1003 of MIL-STD-1344 with the exception that the temperature extremes shall be as specified (see 3.1). Cleaning of the optical termini of the unmated assembly in accordance with 4.7.4 prior to optical testing shall be permissible (see 3.7.9). Termini shall be connectorized and mated.

4.7.10 Tensile strength. Terminus assemblies shall be subjected to tensile strength in accordance with method 2003 of MIL-STD-1344 (see 3.7.10). Crimping tools, when required, shall be specified in the applicable specification sheet (see 3.1).

4.7.11 Mating durability for fiber optic connecting devices. Termini shall be installed in a qualified connector and shall be subjected to 500 cycles of mating and unmating in accordance with EIA-455-21 (FOTP-21). The change in insertion loss and coupling forces after the durability tests shall be measured. Cleaning will be permitted after completion of durability cycling in order to meet the requirements of 3.6.1 (see 3.7.11).

4.7.12 Physical shock test. Optical termini shall be tested in accordance with MIL-STD-1344 method 2004 test condition "D". Termini shall be connectorized and mated.

4.7.13 Vibration test procedures for fiber optic connecting devices. Optical termini shall be tested in accordance with MIL-STD-1344 method 2005, test condition III (see 3.7.13). Termini shall be connectorized and mated.

4.7.14 Salt spray (corrosion). Connectorized and mated termini assemblies shall be tested in accordance with test condition B of method 1001 of MIL-STD-1344. After test exposure the assemblies shall be externally cleaned and examined under 3 power magnification for damage to external parts (see 3.7.14).

4.8 Marking inspection. The termini shall be visually examined to verify that they meet the marking requirements of 3.8.

4.9 Workmanship inspection. The termini shall be visually examined to verify that they meet the workmanship requirement of 3.9.

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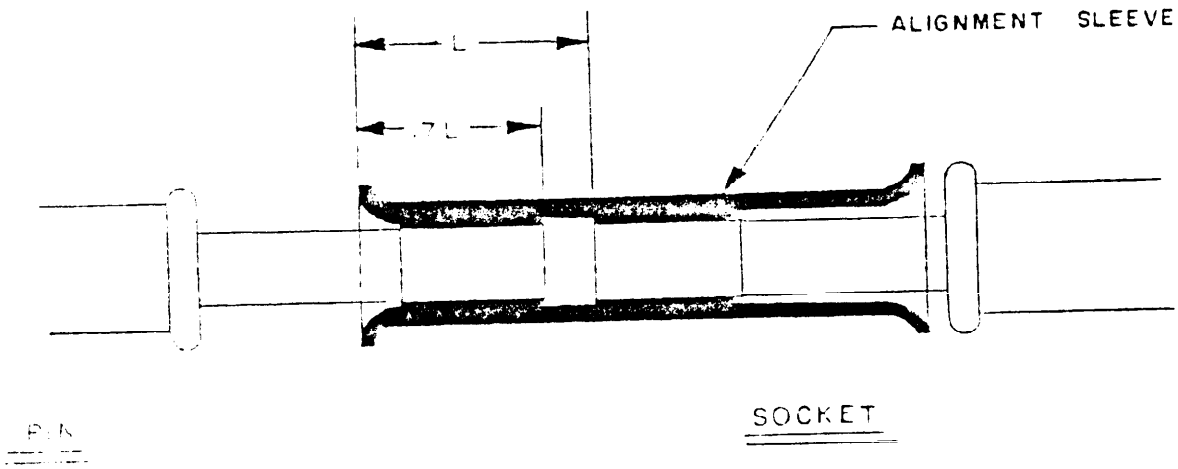

L = Distance from socket end face
to the end of the alignment sleeve

FIGURE 2. Depth of engagement for termini engagement and separation force tests.

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5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-C-55330.

6. NOTES

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

6.1 Intended use. Termini covered by this specification are primarily intended for use in multitermini connectors where the coupling means is provided separately from the individual termini. Specific application and mating termini will be included for information in the specification sheets. Termini that are an integral part of the connector are not intended to be qualified to this specification; however, these termini may be tested as required (see 3.1).

6.2 Acquisition requirements. Acquisition documents shall specify the following:

a. Title, number, and date of this specification.

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).

c. Complete part or PIN.

6.3 Qualification. Awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in applicable qualified products list, whether or not such products have actually been so listed by that date. The attention of the contractors is called to this requirement, and manufacturers are urged to arrange to have the products, that they propose to offer to the federal Government, tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the Space and Naval Warfare Systems Command (SPAWAR), Washington, DC 20363; however, informantion pertaining to qualification of products may be obtained from Defense Electronics Supply Center (DESC-E), 1507 Wilmington Pike, Dayton, OH 45444.

