



**AMERICAN NATIONAL
STANDARD**
ANSI/EIA/TIA-492AAAA-1989
APPROVED: February 9, 1989

EIA/TIA SPECIFICATION

Detail Specification for
62.5- μ m Core Diameter/125- μ m
Cladding Diameter Class Ia
Multimode, Graded Index
Optical Waveguide Fibers

EIA/TIA-492AAAA

ADOPTED FOR USE BY THE
FEDERAL GOVERNMENT
ITPS
PUB 159
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EIA/TIA-492AAAA

FEBRUARY 1989

ELECTRONIC INDUSTRIES ASSOCIATION
ENGINEERING DEPARTMENT



APPROVED FOR USE IN
THE NECQ SYSTEM

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APPROVED FOR USE IN THE NECQ SYSTEM AS NQ/EIA/TIA-492AAAA

This standard has been adopted for Federal Government use.

Details concerning its use within the Federal Government are contained in Federal Information Processing Standards Publication 159, Detail Specification for 62.5- μ m Core Diameter/125- μ m Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibers. For a complete list of the publications available in the Federal Information Processing Standards Series, write to the Standards Processing Coordinator (ADP), National Institute of Standards and Technology, Gaithersburg, MD 20899.

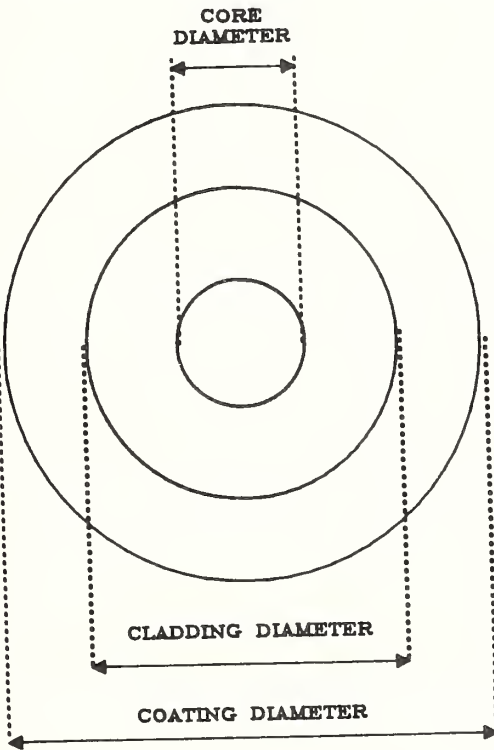
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DETAIL SPECIFICATION
FOR 62.5- μm CORE DIAMETER/125- μm CLADDING DIAMETER
CLASS Ia MULTIMODE, GRADED-INDEX OPTICAL WAVEGUIDE FIBERS

(From EIA Standards Proposal No. 2124-B, formulated under the cognizance of the TR-41.8.1 Ad Hoc Group on Building Wiring for Commercial Enterprises.)

<p>Electronic Industries Association 2001 Eye Street, N.W. Washington, DC 20006</p>	<p>Detail Specification EIA/TIA-492AAAA February, 1989</p>
<p>Electronic Components of Assessed Quality in Accordance with Generic Specification EIA-4920000-A</p>	<p>Blank Detail Specification EIA-492AA00</p>
<p>Outline Drawing:</p>  <p>The diagram shows a cross-section of a multimode optical fiber with three concentric layers. The innermost layer is the core, the middle layer is the cladding, and the outermost layer is the coating. Three horizontal double-headed arrows indicate the diameters of these layers: the innermost arrow is labeled 'CORE DIAMETER', the middle arrow is labeled 'CLADDING DIAMETER', and the outermost arrow is labeled 'COATING DIAMETER'. Dotted lines extend from the ends of these arrows to the corresponding boundaries of the layers.</p>	<p>Description: Class Ia Multimode, Graded-Index Optical Waveguide Fibers</p>
	<p>Construction:</p> <ul style="list-style-type: none"> • Core Diameter: 62.5 μm • Cladding Diameter: 125 μm • NA: 0.275 • Fiber Composition: Glass • Coating Diameter: A function of cable design; nominal value shall be indicated in the Detail Specification Extension. • Coating Composition: Usually made from one or more plastic materials or compositions, to protect the fiber during manufacture, handling, and use.
	<p>Applications: On-premises inter- building and intrabuilding fiber installations, including LANs, PBXs, video, various multiplex- ing uses, outside telephone cable plant use, and miscellaneous related uses.</p>

