

INCH-POUND

MIL-F-15160G  
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 SUPERSEDING  
 MIL-F-15160F  
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## MILITARY SPECIFICATION

### FUSES: INSTRUMENT, POWER, AND TELEPHONE

*This specification is approved for use by all departments and agencies of the Department of Defense.*

#### 1. SCOPE

**1.1 Scope.** This specification covers nonrenewable instrument, power, and telephone fuses designed for the protection of electrical and electronic equipment.

#### 1.2 Classification.

**1.2.1 Type designation.** The type designation shall be in the following form and as specified (see 3.1 and 6.2):

<u>F02</u>	<u>A</u>	<u>250V</u>	<u>1-1/2A</u>	<u>S</u>
Style	Characteristic	Voltage	Current	Silver
(1.2.1.1)	(1.2.1.2)	rating	rating	plated
		(1.2.1.3)	(1.2.1.4)	(1.2.1.5)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter

AMSC N/A

FSC 5920

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**1.2.1.1 Style.** The style shall be identified by the letter "F" followed by a two-digit number, denoting a fuse of a given construction and dimensions.

**1.2.1.2 Characteristics.** The characteristics shall be identified by a one- or two-letter symbol which indicates the relative overload interrupt time (see 6.7) and other special features in accordance with table I.

TABLE I. *Relative overload interrupt time.*

Symbol	Relative overload interrupt time
A	Normal blowing – normal interrupting capacity
B	Time delay – normal interrupting capacity
BR	Time delay – very high interrupting capacity, reject feature
C	Normal blowing – very high interrupting capacity

**1.2.1.3 Voltage rating.** The voltage rating shall be the maximum direct current (dc) or alternating current (ac) root mean square (rms) voltage for which a fuse is designed. The voltage rating is identified by a numerical value followed by the letter "V". The voltage rating shall be as specified (see 3.1 and 6.2).

**1.2.1.4 Current rating.** The current rating shall be the amount of current a fuse will carry indefinitely without interruption. The current rating in amperes is identified by a numerical value followed by the letter "A". The current rating shall be as specified (see 3.1 and 6.2).

**1.2.1.5 Silver plating.** The letter "S" shall identify fuses which have silver-plated terminals (see 3.5.4.1 and 6.2). Identification of other platings is not required.

## 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).

**MIL-F-15160G****SPECIFICATIONS****FEDERAL**

<b>J-C-30</b>	<b>Cable and Wire, Electrical (Power, Fixed Installation)</b>
<b>L-P-513</b>	<b>Plastic Sheet and Insulation Sheet, Electrical (Laminated, Thermosetting, Paper-Base, Phenolic-Resin)</b>
<b>NN-P-71</b>	<b>Pallets, Material Handling, Wood, Stringer Construction, 2-Way and 4-Way (Partial)</b>
<b>PPP-B-566</b>	<b>Boxes, Folding, Paperboard</b>
<b>PPP-B-585</b>	<b>Boxes, Wood, Wirebound</b>
<b>PPP-B-601</b>	<b>Boxes, Wood, Cleated-Plywood</b>
<b>PPP-B-621</b>	<b>Boxes, Wood, Nailed and Lock-Corner</b>
<b>PPP-B-636</b>	<b>Boxes, Shipping, Fiberboard</b>
<b>PPP-B-676</b>	<b>Boxes, Setup</b>
<b>PPP-F-320</b>	<b>Fiberboard: Corrugated and Solid, Sheet Stock (Container Grade) and Cut Shapes</b>
<b>PPP-T-60</b>	<b>Tape: Packaging, Waterproof</b>
<b>PPP-T-76</b>	<b>Tape: Packaging, Paper (for Carton Sealing)</b>
<b>QQ-B-613</b>	<b>Brass, Leaded and Nonleaded: Flat Products (Plate, Bar, Sheet, and Strip)</b>
<b>QQ-B-626</b>	<b>Brass, Leaded and Nonleaded: Rod, Shapes, Forgings, and Flat Products with Finished Edges (Bar and Strip)</b>
<b>QQ-B-750</b>	<b>Bronze, Phosphor; Bar, Plate, Rod, Sheet, Strip, Flat Wire, and Structural and Special Shaped Sections</b>
<b>QQ-C-576</b>	<b>Copper Flat Products with Slit, Slit and Edge-Rolled, Sheared, Sawed, or Machined Edges, (Plate, Bar, Sheet, and Strip)</b>
<b>QQ-N-290</b>	<b>Nickel Plating (Electrodeposited)</b>
<b>QQ-S-365</b>	<b>Silver Plating, Electrodeposited: General Requirements for</b>
<b>QQ-S-781</b>	<b>Strapping, Steel, and Seals</b>