6.3.1 Conformity to qualification sample. It is understood that termini supplied under the contract shall be identical in every respect to the qualification sample tested and found satisfactory, except for changes previously approved by the Government. Any unapproved changes from the qualification sample shall constitute cause for rejection.

6.3.2 Provisions governing qualification SD-6. Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

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6.4 TICC code bands. Color bands are intended for identification of termini before they are installed in the connector and prior to termini crimping.

6.5 PIN. The PIN should be structured in accordance with 3.8.

6.6 Subject term (key word) listing.

Connectors
Fiber optic
Military specification
Optical performance requirements
Removable
Termini

6.7 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

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APPENDIX A

TERMINI IDENTIFICATION MARKING

10. SCOPE

10.1 Scope. This appendix is utilized to relate the termini identification color code (TICC) to an actual description of the PIN specified in MIL-T-29504A. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

20.1 GOVERNMENT DOCUMENT

20.1.1 Specifications, standards, and handbooks.

MIL-C-28876/16 - Connectors, Fiber Optic, Environment Resisting Pin Terminus.
MIL-C-28876/17 - Connectors, Fiber Optic, Environment Resisting Socket Terminus.
MIL-C-28876/18 - Connectors, Fiber Optic, Environment Resisting, Dummy Terminus.

30. TERMINI SUMMARY AND SUPERSESSION DATA

30.1 Termini summary. The termini summary table is provided as table V. The termini shall be marked with the color bands indicated in table V and in accordance with 3.6.

30.2 Supersession data for pin termini. All optical termini that were specified in MIL-C-28876/16 have been superseded. The TICC numbers 4006 through 4018 have superseded those termini previously covered by MIL-C-28876/16.

30.3 Supersession data for socket termini. All optical termini that were specified in MIL-C-28876/17 have been superseded. The TICC numbers 4019 through 4037 have superseded those termini previously covered by MIL-C-28876/17.

30.4 Supersession data for dummy termini. MIL-C-28876/18 for a dummy terminus has been superseded by the TICC number 4038.

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TABLE V. Termini summary.

TICC 1/	Color bands 1st 2/	2nd	3rd	Mating end 4th	PIN	Pin (P), Socket (S) or Dummy (D)	Mating end size	Type (see 1.2.3)	Style (see 1.2.4)	Cladding diameter (min um)	Supserseded PIN	Connector used with (specification)
4000 3/	Yellow	Black	Black	Black	M29504/01-4000	P	16	II	A	119.5	M28876/16-048XXX 4/	MIL-C-28876 MIL-C-83526
4001	Yellow	Black	Black	Brown	M29504/01-4001	P	16	II	A	122.0	M28876/16-049XXX	MIL-C-28876 MIL-C-83526
4002	Yellow	Black	Black	Red	M29504/01-4002	P	16	II	A	124.5	M28876/16-050XXX	MIL-C-28876 MIL-C-83526
4003	Yellow	Black	Black	Orange	M29504/01-4003	P	16	II	A	127.0	M28876/16-051XXX	MIL-C-28876 MIL-C-83526
4004 3/	Yellow	Black	Black	Yellow	M29504/01-4004	P	16	II	A	129.5	M28876/16-052XXX	MIL-C-28876 MIL-C-83526
4005 3/	Yellow	Black	Black	Green	M29504/01-4005	P	16	II	A	132.0	M28876/16-053XXX	MIL-C-28876 MIL-C-83526
4006 3/	Yellow	Black	Black	Blue	M29504/01-4006	P	16	II	A	134.5	M28876/16-054XXX	MIL-C-28876 MIL-C-83526
4007	Yellow	Black	Black	Violet	M29504/01-4007	P	16	II	A	137.0	M28876/16-055XXX	MIL-C-28876 MIL-C-83526
4008	Yellow	Black	Black	Gray	M29504/01-4008	P	16	II	A	139.5	M28876/16-056XXX	MIL-C-28876 MIL-C-83526
4009	Yellow	Black	Black	White	M29504/01-4009	P	16	II	A	142.0	M28876/16-057XXX	MIL-C-28876 MIL-C-83526
4010 3/	Yellow	Black	Brown	Black	M29504/01-4010	P	16	II	A	145.0	M28876/16-058XXX	MIL-C-28876 MIL-C-83526
4011 3/	Yellow	Black	Brown	Brown	M29504/01-4011	P	16	II	A	193.0	M28876/16-077XXX	MIL-C-28876 MIL-C-83526
4012 3/	Yellow	Black	Brown	Red	M29504/01-4012	P	16	II	A	195.5	M28876/16-078XXX	MIL-C-28876 MIL-C-83526
4013 3/	Yellow	Black	Brown	Orange	M29504/01-4013	P	16	II	A	198.0	M28876/16-079XXX 4/	MIL-C-28876 MIL-C-83526
4014 3/	Yellow	Black	Brown	Yellow	M29504/01-4014	P	16	II	A	200.5	M28876/16-080XXX	MIL-C-28876 MIL-C-83526
4015 3/	Yellow	Black	Brown	Green	M29504/01-4015	P	16	II	A	203.0	M28876/16-081XXX	MIL-C-28876 MIL-C-83526
4016 3/	Yellow	Black	Brown	Blue	M29504/01-4016	P	16	II	A	205.5	M28876/16-082XXX	MIL-C-28876 MIL-C-83526
4017 3/	Yellow	Black	Brown	Violet	M29504/01-4017	P	16	II	A	208.0	M28876/16-083XXX	MIL-C-28876 MIL-C-83526
4018 3/	Yellow	Black	Brown	Gray	M29504/01-4018	P	16	II	A	211.0	M28876/16-084XXX	MIL-C-28876 MIL-C-83526