1.0 SECTION ONE - GENERAL

1.1 General Information

This Detail Specification applies to a Class Ia Multimode, Graded-Index Optical Waveguide fiber. The core and cladding shall consist of all glass, with the core having a refractive index profile that varies across the core. The profile is defined by a profile parameter, g , whose value is $3 > g > 1$. The coating and/or buffer, usually made from one or more plastic materials or compositions, protects the fiber during manufacture, handling, and use.

1.2 Related Documents

American Society for Testing and Materials (ASTM) Recommended Practice E29, "Standard Recommended Practice for Indicating Which Places of Figures Are to be Considered Significant in Specified Limiting Values." Unless otherwise specified herein, the terms used in this Detail Specification shall be as defined in EIA-440-A, "Fiber Optic Terminology" (when issued). There are no additional related documents, other than those referenced in Generic Specification EIA-4920000-A and Sectional Specification EIA-492A000.

1.3 Specifications

Specifications shall be as delineated in "Performance Requirements" columns of Tables A and B.

1.4 Marking

Marking shall conform to the provisions of clause 1.5 of Sectional Specification EIA-492A000.

1.5 Ordering Information

Orders for fibers covered by this Specification shall contain, in clear or in coded form, the following minimum information:

Number and issue reference of this Detail Specification

1.6 Additional Information (Not for Inspection Purposes): Suppliers and users of cables containing optical fiber specified by this document are directed to the following Series of EIA Standards which provide the mechanisms for preparation of Detailed Specifications for fiber optic cable:

- ANSI/EIA-472, "Generic Specification for Fiber Optic Cables";
- ANSI/EIA-472A, "Sectional Specification for Fiber Optic Communication Cables for Outside Aerial Use";

- ANSI/EIA-472B, "Sectional Specification for Fiber Optic Communication Cables for Underground and Buried Use";
- ANSI/EIA-472C, "Sectional Specification for Fiber Optic Communication Cables for Indoor Use";
- ANSI/EIA-472D, "Sectional Specification for Fiber Optic Communication Cables for Outside Telephone Plant Use";
- ANSI/EIA-472AXXO, "Blank Detail Specification for Fiber Optic Communication Cables for Outside Aerial Use";
- ANSI/EIA-472BXXO, "Blank Detail Specification for Fiber Optic Communication Cables for Underground and Buried Use";
- ANSI/EIA-472CXXO, "Blank Detail Specification for Fiber Optic Communication Cables for Indoor Use"; and
- ANSI/EIA-472DXXO, "Blank Detail Specification for Fiber Optic Communication Cables for Outside Telephone Plant Use".

The latest revisions of the above Specifications must be obtained, as several revisions are underway at the time of publication of this Detail Specification.

A family of optical fiber cable Detail Specifications, based on the above 472-Series Specifications, is also being prepared by EIA Task Group FO-6.7.11 at the time of publication of this Detail Specification.

This Detail Specification was prepared under the authority of EIA TR-41.8.1 (WG on Commercial and Industrial Building Wiring Standards) in accordance with the recommendations set forth in EIA-492AA00, Blank Detail Specification for Class Ia Multimode, Graded-Index Optical Waveguide Fiber. This specification, in conjunction with Generic Specification EIA-4920000-A, and Sectional Specification 492A000, follow the specification structure of the National Electronic Components Quality Assessment System (NECQ).

Three fiber attributes: Length, Attenuation Coefficient, and Information Transfer Capacity, are designated "Graded Parameters" by EIA 492A000. For these, a range of acceptable values is specified in this Detail Specification. This offers the user a "Shopping List" that permits cost/performance tradeoffs to be made, based on the needs of specific installations.