**MILITARY**

<b>MIL-I-10</b>	<b>Insulating Compound, Electrical, Ceramic, Class L</b>
<b>MIL-P-79</b>	<b>Plastic Rods and Tubes, Thermosetting, Laminated</b>
<b>MIL-P-116</b>	<b>Preservation, Methods of</b>
<b>MIL-T-10727</b>	<b>Tin Plating; Electrodeposited or Hot-Dipped, for Ferrous and Nonferrous Metals</b>
<b>MIL-P-15037</b>	<b>Plastic Sheet, Laminated, Thermosetting, Glass-Cloth, Melamine-Resin</b>
<b>MIL-I-16923</b>	<b>Insulating Compound, Electrical, Embedding</b>
<b>MIL-L-19140</b>	<b>Lumber and Plywood, Fire-Retardant Treated</b>
<b>MIL-F-21346</b>	<b>Fuseholders, Block, and Shroud Type, and Associated Fuse Clips, General Specification for</b>

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**MIL-C-21768**      Copper Alloy Numbers 210 (Gilding, 95 percent) and 220 (Commercial Bronze, 90 percent) Sheet and Strip

(See supplement 1 for list of associated specifications.)

**STANDARDS****MILITARY**

**MIL-STD-105**      Sampling Procedures and Tables for Inspection by Attributes  
**MIL-STD-129**      Marking for Shipment and Storage  
**MIL-STD-147**      Palletized Unit Loads  
**MIL-STD-202**      Test Methods for Electronic and Electrical Component Parts  
**MIL-STD-1285**      Marking of Electrical and Electronic Parts

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

**2.2 Non-Government publications.** The following documents 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).

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

**D 495**      Standard Test Method for High-Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation, (DOD adopted)  
**D 570**      Standard Test Method for Water Absorption of Plastics; (DOD adopted)  
**D 710**      Standard Specification for Vulcanized Fibre Sheets, Rods, and Tubes Used for Electrical Insulation, (DOD adopted)  
**D 1180**      Standard Test Method for Bursting Strength of Round Rigid Plastic Tubing  
**D 2863**      Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastic (Oxygen Index); (DOD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(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 specification sheets), the text of this document takes precedence. Nothing in this specification, 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 sheet. In the event of any conflict between this specification and the specification sheet, the latter shall govern.

**3.1.1 Fuses with ratings not covered by a specification sheet.** The requirements of this specification shall apply to fuses with other voltage and current ratings, provided the fuse has the same dimensions and falls within the minimum and maximum current and voltage rating of an existing specification sheet, and conforms to all other requirements of that specification sheet. The qualified products list shall be applicable to these fuses.

**3.2 Qualification.** Fuses furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4.5 and 6.5).

**3.3 First article.** (For fuses not covered by qualification) when specified (see 6.2), prior to beginning production, a sample fuse manufactured by production tools and processes shall be subjected to first article inspection (see 6.4) in accordance with 4.6.

**3.4 Material.** The material for each part shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the fuses to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product (see 4.4).