See footnotes at end of table.

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TABLE V. Termini summary - Continued.

TICC 1/	Color bands Mating end 1st 2/	2nd	3rd	4th	PIN	Pin (P), Socket (S) or Dummy (D)	Mating end size	Type (see 1.2.3)	Style (see 1.2.4)	Cladding diameter (min um)	Supserseded PIN	Connector used with (specification)
4019 3/	Yellow	Black	Brown	White	M29504/02-4019	S	16	II	A	119.5	M28876/17-048XXX	MIL-C-28876 MIL-C-83526
4020	Yellow	Black	Red	Black	M29504/02-4020	S	16	II	A	122.0	M28876/17-049XXX	MIL-C-28876 MIL-C-83526
4021	Yellow	Black	Red	Brown	M29504/02-4021	S	16	II	A	124.5	M28876/17-050XXX	MIL-C-28876 MIL-C-83526
4022	Yellow	Black	Red	Red	M29504/02-4022	S	16	II	A	127.0	M28876/17-051XXX	MIL-C-28876 MIL-C-83526
4023 3/	Yellow	Black	Red	Orange	M29504/02-4023	S	16	II	A	129.5	M28876/17-052XXX	MIL-C-28876 MIL-C-83526
4024 3/	Yellow	Black	Red	Yellow	M29504/02-4024	S	16	II	A	132.0	M28876/17-053XXX	MIL-C-28876 MIL-C-83526
4025 3/	Yellow	Black	Red	Green	M29504/02-4025	S	16	II	A	134.5	M28876/17-054XXX	MIL-C-28876 MIL-C-83526
4026	Yellow	Black	Red	Blue	M29504/02-4026	S	16	II	A	137.0	M28876/17-055XXX 4/	MIL-C-28876 MIL-C-83526
4027	Yellow	Black	Red	Violet	M29504/02-4027	S	16	II	A	139.5	M28876/17-056XXX	MIL-C-28876 MIL-C-83526
4028	Yellow	Black	Red	Gray	M29504/02-4028	S	16	II	A	142.0	M28876/17-057XXX	MIL-C-28876 MIL-C-83526
4029 3/	Yellow	Black	Red	White	M29504/02-4029	S	16	II	A	145.0	M28876/17-058XXX	MIL-C-28876 MIL-C-83526
4030 3/	Yellow	Black	Orange	Black	M29504/02-4030	S	16	II	A	193.0	M28876/17-077XXX	MIL-C-28876 MIL-C-83526
4031 3/	Yellow	Black	Orange	Brown	M29504/02-4031	S	16	II	A	195.5	M28876/17-078XXX	MIL-C-28876 MIL-C-83526
4032 3/	Yellow	Black	Orange	Red	M29504/02-4032	S	16	II	A	198.0	M28876/17-079XXX	MIL-C-28876 MIL-C-83526
4033 3/	Yellow	Black	Orange	Orange	M29504/02-4033	S	16	II	A	200.5	M28876/17-080XXX	MIL-C-28876 MIL-C-83526
4034 3/	Yellow	Black	Orange	Yellow	M29504/02-4034	S	16	II	A	203.0	M28876/17-081XXX	MIL-C-28876 MIL-C-83526
4035 3/	Yellow	Black	Orange	Green	M29504/02-4035	S	16	II	A	205.5	M28876/17-082XXX	MIL-C-28876 MIL-C-83526
4036 3/	Yellow	Black	Orange	Blue	M29504/02-4036	S	16	II	A	208.0	M28876/17-083XXX	MIL-C-28876 MIL-C-83526
4037 3/	Yellow	Black	Orange	Violet	M29504/02-4037	S	16	II	A	211.0	M28876/17-084XXX	MIL-C-28876 MIL-C-83526
4038	Yellow	Black	Orange	Gray	M29504/03-4038	D	16	N/A	N/A	N/A	M28876/18-16	MIL-C-28876 MIL-C-83526

See footnotes at end of table.