Application-level requirements for these Graded Parameters shall be specified in the Detail Specification Extension (DSE). For further details see clauses 2.3 and 3.3 in Generic Specification EIA-4920000-A.

1.7 Additional Requirements:

Additional attributes (See Tables A and B): Material ("Chromatic") Dispersion; Temperature Dependence of Attenuation; Temperature-Humidity Cycling; OH⁻ [Hydroxide Ion] Induced Attenuation; Irreversible Loss after 1/2 or 1 Full Cycle of T [Temperature] or RH [Relative Humidity] Cycling or Both; and Point Defects. For Performance Requirements of Tables A and B, all values for tolerances shall be rounded in compliance with ASTM Recommended Practice E29, "Standard Recommended Practice for Indicating which Places of Figures Are to be Considered Significant in Specified Limiting Values."

2.0 SECTION TWO - INSPECTION REQUIREMENTS

2.1 Qualification Approval

For Qualification Approval, the process shall be in accordance with clause 3.2 of Sectional Specification EIA-492A000, which in turn references clause 3.1 of Generic Specification EIA-4920000-A.

Table A specifies the requirements for Qualification Approval, including EIA Fiber Optic Test Procedure (FOTP) Methods.

2.2 Requalification

For requalification the process shall be in accordance with clause 3.3 of Sectional Specification EIA-492A000, which in turn references clause 3.2 of Generic Specification EIA-4920000-A.

2.3 Quality Conformance Inspection (QCI)

For QCI the process shall be in accordance with clause 3.4 of Sectional Specification EIA-492A000, which in turn references clause 3.3 of Generic Specification EIA-4920000-A.

Table B specifies the requirements for QCI, including EIA Fiber Optic Test Procedure (FOTP) Methods.

3.0 SECTION THREE - QUALITY ASSESSMENT TABLES

TABLE A
 QUALIFICATION APPROVAL
 PERFORMANCE TESTING

Group No.	Destructive ¹	Sec. Spec. Sub-clause	Attribute	FOTP Method(s)	Min. No. Samples	Performance Requirements
1	Min.	4.1.1	Cladding Diameter	45 or 48	3	$125 \pm 2.0 \mu\text{m}$
	Min.	4.1.2	Cladding Noncircularity	45 or 48	3	Max. Allowable: $\leq 2\%$
	Min.	4.3.4	<u>Splice-ability:</u> ² Core Diameter	58, by 43 or 44 or 29, and 57	3	$62.5 \pm 3.0 \mu\text{m}$
	Min.	4.1.3	Core Noncircularity	45	3	Max. Allowable: $\leq 6\%$
	Min.	4.1.4	Core/ Cladding Concentricity Error	45	3	Max. Allowable: $\leq 6\%$
	Min.	4.3.3	Numerical Aperture	177 (When Issued), by 47 or 29	3	0.275 ± 0.015

(Table continues on next page. Footnotes appear at the end of the Table.)

TABLE A (Cont'd.)
QUALIFICATION APPROVAL
PERFORMANCE TESTING

Group No.	Destructive ¹	Sec. Spec. Sub-clause	Attribute	FOTP Method(s)	Min. No. Samples	Performance Requirements
1 cont'd.	Min.	N/A	Material (Chromatic) Dispersion	168 or 175	3	$\lambda_{\text{omin}} = 1320\text{nm}$ $\lambda_{\text{omax}} = 1365\text{nm}$ $S_{\text{omax}} = 0.110$ $\text{ps}/(\text{nm}^2 \cdot \text{km})$ for $1320 \text{ nm} \leq \lambda_0 \leq 1348 \text{ nm}$ $S_{\text{omax}} = \frac{1458 - \lambda_0}{1000}$ $\text{ps}/(\text{nm}^2 \cdot \text{km})$ for $1348 \text{ nm} \leq \lambda_0 \leq 1365 \text{ nm}$ See footnote 3 and Figure 1
2a	N/A	N/A	Coating	N/A	3	Conforms to DSE ⁵
	Min.	4.1.5	Coating Diameter	55A or 173 (When Issued)	3	Nominal $\pm 6\%$: Conforms to DSE ⁵
	Min.	4.1.6	Coating/Cladding Concentricity Error	55A	3	Max. Allowable: 16 %
	No	4.1.7	Length of Fiber ⁴	60	3	Range from 1.0 to 6.4 km: Conforms to DSE
	No	4.2.2	Factory Splice	N/A	3	Max. No. Allowable: 0 /km