**3.4.1 Recovered materials.** Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

**3.4.2 Restricted material.** Flammable or explosive material, or material which can produce toxic or suffocating fumes when the fuses are in service shall not be used in the construction of fuses

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**3.4.3 Case or body.**

**3.4.3.1 Glass.** Glass shall be of high quality, free from strain, and sufficiently clear to permit the enclosed fuse element to be readily seen.

**3.4.3.2 Fiber.** Fiber shall be electrical insulation grade in accordance with ASTM D 710.

**3.4.3.2.1 Alternate material (tube).** As an alternate to fiber, the material may be a glass fiber, reinforced, mineral filled, unsaturated polyester with the following characteristics:

Oxygen index	- 25 percent (ASTM D 2863)
Water absorption	- Maximum 1.0 percent by weight (ASTM D 570)
Arc Resistance	- Not less than 130 seconds (ASTM D 495)
Burst strength	- Values as specified (see 3.1) (ASTM D 1180)

**3.4.3.3 Plastics.** Plastic shall be as specified (see 3.1). Laminated plastic sheets shall be of either type PBE-P or GMG conforming to L-P-513 and MIL-P-15037, respectively; laminated tubes shall be of type PBE, PBG, or GMG, form Tr, in accordance with MIL-P-79.

**3.4.3.4 Ceramic.** Ceramic insulation shall be grade L211 or higher grade, in accordance with MIL-I-10.

**3.4.3.5 Epoxy.** Epoxy encapsulant compound shall be in accordance with type B of MIL-I-16923.

**3.4.4 Current-carrying parts (except fuse elements).** Current-carrying parts shall be of brass in accordance with QQ-B-613 or QQ-B-626, or copper, phosphor bronze, or copper alloy in accordance with QQ-C-576, QQ-B-750 and MIL-C-21768, respectively.

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

**3.5.1 Terminal mounting.** Terminals shall be secured to the fuse body so that they will not loosen. The fuse wire shall be so attached to the terminals that there shall be no danger of breaking the fuse wire or connections when installing the fuse. Terminals other than ends attached to fusible elements shall be free from solder.

**3.5.2 Ferrule alignment.** Fuses with ferrule terminals shall pass through a tubular gauge having a length equal to the fuse. The tubular gauge shall have an internal diameter of 0.010 inch greater than the maximum ferrule diameter for fuse lengths up to and including 1.75 inches. For fuse lengths greater than 1.75 inches, the tubular gauge shall have an internal diameter of 0.015 inch greater than the maximum ferrule diameter.

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**3.5.3 Terminal alignment.** Fuses with knife blade and lug type terminals shall be aligned or shall be capable of self aligning so that their planes are within 4 degrees of each other.

**3.5.4 Terminal finish or plating.** Ferrules, knife blades, lugs or other terminals shall be finished (plated, dipped, coated) or shall be natural (no finishing process), as specified (see 3.1) Finish shall be optional when not specified.

**3.5.4.1 Silver plating.** (See 1.2.1.5 and 3.1.) Silver plating shall be in accordance with QQ-S-365 and shall be 99.9 percent pure silver, not coin silver. It shall be not less than 0.0002 inch thick and shall show no tendency to peel. For the Department of the Army, fuses of 30 amperes or less shall not be silver-plated.

**3.5.4.2 Nickel plating.** Nickel plating shall be in accordance with QQ-N-290 and shall be not less than 0.0002 inch thick over brass or copper.

**3.5.4.3 Bright alloy plating.** Plating of bright alloy shall be not less than 0.00008 inch thick for brass terminals with less than 85 percent copper and 0.0002 inch for 85 percent or more copper terminals. The plating shall be of the following composition:

Copper	— 50 to 60 percent
Tin	— 25 to 28 percent
Zinc	— 14 to 18 percent.

**3.5.4.4 Tin plating or coating.** Tin plating or coating shall be in accordance with MIL-T-10727.

**3.5.4.5 Bright dip.** When bright dip is used (see 3.1), the metal parts shall be treated and washed to remove tarnish before assembly. Plating is not required

**3.6 Continuity.** Fuses shall have electrical continuity (see 4.9.1).

**3.7. Current-carrying capacity.** There shall be no evidence of mechanical damage or failure when fuses are tested as specified (see 4.9.2). Unless otherwise specified on the applicable specification sheet (see 3.1) the temperature of the case, body, and terminals shall not rise above ambient temperature more than shown in Table II when using either the thermometer or thermo-couple method.