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TABLE V. Termini summary - Continued.

TICC 1/	Color bands Mating end 1st 2/	2nd	3rd	4th	PIN	Pin (P), Socket (S) or Dummy (D)	Mating end size	Type (see 1.2.3)	Style (see 1.2.4)	Cladding diameter (min µm)	Supserseded PIN	Connector used with (specification)
4039	Yellow	Black	Orange	White	M29504/04-4039	P	16	II	A	124.5	N/A	MIL-C-38999
4040	Yellow	Black	Yellow	Black	M29504/04-4040	P	16	II	A	127.0	N/A	MIL-C-38999
4041	Yellow	Black	Yellow	Brown	M29504/04-4041	P	16	II	A	129.5	N/A	MIL-C-38999
4042	Yellow	Black	Yellow	Red	M29504/04-4042	P	16	II	A	139.5	N/A	MIL-C-38999
4043	Yellow	Black	Yellow	Orange	M29504/04-4043	P	16	II	A	142.0	N/A	MIL-C-38999
4044	Yellow	Black	Yellow	Yellow	M29504/04-4044	P	16	II	A	145.0	N/A	MIL-C-38999
4045	Yellow	Black	Yellow	Green	M29504/05-4045	S	16	II	A	124.5	N/A	MIL-C-38999
4046	Yellow	Black	Yellow	Blue	M29504/05-4046	S	16	II	A	127.0	N/A	MIL-C-38999
4047	Yellow	Black	Yellow	Violet	M29504/05-4047	S	16	II	A	129.5	N/A	MIL-C-38999
4048	Yellow	Black	Yellow	Gray	M29504/05-4048	S	16	II	A	139.5	N/A	MIL-C-38999
4049	Yellow	Black	Yellow	White	M29504/05-4049	S	16	II	A	142.0	N/A	MIL-C-38999
4050	Yellow	Black	Green	Black	M29504/05-4050	S	16	II	A	145.0	N/A	MIL-C-38999
4051 3/	Yellow	Black	Green	Brown	M29504/06-4051	P	16	II	A	124.5	N/A	DOD-C-83527
4052	Yellow	Black	Green	Red	M29504/06-4052	P	16	II	A	127.0	N/A	DOD-C-83527
4053	Yellow	Black	Green	Orange	M29504/06-4053	P	16	II	A	129.5	N/A	DOD-C-83527
4054	Yellow	Black	Green	Yellow	M29504/06-4054	P	16	II	A	139.5	N/A	DOD-C-83527
4055 3/	Yellow	Black	Green	Green	M29504/06-4055	P	16	II	A	142.0	N/A	DOD-C-83527
4056 3/	Yellow	Black	Green	Blue	M29504/06-4056	P	16	II	A	145.0	N/A	DOD-C-83527
4057 3/	Yellow	Black	Green	Violet	M29504/07-4057	S	16	II	A	124.5	N/A	DOD-C-83527
4058	Yellow	Black	Green	Gray	M29504/07-4058	S	16	II	A	127.0	N/A	DOD-C-83527

See footnotes at end of table.

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TABLE V. Termini summary - Continued.