(Table continues on next page. Footnotes appear at the end of the Table.)

TABLE A (Cont'd.)
 QUALIFICATION APPROVAL
 PERFORMANCE TESTING

Group No.	Destructive ¹	Sec. Spec. Sub-clause	Attribute	FOTP Method(s)	Min. No. Samples	Performance Requirements
2a cont'd.	No	N/A	Point Defects	59 (When Issued)	3	Max. Attenuation at a Point Defect, No. of Point Defects, and Min. Distance between Point Defects Are as Defined in the DSE ⁵
	Min.	4.2.3	Coating Removal	General Methods Permitted	3	Strippable
	No	4.2.4	Shipping Reel	N/A	3	Conforms to DSE ⁵
	No	4.2.5	Shipping Package	N/A	3	Conforms to DSE ⁵
2b	Pot.	4.2.1	Tensile Proof	31	3	$\geq 0.35 \text{ GN/m}^2$; $23 \pm 2 \text{ }^\circ\text{C}$
2c	Yes	N/A	Temperature Dependence of Attenuation	52 and 3 (When Issued)	3	Induced Attenuation: $\alpha(T) - \alpha$ $\leq 0.2 \text{ dB/km}$; $-40^\circ\text{C} \leq T \leq 85^\circ\text{C}$ @ 850 & 1300 nm
	Yes	N/A	Temperature-Humidity Cycling	73	3	Induced Attenuation: $\alpha(T, \text{RH}) - \alpha$ $-10^\circ\text{C} \leq T \leq 65^\circ\text{C}$; $4\% \leq \text{RH} \leq 98\%$ $\leq 0.6 \text{ dB/km}$ @ 850 & 1300 nm

(Table continues on next page. Footnotes appear at the end of the Table.)

TABLE A (Cont'd.)
QUALIFICATION APPROVAL
PERFORMANCE TESTING

Group No.	Destructive ¹	Sectional Spec. Sub-clause	Attribute	FOTP Method(s)	Min. No. Samples	Performance Requirements
2c cont'd	Yes	N/A	Irreversible Loss after 1/2 or 1 Full Cycle of T or RH Cycling, or Both	52 and 73	3	≤ 0.1 dB/km @ 850 & 1300 nm
3	Min.	4.3.1	Attenuation Coefficient ⁴ (α)	46 or 53, 57 and 50	5	$2.8^6 \leq \alpha \leq 5.0$ dB/km @ 850 nm
				46 or 53, 57 and 50	5	$0.5^6 \leq \alpha \leq 2.0$ dB/km @ 1300 nm
	Min.	N/A	OH ⁻ Induced Attenuation	46 and 50	5	Attenuation ₁₃₈₀ - Attenuation ₁₃₀₀ ≤ 1.5 dB/km
	Min.	4.3.2	Information Transmission Capacity ⁴ , ITC (Bandwidth)	51 or 30, 54 and 57 51 or 30, 54 and 57	5 5	$100 \leq \text{ITC} \leq 1000^6$ MHz•km @ 850 nm $100^7 \leq \text{ITC} \leq 2000^6$ MHz•km @ 1300 nm

N/A = Not Applicable

¹ Min. = Minimum loss of sample during testing, on the order of 2 m of length.
Pot. = Potential loss of entire length if failure occurs during testing.

² The four attributes, core noncircularity, core/cladding concentricity error, numerical aperture, and core diameter, represent the components of a spliceability-measurement concept called the Intrinsic Quality Factor (IQF). See Appendix B of Sectional Specification EIA-492A000 for details.