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TABLE II. *Allowable temperature rise in degrees Celsius (°C).*

Casing or body		Terminal	
Thermometer	Thermocouple	Thermometer	Thermocouple
50	90	50	90

**3.8 Resistance.** Electrical resistance when applicable shall be as specified (see 3.1 and 4.9.3).

**3.9 Terminal strength.** Fuse terminals shall not loosen or become damaged (see 4.9.4).

**3.10 Overload interrupt** (see 4.9.5). Fuses shall open the circuit within the time limits specified (see 3.1) without causing the case or body to char or fracture (see 4.9.5). The fuse shall remain in the energized circuit 1 minute minimum without any indication of the circuit closing again. There shall be no mechanical failure and the insulation resistance shall be as specified in 3.11.

**3.10.1 Low voltage overload interrupt.** The fuses when specified, shall interrupt the overload currents within the time specified (see 3.1, 4.9.5.2, and 6.1.5.1).

**3.11 Insulation resistance.** Insulation resistance shall be not less than 0.5 megohms (see 4.9.6).

**3.12 Short circuit interrupt.** Fuses shall remain intact and shall open the circuit (see 4.9.7). The fuse shall remain in the energized circuit 1 minute minimum without any indication of the circuit closing again. The insulation shall not puncture; the ferrules or body shall not rupture or separate, and the terminals shall not be shunted. Fuses shall not emit flame or molten metal sufficient to ignite surgical cotton surrounding the case. Insulation resistance shall be as specified in 3.11

**3.13 Vibration.** The fuses, when specified (see 3.1), shall not open when subjected to vibration tests (see 4.9.8).

**3.14 Shock.** The fuses, when specified (see 3.1), shall not open when subjected to shock tests (see 4.9.9).

**3.15 Marking.** Unless otherwise specified (see 3.1), each fuse shall be marked in accordance with method 1 of MIL-STD-1285, and either 3.15.1 or 3.15.2, or a combination of both.



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**3.15.1 Ferrule and end cap marking.** When fuse ferrules and end caps are marked, the marking shall include the following:

- a. Type designation (see 1.2.1)
- b. Manufacturer's name, trademark or code symbol.

**3.15.2 Labels.** When fuse labels are used, the following shall apply:

**3.15.2.1 Material.** The label material shall be a pressure sensitive polyester tape, Permacel, EE-6951 or equivalent, and shall show no evidence of peeling, wrinkling, ends lifting, or illegible ink markings (see 4.9.10.1).

**3.15.2.2 Information.** Fuse marking shall include the information shown in the following example:

Marking	Explanation
Fuse	Component identification
F02A	Style and characteristic
250V	Voltage rating
1/500 amps	Current rating
S	Silver-plated (when specified)
Normal blow	Relative overload characteristic (not required on fuses not greater than 0.25 inch in diameter)
Manufacturer's symbol	The manufacturer's identification may be shown on the printed label or may be stamped on the fuse ferrule (or both).

The print size shall be the largest possible which will permit all of the required information to appear on the label.

**3.15.2.3 Label size.** The width of the label for fuses 2 inches in length or less shall almost touch the fuse ferrule on each end of the fuse. For fuses more than 2 inches in length, the label shall be large enough so that the markings will be legible. The label shall be centered on the fuse. The label shall completely wrap around the fuse body between the ferrules. Overlapping of the label upon itself is permitted, provided it does not overlap any of the printed information. For fuses not greater than 0.406-inch diameter, the printed information shall run the length of the fuse body from ferrule to ferrule. For other fuse sizes, the printed information may run perpendicular to the fuse length.