TICC 1/	Color bands 1st 2/	2nd	3rd	Mating end 4th	PIN	Pin (P), Socket (S) or Dummy (D)	Mating end size	Type (see 1.2.3)	Style (see 1.2.4)	Cladding diameter (min μm)	Supserseded PIN	Connector used with (specification)
4059 3/	Yellow	Black	Green	White	M29504/07-4059	S	16	II	A	129.5	N/A	DOD-C-83527
4060	Yellow	Black	Blue	Black	M29504/07-4060	S	16	II	A	129.5	N/A	DOD-C-83527
4061	Yellow	Black	Blue	Brown	M29504/07-4061	S	16	II	A	142.0	N/A	DOD-C-83527
4062	Yellow	Black	Blue	Red	M29504/07-4062	S	16	II	A	145.0	N/A	DOD-C-83527
4063 3/	Yellow	Black	Blue	Orange	M29504/08-4063	P	16	II	A	124.5	N/A	MIL-C-28840
4064 3/	Yellow	Black	Blue	Yellow	M29504/08-4064	P	16	II	A	127.0	N/A	MIL-C-28840
4065 3/	Yellow	Black	Blue	Green	M29504/08-4065	P	16	II	A	129.5	N/A	MIL-C-28840
4066	Yellow	Black	Blue	Blue	M29504/08-4066	P	16	II	A	139.5	N/A	MIL-C-28840
4067	Yellow	Black	Blue	Violet	M29504/08-4067	P	16	II	A	142.0	N/A	MIL-C-28840
4068	Yellow	Black	Blue	Gray	M29504/08-4068	P	16	II	A	145.0	N/A	MIL-C-28840
4069 3/	Yellow	Black	Blue	White	M29504/09-4069	S	16	II	A	124.5	N/A	MIL-C-28840
4070 3/	Yellow	Black	Violet	Black	M29504/09-4070	S	16	II	A	127.0	N/A	MIL-C-28840
4071 3/	Yellow	Black	Violet	Brown	M29504/09-4071	S	16	II	A	129.5	N/A	MIL-C-28840
4072 3/	Yellow	Black	Violet	Red	M29504/09-4072	S	16	II	A	139.5	N/A	MIL-C-28840
4073 3/	Yellow	Black	Violet	Orange	M29504/09-4073	S	16	II	A	142.0	N/A	MIL-C-28840
4074 3/	Yellow	Black	Violet	Yellow	M29504/09-4074	S	16	II	A	145.0	N/A	MIL-C-28840
4075 3/	Yellow	Black	Violet	Green	M29504/10-4075	P	16	II	A	124.5	N/A	MIL-C-83723, Series III
4076 3/	Yellow	Black	Violet	Blue	M29504/10-4076	P	16	II	A	127.0	N/A	MIL-C-83723
4077 3/	Yellow	Black	Violet	Violet	M29504/10-4077	P	16	II	A	129.5	N/A	MIL-C-26482, Series II

See footnotes at end of table.

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TABLE V. Termini summary - Continued.

TICC 1/	Color bands Mating end 1st 2/	2nd	3rd	4th	PIN	Pin (P), Socket (S) or Dummy (D)	Mating end size	Type (see 1.2.3)	Style (see 1.2.4)	Cladding diameter (min µm)	Supserseded PIN	Connector used with (specification)
4078	Yellow	Black	Violet	Gray	M29504/10-4078	P	16	II	A	139.5	N/A	MIL-C-83723, Series III
4079	Yellow	Black	Violet	White	M29504/10-4079	P	16	II	A	142.0	N/A	MIL-C-83723
4080	Yellow	Black	Gray	Black	M29504/10-4080	P	16	II	A	145.0	N/A	MIL-C-26482, Series II
4081	Yellow	Black	Gray	Brown	M29504/11-4081	S	16	II	A	124.5	N/A	MIL-C-83723, Series III
4082	Yellow	Black	Gray	Red	M29504/11-4082	S	16	II	A	127.0	N/A	MIL-C-83723
4083	Yellow	Black	Gray	Orange	M29504/11-4083	S	16	II	A	129.5	N/A	MIL-C-26482, Series II
4084	Yellow	Black	Gray	Yellow	M29504/11-4084	S	16	II	A	139.5	N/A	MIL-C-83723, Series III
4085	Yellow	Black	Gray	Green	M29504/11-4085	S	16	II	A	142.0	N/A	MIL-C-83723
4086	Yellow	Black	Gray	Blue	M29504/11-4086	S	16	II	A	145.5	N/A	MIL-C-26482, Series II

1/ TICC: Termini identification color code.

2/ The first color band shall always be yellow to differentiate a fiber optic termini from an electrical contact.

3/ Inactive for new design.

4/ X indicates all numerical combinations possible.

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APPENDIX B

CIRCULAR RUNOUT

10. SCOPE

10.1 Scope. The purpose of this test procedure is to determine the total runout tolerance of the mating end of the fiber optic termini relative to the aligning surface (see figure 3). This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

30. TEST EQUIPMENT

30.1 Test equipment. The test equipment shall consist of a "V" alignment plate, a microscope, minimum of 200X power with a reticle (see figure 4), and a means of rotating the part under test while holding it against the test fixture. A video system and a TV monitor with projected lines may be substituted for the reticle. A precision hole with a clearance less than 0.0001 from the sample outer diameter may be used instead of the "V".

30.2 Calibration. A line width standard with an accuracy of better than 0.00005 (traceable to the National Bureau of Standards) shall be placed under the microscope. The lines on the reticle (or TV monitor) shall be within (or adjusted to within, when possible) 0.0001 or 0.0002 as required for measurement.

40. TEST SAMPLE

40.1 Test sample. A test sample shall consist of a finished pin or a socket without alignment sleeve. The test sample shall be free from dirt or dust with a front surface polished sufficiently to allow delineation of the boundaries of the hole.