³ Three-term Sellmeier equation applicable from 750 nm to 1450 nm, inclusive.

⁴ A graded parameter. See subclause 3.2.3 of the Sectional Specification.

- ⁵ If applicable. DSE = Detail Specification Extension. It is suggested that requirements designated DSE be kept out of the Detail Specification and be placed in a separate purchasing agreement called the Detail Specification Extension, or in individual purchase orders. For further details see clauses 2.3 and 3.3 in Generic Specification EIA-4920000-A.
- ⁶ These are theoretical limits. Each manufacturer may support only a portion of the range, with Qualification Approval. This range shall be indicated in the DSE.
- ⁷ The minimum ITC value of 100 MHz•km at 1300 nm is specified to accommodate short segments of connectorized cable such as pigtails and/or jumpers. This minimum is NOT implied to be adequate for inter- or intrabuilding cable runs, where a minimum ITC of 400 MHz•km is recommended, and must be specified in the DSE or other procurement document. An even higher ITC may be required for some systems/networking applications.

TABLE B
QUALITY CONFORMANCE INSPECTION
PERFORMANCE TESTING

Group No.	De-structive ¹	Sect. Spec. Sub-clause	Attribute	FOTP Method(s)	Performance Requirements	QCI Conformance Code ²	
						Supplier	User
1	Min.	4.1.1	Cladding Diameter	45 or 48	$125 \pm 2.0 \mu\text{m}$	DSE ³	DSE ³
	Min.	4.1.2	Cladding Noncircularity	45 or 48	Max. Allowable: 2%	DSE ³	DSE ³
	Min.	4.1.3	Core Noncircularity ⁴	45	Max. Allowable: 6%	DSE ³	DSE ³
	Min.	4.1.4	Core/Cladding Concentricity Error ⁴	45	Max. Allowable: 6%	DSE ³	DSE ³
	Min.	N/A	Material (Chromatic) Dispersion	168 or 175	$\lambda_{\text{omin}} = 1320 \text{ nm}$ $\lambda_{\text{omax}} = 1365 \text{ nm}$ $S_{\text{omax}} = 0.110$ $\text{ps}/(\text{nm}^2 \cdot \text{km})$ for $1320 \text{ nm} \leq \lambda_0 \leq 1348 \text{ nm}$ $S_{\text{omax}} =$ $\frac{1000}{1458 - \lambda_0}$ 1000 $\text{ps}/(\text{nm}^2 \cdot \text{km})$ for $1348 \text{ nm} \leq \lambda_0 \leq 1365 \text{ nm}$ See footnote 5 and Figure 1	DSE ³	DSE ³
	N/A	N/A	Coating	N/A	In DSE ^{3, 6}	DSE ³	DSE ³
	Min.	4.1.5	Coating Diameter	55A or 173 (When Issued)	Nominal $\pm 6\%$ ^{3, 6}	DSE ³	DSE ³

(Table continues on next page. Footnotes appear at the end of the Table.)

TABLE B (Cont'd)
QUALITY CONFORMANCE INSPECTION
PERFORMANCE TESTING

Group No.	De-structive ¹	Sec. Spec. Sub-clause	Attribute	FOTP Method(s)	Performance Requirements	QCI Conformance Code ²	
						Supplier	User
1 Cont.	Min.	4.1.6	Coating/ Cladding Concentricity Error	55A	Max. Allowable: 16%	DSE ³	DSE ³
	No	4.1.7	Length of Fiber	60	Range from 1.0 to 6.4 km: DSE ³	DSE ³	DSE ³
2a	Pot.	4.2.1	Tensile Proof	31	$\geq 0.35 \text{ GN/m}^2$; $23 \pm 2 \text{ }^\circ\text{C}$	DSE ³	DSE ³
2b	Min.	4.2.2	Factory Splice	N/A	Max. No. Allowable: 0 /km	DSE ³	DSE ³
	No	N/A	Point Defects	59 (When Issued)	Max. Attenuation at a Point Defect, No. of Point Defects, and Min. Distance between Point Defects Are as Defined in the DSE ⁵	DSE ³	DSE ³
						DSE ³	DSE ³
	Min.	4.2.3	Coating Removal	General Methods Permitted	Strippable	DSE ³	DSE ³
	Min.	4.2.4	Shipping Reel	N/A	Conforms to DSE ³	DSE ³	DSE ³

(Table continues on next page. Footnotes appear at the end of the Table.)