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**3.15.2.4 Label color.** The label color shall be white. Permanent type alcohol-based printing ink shall be used. The color of the printing ink for the various fuses shall be as follows:

<b>Fuse characteristics</b>	<b>Color</b>
A	Black
B	Green
BR	Brown
C	Red

**3.15.3 Marking of fuses with ratings not covered by specification sheets.** Unless otherwise specified (see 6.2), each fuse shall be marked in accordance with method I of MIL-STD-1285 with the following:

- a. Style (see 1.2.1.1)
- b. Characteristic (see 1.2.1.2)
- c. Voltage rating (see 1.2.1.3)
- d. Current rating (see 1.2.1.4)
- e. Silver plating (see 1.2.1.5) (when required)
- f. Manufacturer's name, trademark, or code symbol.

**3.16 Soldering.** Soldering shall minimize the spattering of solder and flux onto surrounding surfaces. Only noncorrosive fluxes shall be used, unless it can be shown that all corrosive products have been satisfactorily removed or neutralized after soldering. Soldered connections shall be of a character and quality that the bonding between the soldered items may be determined by visual examination. There shall be no evidence of "cold soldering" and the use of excessive amounts of solder will not be permitted.

**3.17 Workmanship.** Fuses shall be manufactured and processed in a manner uniform in quality and shall be free from loose terminals, cracked, broken glass or insulating material, displaced parts, sharp edges, burrs, and other defects that will affect life, serviceability, or appearance.

#### **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 (examinations 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 the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

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**4.1.1 Responsibility for compliance.** All items shall 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.

**4.2 Classification of inspection.** The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.5)
- b. First article inspection (see 4.6)
- c. Quality conformance inspection (see 4.7).

**4.3 Inspection conditions.** Unless otherwise specified herein, all inspections shall be performed under the following test conditions:

Temperature	– 15 to 35 °C (59 to 95 degrees Fahrenheit (°F))
Relative humidity	– 45 to 76 percent
Air pressure	– 650 to 800 millimeters of mercury.

**4.4 Materials inspection.** Materials inspection shall consist of certification supported by verifying information that the materials listed in table III, used in fabricating the fuses, are in accordance with the applicable referenced specification or requirements prior to such fabrication (see 6.3).

TABLE III. *Materials inspection.*

Material	Requirement	Applicable specification
Glass	3.4.3.1	–
Fiber	3.4.3.2	ASTM D 710
Alternate material (tube)	3.4.3.2.1	–
Plastic	3.4.3.3	L-P-513, MIL-P-15037, MIL-P-79
Ceramic	3.4.3.4	MIL-I-10
Epoxy	3.4.3.5	MIL-I-16923
Brass	3.4.4	QQ-B-613, QQ-B-626
Copper	3.4.4	QQ-C-576
Bronze, phosphor	3.4.4	QQ-B-750
Copper alloy	3.4.4	MIL-C-21768
Silver plating	3.5.4.1	QQ-S-365

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TABLE III. *Materials inspection. (Cont'd)*

Material	Requirement	Applicable specification
Nickel plating	3.5.4.2	QQ-N-290
Bright alloy plating	3.5.4.3	—
Tin plating	3.5.4.4	MIL-T-10727
Polyester tape labels	3.15.2.1	—

**4.5 Qualification inspection.** Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.5) on sample units produced with equipment and procedures normally used in production.

**4.5.1 Sample size.** Unless otherwise specified (see 3.1 and 4.5.1.1), the number of fuses to be subjected to qualification shall be as shown in table IV. The numbers shown in the table shall be for each of the maximum and minimum current and voltage ratings of each style and characteristics shown on the specification sheet for which qualification is desired. Four additional samples of each of the above fuses shall be forwarded to the qualifying activity