50. TEST PROCEDURE

50.1 Testing. Testing shall be conducted under standard atmospheric conditions in accordance with 4.2.2 herein.

50.2 Method.

50.2.1 Test setup. The test setup shall be configured as shown on figure 5. The test sample shall be inserted into the "V" with the front surface towards the microscope and the alignment surface against the "V". Move the holder-rotater into position to hold test sample against "V".

50.2.2 Test procedure. Focus the microscope on the front surface of the test sample and bring the hole edge to the center of the viewing area. Rotate the part and observe the position where the hole edge is at the farthest point to the left. This point shall be defined as the reference point for determining the axial concentricity of the hole. Now position the first line of the reticle at the reference point previously observed (see figure 6). Completely rotate the test sample and observe if the hole edge passes the second line on the reticle. If the hole edge extends past the second line (see figure 7) the test sample does not meet the concentricity test. Small surface imperfections on the hole edge may be ignored provided that it does not extend into the hole or does not subtend more than a 10° angle.

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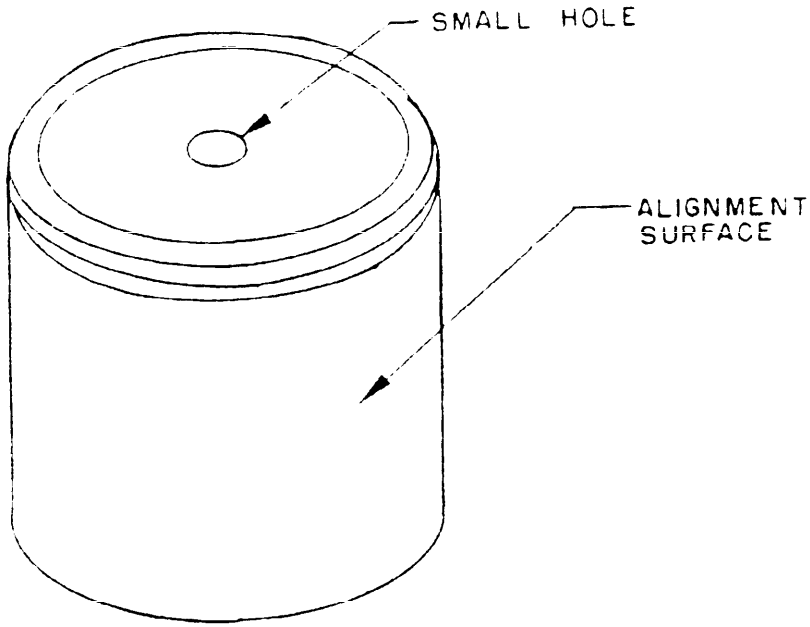

FIGURE 3. Fiber optic termini.

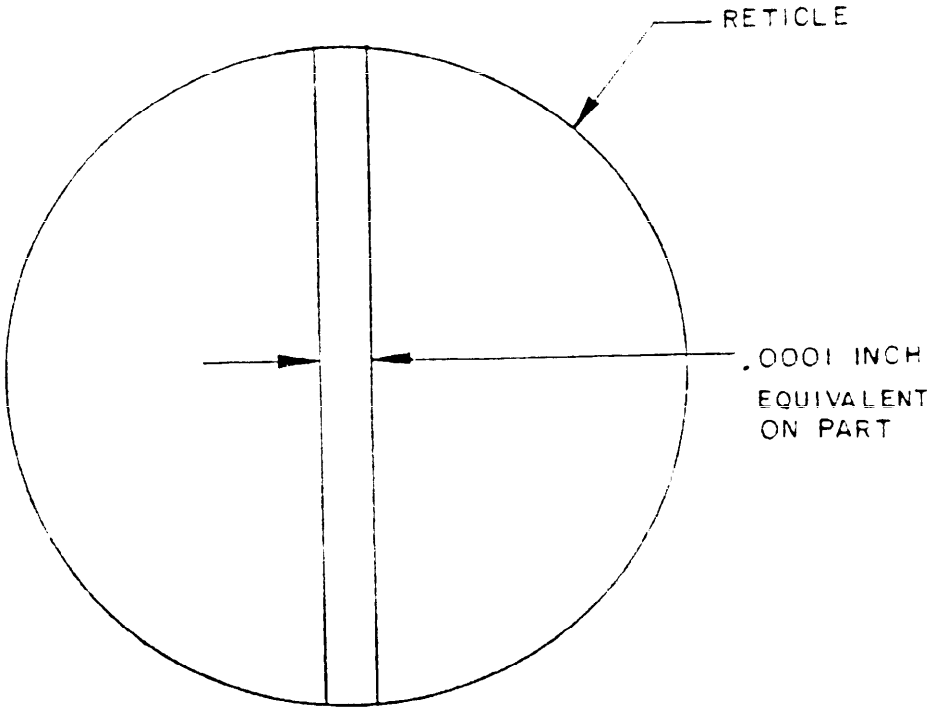

FIGURE 4. Reticle.