TABLE B (Cont'd)
 QUALITY CONFORMANCE INSPECTION
 PERFORMANCE TESTING

Group No.	De-structive ¹	Sec. Spec. Sub-clause	Attribute	FOTP Method(s)	Performance Requirements	QCI Conformance Code ²	
						Supplier	User
2b Cont.	Min.	4.2.5	Shipping Package	N/A	Conforms to DSE ³	DSE ³	DSE ³
2c	Yes	N/A	Temperature Dependence of Attenuation	52 and 3 (When Issued)	Induced Attenuation: $\alpha(T) - \alpha$ $-40^{\circ}\text{C} \leq T \leq 85^{\circ}\text{C}$ $\leq 0.2 \text{ dB/km}$ @850 & 1300 nm	DSE ³	DSE ³
	Yes	N/A	Temperature-Humidity Cycling	73	Induced Attenuation: $\alpha(T, \text{RH}) - \alpha$ $-10^{\circ}\text{C} \leq T \leq 65^{\circ}\text{C};$ $4\% \leq \text{RH} \leq 98\%$ $\leq 0.6 \text{ dB/km}$ @ 850 & 1300 nm	DSE ³	DSE ³
	Yes	N/A	Irreversible Loss after 1/2 or 1 Full Cycle of T or RH Cycling, or Both	52 and 73	$\leq 0.1 \text{ dB/km}$ @ 850 and 1300 nm	DSE ³	DSE ³
3	Min.	4.3.1	Attenuation Coefficient (α)	46 or 53, 57 and 50	$2.8^7 \leq \alpha \leq 5.0 \text{ dB/km}$ @ 850 nm $0.5^7 \leq \alpha \leq 2.0 \text{ dB/km}$ @ 1300 nm	DSE ³	DSE ³
	Min.	N/A	OH ⁻ Induced Attenuation	46 and 50	Attenuation ₁₃₈₀ -Attenuation ₁₃₀₀ $\leq 1.5 \text{ dB/km}$	DSE ³	DSE ³

(Table continues on next page. Footnotes appear at the end of the Table.)

TABLE B (Cont'd.)
 QUALITY CONFORMANCE INSPECTION
 PERFORMANCE TESTING

Group No.	De-structive ¹	Sec. Spec. Sub-clause	Attribute	FOTP Method(s)	Performance Requirements	QCI Conformance Code ²	
						Supplier	User
3 cont.	Min.	4.3.2	Information Transmission Capacity, ITC (Bandwidth)	51 or 30, 54 and 57	$100 \leq \text{ITC} \leq 1000^7$ MHz•km @ 850 nm	DSE ³	DSE ³
				51 or 30, 54 and 57	$100^8 \leq \text{ITC} \leq 2000^7$ MHz•km @ 1300 nm	DSE ³	DSE ³
	Min.	4.3.3	Numerical Aperture ⁴	177 (When Issued), by 47 or 29	0.275 ± 0.015	DSE ³	DSE ³
	Min.	4.3.4	Core Diameter ⁴	58, by 43 or 44 or 29 and 57	$62.5 \pm 3.0 \mu\text{m}$	DSE ³	DSE ³

N/A = Not Applicable

¹ Min. = Minimum loss of sample during testing, on the order of 2 m of length.
 Pot. = Potential loss of entire length if failure occurs during testing.

² See Appendix A of Sectional Specification EIA-492A000 for tabulated code letters for Quality Conformance Inspection. Further details are given in Generic Specification EIA-4920000-A, subclauses 3.3.1 and 3.3.2.