TABLE IV. *Qualification inspection.*

Examination or test	Requirement	Test method
<i>Group I (all samples)</i>		
Visual and mechanical examination <sup>1</sup>	3.4, 3.5, 3.15, 3.16, 3.17	4.8
Continuity	3.6	4.9.1
Current-carrying capacity	3.7	4.9.2
<i>Group II (eight samples)<sup>2</sup></i>		
Resistance <sup>3</sup>	3.8	4.9.3
Terminal strength	3.9	4.9.4
Overload interrupt	3.10	4.9.5
Insulation resistance	3.11	4.9.6
<i>Group III (eight samples)<sup>2</sup></i>		
Insulation resistance	3.11	4.9.6
Short circuit interrupt	3.12	4.9.7

See footnotes on the next page

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TABLE IV. *Qualification inspection.*

Examination or test	Requirement	Test method
<i>Group IV (four samples)<sup>3</sup></i>		
Continuity	3.6	4.9.1
Vibration	3.13	4.9.8
Shock	3.14	4.9.9
<i>Group V (four samples)<sup>2</sup></i>		
Low voltage overload interrupt	3.10.1	4.9.5.2
<i>Group VI (five samples)<sup>2</sup></i>		
Moisture resistance (fuse labels)	3.15.2.1	4.9.10.1

<sup>1</sup>Physical dimensions need only be measured on four fuses (see 3.1).

<sup>2</sup>Unless otherwise specified (see 3.1)

<sup>3</sup>When applicable (see 3.1)

**4.5.1.1 Samples for fuse label test.** Five sample fuses, each of the smallest and largest diameter fuse tubes of each tube material with appropriate labels which the manufacturer proposes to qualify, shall be subjected to the fuse label test (see 4.9.10.1).

**4.5.2 Inspection routine.** Sample units selected in accordance with 4.5.1 shall be subjected to the inspection of group I, table IV. Unless otherwise specified (see 3.1), the samples shall then be divided as specified for the remaining groups, excluding group VI, and subjected to the inspection for their particular group in the order shown. The samples of 4.5.1.1 shall be subjected to the group VI (fuse label) test.

**4.5.3 Failures.** One or more failures shall be cause for refusal to grant qualification approval. If one or more samples explode or show signs of any missing glass parts, the qualification inspection shall be terminated.

**4.5.4 Retention of qualification.** To retain qualification, the contractor shall forward a report at 12-month intervals to the qualifying activity. 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. The results of tests of all reworked lots shall be identified and accounted for.

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- b A summary of the results of tests performed for qualification verification inspection (group C), including the number and mode of any subgroup failures. The summary shall include results of all qualification verification inspection tests performed on completed lots during the 36-month period. If the summary of the test results indicates 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 12-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the supplier shall immediately notify the qualifying activity at any time that the inspection data indicates noncompliance of the product to meet the requirements of this specification. In the event that no production occurred during the reporting period, a report shall be submitted verifying 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 a representative product of each style, and minimum and maximum voltage and current rating to testing in accordance with the qualification inspection requirements.

**4.6 First article inspection.** First article inspection shall consist of the examination and tests specified in table IV. First article inspection shall be performed on sample units produced with equipment and procedures normally used in production. Unless otherwise specified (see 6.5), fuses furnished under this specification, not covered by a specification sheet and not falling within the minimum and maximum current voltage ratings of 3.1.1, shall be products which have been subjected to and passed the first article inspection.

**4.6.1 Sample size.** The sample size shall be the same as that submitted for qualification inspection (see 4.5.1).

**4.6.2 Failures.** One or more failures shall be cause for refusal to grant first article approval

**4.7 Quality conformance inspection.**

**4.7.1 Inspection of product for delivery.** Inspection of product for delivery shall consist of groups A and B inspections (see 4.7.1.2 and 4.7.1.3).

**4.7.1.1 Inspection lot.** An inspection lot shall consist of all fuses of the same style, current rating, characteristic, and voltage produced under essentially the same conditions, and offered for inspection at one time.