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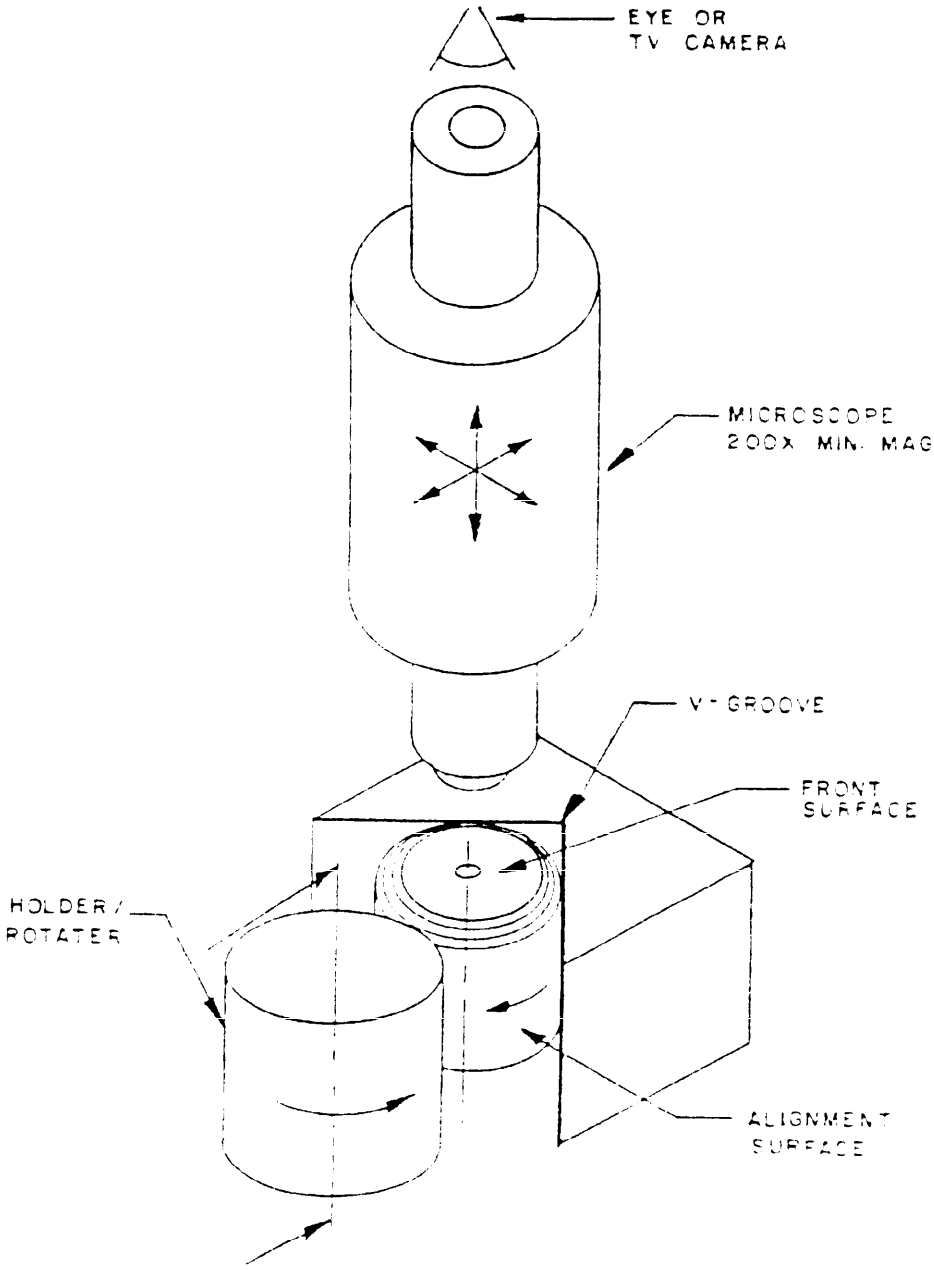

FIGURE 5. Test setup.