³ DSE = Detail Specification Extension. It is suggested that requirements designated DSE be kept out of the Detail Specification and be placed in a separate purchasing agreement called the Detail Specification Extension, or in individual purchase orders. For further details see clauses 2.3 and 3.3 in Generic Specification EIA-4920000-A.

⁴ The four attributes, core noncircularity, core/cladding concentricity error, numerical aperture, and core diameter, represent the components of a spliceability-measurement concept called the Intrinsic Quality Factor (IQF). See Appendix B of Sectional Specification EIA-492A000 for details.

⁵ Three-term Sellmeier equation applicable from 750 nm to 1450 nm, inclusive.

⁶ If applicable

⁷ These are theoretical limits. Each manufacturer may support only a portion of the range, with Qualification Approval. This range shall be indicated in the DSE.

...footnotes continued on next page....

⁸ The minimum ITC value of 100 MHz•km at 1300 nm is specified to accommodate short segments of connectorized cable such as pigtails and/or jumpers. This minimum is NOT implied to be adequate for inter- or intrabuilding cable runs, where a minimum ITC of 400 MHz•km is recommended, and must be specified in the DSE or other procurement document. An even higher ITC may be required for some systems/networking applications.

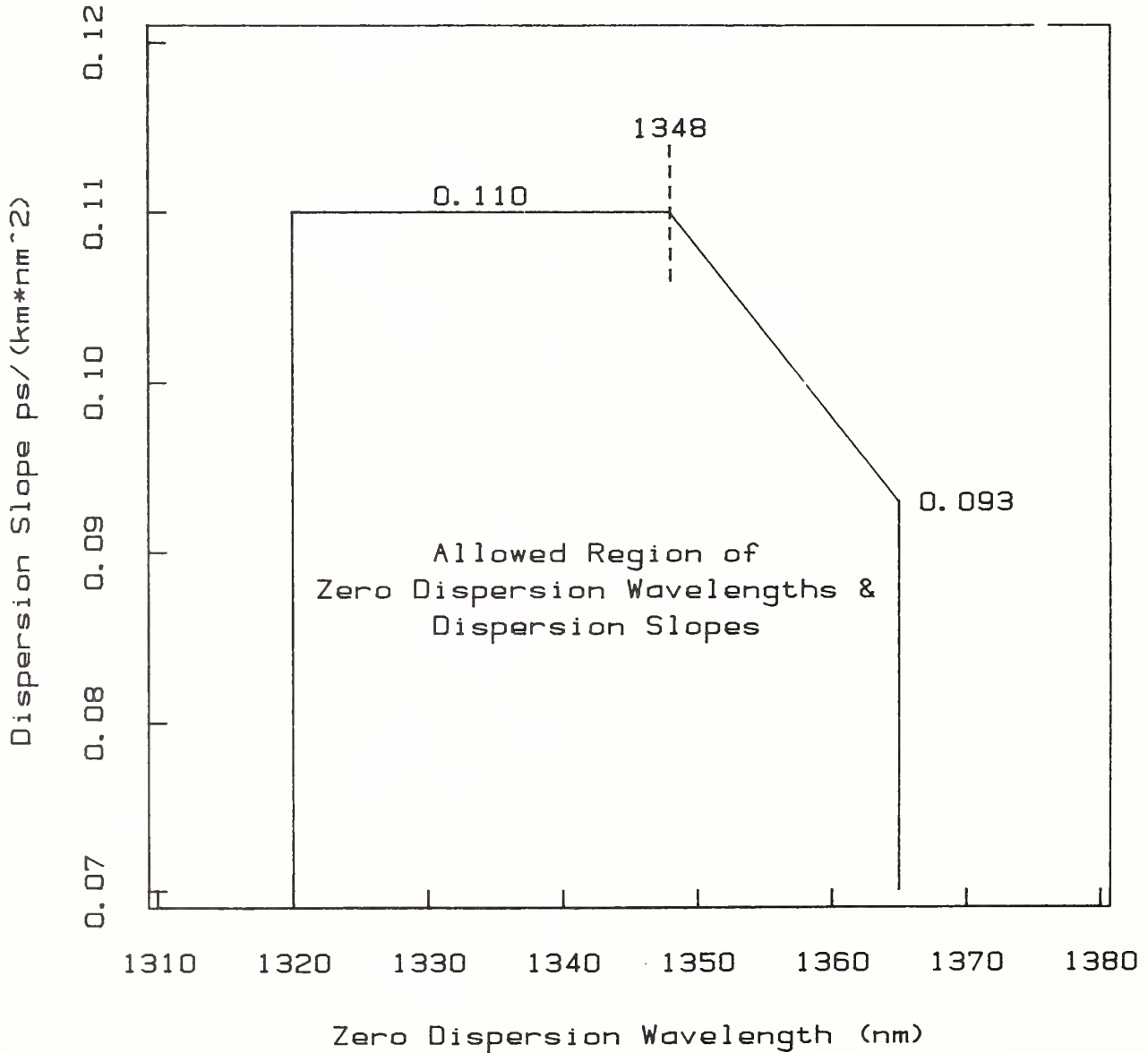


Figure 1. Material Dispersion Specification