**4.7.1.2 Group A inspection.** Group A inspection shall consist of the examination and tests specified in table V.

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TABLE V. *Group A inspection.*

Examination or test	Requirement	Test method
Visual and mechanical examination	3.4, 3.5, 3.15, 3.15.1, 3.16, 3.17	4.8
Continuity <sup>1</sup>	3.6	4.9.1
Resistance <sup>2</sup>	3.8	4.9.3

<sup>1</sup>Not required when resistance test is conducted.<sup>2</sup>When specified (see 3.1)

4.7.1.2.1. **Sampling plan.** The sampling plan for group A inspection shall be as specified in table VI.

TABLE VI. *Group A inspection sampling plan.*

Lot size	Sample size	Accept	Reject <sup>1,2,3</sup>
<i>Major defects</i>			
2 - 50	5	0	1
51 - 90	7	0	1
91 - 150	11	0	1
151 - 280	13	0	1
281 - 500	16	0	1
501 - 1,200	19	0	1
1,201 - 3,200	23	0	1
3,201 - 10,000	29	0	1
10,001 - 35,000	35	0	1
35,001 - OVER	40	0	1
<i>Minor defects</i>			
2 - 150	5	0	1
151 - 1,200	20	1	2
1,201 - 10,000	32	2	3
10,001 - 35,000	50	3	4
35,001 - 500,000	80	5	6
500,001 - and OVER	125	7	8

<sup>1</sup>If there are any failures in a sample size, the defective fuses shall be removed from the sample size and the remaining fuses shall be returned to the lot. Defective fuses shall be replaced with new fuses, when available

<sup>2</sup>This procedure shall be repeated once. If the sample size conforms to the accept criteria, the lot is accepted

<sup>3</sup>At the option of the manufacturer, in-process inspection such as Statistical Process Control, which includes inspection of all of the examinations or tests specified in table IV, may be used after approval from Government in lieu of the sampling plan provided. All of the contractors' in-process control data for these tests shall be made available to the Government on request

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**4.7.1.2.1.1 Classification of defects.** The classification of defects for group A shall be as follows in table VII:

TABLE VII. *Classification of defects.*

Categories	Defects
<b>Major</b>	
1	Material not as specified (see table III)
2	Ferrule and terminal mounting not as specified (see 3.5.1)
3	Fuses will not pass through gauge as specified (see 3.5.2)
4	Terminal alignment not as specified (see 3.5.3)
5	Terminal finish not as specified (see 3.5.4)
6	Fuse does not have continuity (see 3.6)
7	Loose terminals, cracked or displaced parts, broken glass or insulating material, sharp edges or loose ferrules or ferrule type fuses (see 3.17)
8	Marking – incorrect type designation or label peeling (see 3.15)
9	Following critical dimensions out of tolerance (see 3.1 and 3.5) <ul style="list-style-type: none"> <li>a Overall length of fuse knifeblades length when applicable</li> <li>b Ferrule outer diameter</li> <li>c Rejection groove length and width for fuses with reject feature</li> </ul>
<b>Minor</b>	
10	Illegible or improperly located markings (see 3.15)
11	Minor cuts, scratches, burrs and nicks not impairing function
12	Incomplete removal of soldering flux residue (see 3.16)
13	Other evidence of poor workmanship not affecting the function of the fuse

**4.7.1.3 Group B inspection.** Group B inspection shall consist of the tests specified in table VIII in the order shown and shall be made on sample units which have passed the group A inspection. Sample units which have been subjected to group B inspection shall not be delivered on the contract or purchase order.



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TABLE V. *Group B inspection.*

Test	Requirement	Test method
Current-carrying capacity	3.7	4.9.2
Terminal strength	3.9	4.9.4
Overload interrupt <sup>1</sup>	3.10	4.9.5
Insulation resistance	3.11	4.9.6

<sup>1</sup>Overload interrupt tests shall be conducted at room ambient temperature only