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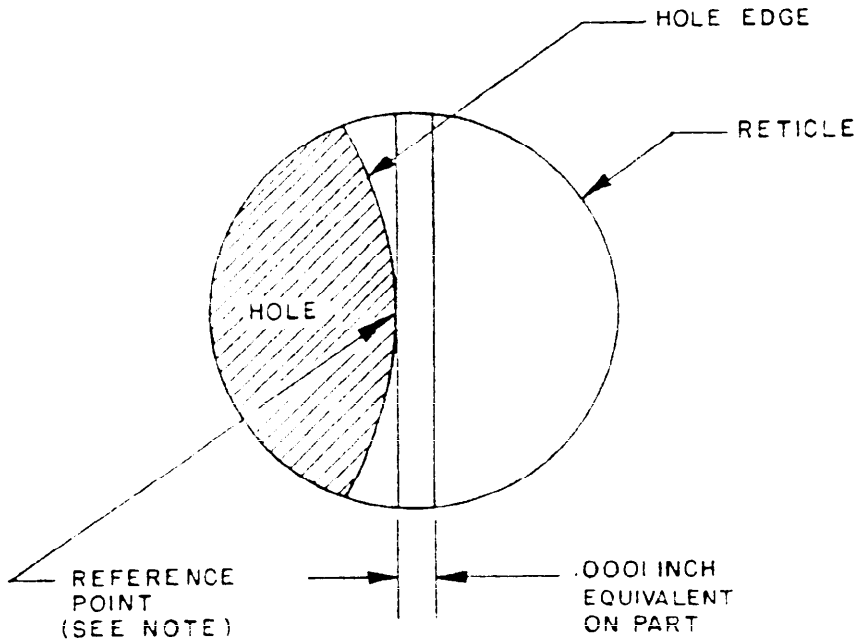

NOTE: Location where hole was viewed at a point farthest to the left.

FIGURE 6. Reference point and location of reticle.

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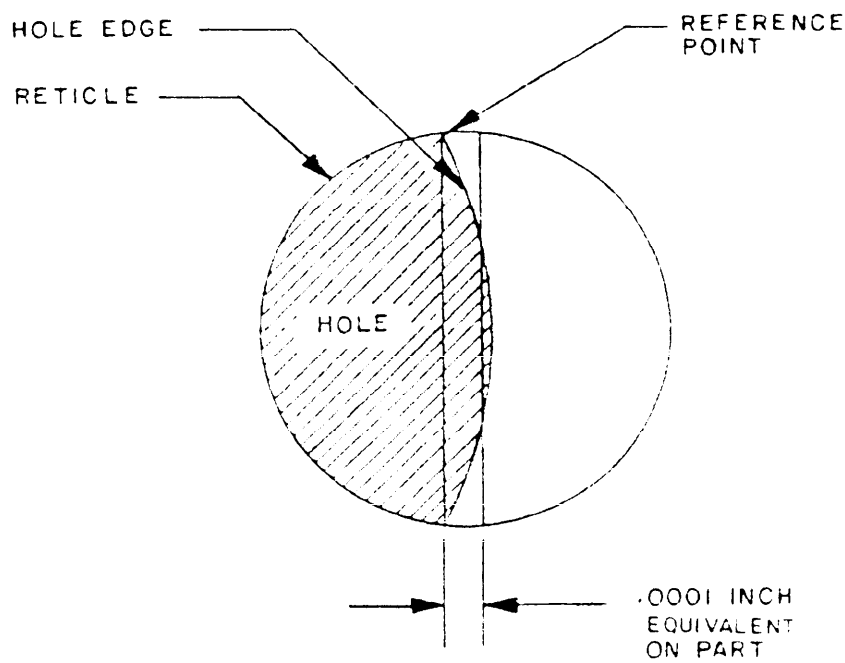

NOTE: Location where hole was viewed at a point farthest to the left.

FIGURE 7. Concentricity failure.

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APPENDIX B

60. DOCUMENTATION

60.1 Documentation. Data sheets shall contain the following:

a. Title of test, date, and test personnel.

b. Sample preparation to include termination procedure.

c. Test equipment used and date of latest calibration including technical description of each item.

d. Values and observations:

(1) Specified concentricity value (see specification sheet).

(2) Measured concentricity value.

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CONCLUDING MATERIAL

Custodians:
Army - CR
Navy - EC
Air Force - 85

Review activities:
Army - MI
Navy - AS, MC, SH
Air Force - 11, 17, 19, 70, 80, 90, 99
DLA - ES

User activities:
Army - AV
Navy - CG, MC, OS, YD
Air Force - 13, 14, 84

Preparing activity:
Navy - EC

Agent:
DLA - ES

(Project 6060-0078)

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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 MIL-T-29504A	2. DOCUMENT DATE (YYMMDD) 19 December 1989

3. DOCUMENT TITLE

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

a. NAME Commander Defense Electronics Supply Center Attn: DESC-ES, 1507 Wilmington Pike, Dayton, OH 45444-5276	b. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON
c. ADDRESS (Include Zip Code)	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

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