EIA STANDARD AND SPECIFICATION NUMBERING

STANDARD

A document that establishes engineering and technical requirements for processes, procedures, practices and methods that have been decreed by authority or adopted by consensus. Standards may also be established for selection, application and design criteria for material.

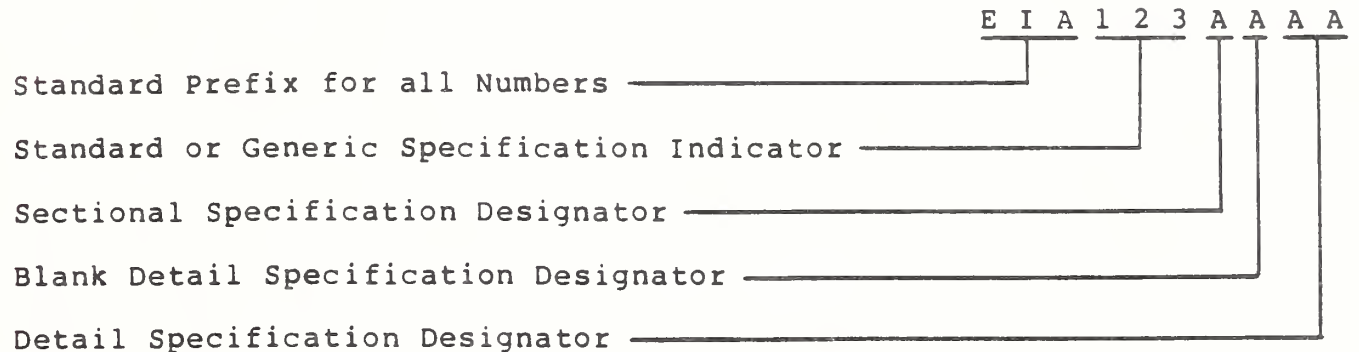
Standards and other documents not in the specification format use only the EIA basic numbering system as follows:

EIA-123	Original Standard
EIA-123-1	Addendum to the Original Standard
EIA-123-A	First Revision of original Standard incorporating all Addenda

SPECIFICATION

A document prepared specifically to facilitate procurement which clearly and accurately describes the essential technical requirements for purchased material. Procedures necessary to determine that the requirements for the purchased material covered by the specification have been met shall also be referenced or included.

EIA Specifications use the following system:



EIA 1230000 is a Generic Specification
EIA 123A000 is a Sectional Specification
EIA 123AA00 is a Blank Detail Specification
EIA 123AAAA is a Detail Specification
EIA 12300AA is a Detail Specification for which no Sectional or Blank Detail Specification was issued

- NOTES
1. Some older specifications may not have been converted to this numbering system.
 2. See EP-11, "Guide for the Preparation of Specifications Using IECQ-System Format," for more detail.