**4.7.1.3.1 Sampling plan.** The sampling plan for group B inspection shall be as specified in table IX.

TABLE IX. *Group B inspection sampling plan.*

Lot size	Sample size	Accept	Reject <sup>1,2,3</sup>
2 - 15	2	0	1
15 - 25	3	0	1
26 - 90	5	0	1
91 - 150	6	0	1
151 - 280	7	0	1
281 - 500	9	0	1
501 - 1,200	11	0	1
1,201 - 3,200	13	0	1
3,201 - OVER	15	0	1

<sup>1</sup>If there are any failures in a sample size, the defective fuses shall be removed from the sample size and the remaining fuses shall be returned to the lot. Defective fuses shall be replaced with new fuses, when available

<sup>2</sup>This procedure shall be repeated until the sample size conforms to the accept criteria at which time the lot is accepted.

<sup>3</sup>At the option of the manufacturer, in-process inspection such as Statistical Process Control, which includes 100% inspection of all of the examinations or tests specified in table IV, may be used after approval from Government in lieu of the sampling plan provided. All of the contractors' in-process control data for these tests shall be made available to the Government on request.

**4.7.2 Qualification verification inspection.** Qualification verification inspection shall consist of group C. Except where the results of these inspections show nonconformance with the applicable requirements (see 4.7.2.1.4), delivery of products which have passes groups A and B shall not be delayed pending the results of these qualification verification inspections.

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**4.7.2.1 Group C inspection.** Group C inspection shall consist of the tests specified in table X, in the order shown. Group C inspection shall be made on sample units selected from inspection lots which have passed the groups A and B inspection, unless the Government considers it more practical to select from current production. A manufacturer's normal quality control tests, production tests and others may be used to fulfill all or part of group C inspections; however, all of group C inspection shall be completed as specified.

TABLE X. *Group C inspection.*

Test	Requirement	Test method
<i>Group I (four samples)</i>		
Insulation resistance	3 11	4.9.6
Short circuit interrupt	3 12	4.9.7
<i>Group II (four samples)<sup>1</sup></i>		
Continuity	3.6	4.9.1
Vibration	3.13	4.9.8
Shock	3.14	4.9.9
<i>Group III (four samples)<sup>1</sup></i>		
Low voltage overload interrupt	3.10 1	4.9.5.2
<i>Group IV (five samples)<sup>1</sup></i>		
Moisture resistance (labels)	3.15.2.1	4.10.1

<sup>1</sup>When applicable (see 3.1).

**4.7.2.1.1 Sampling plan.** Unless otherwise specified (see 3.1), the number of fuses to be subjected to group C inspection shall be as shown in table X. The number shown in the table shall be for each of the maximum and minimum current and voltage ratings of each style and characteristic shown on the specification sheet for which qualification retention is desired. The tests shall be conducted 36 months after the date of notification of qualification and after each subsequent 36-month period. When production of a particular type of fuse has been suspended for 36 months or more, sample units shall be selected from the first lot of the new production presented for acceptance, and after each subsequent 36-month period.

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

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

**4.7.2.1.4 Nonconformance.** If a sample fails group C inspection, the contractor shall take warranted corrective action on the materials, processes, or both, and on all correctable product units manufactured under similar conditions, with similar materials, processes, and so forth, and subject to similar failure. Product acceptance shall be discontinued until Government accepted corrective action has been taken. Subsequently, group C inspection shall be repeated on additional sample units (either all inspections or the failed original sample inspection at Government discretion). Groups A and B inspection may be reinstituted, however, final acceptance shall be withheld until group C reinspection reveals successful corrective action. In the event of failure after reinspection, failure and relevant corrective action information shall be furnished to the cognizant inspection and qualifying activities.

**4.8 Visual and mechanical examination.** Fuses shall be examined to verify that the materials, construction, physical dimensions, markings, and workmanship are in accordance with the requirements specified in 3.1 through 3.5, 3.15, 3.16, and 3.17.

**4.9 Test methods.**

**4.9.1 Continuity.** Continuity of each fuse shall be determined. The equipment used shall limit the current and not cause the fuse to interrupt. (Caution: insulation testers may provide excessive current on low amperage fuses and cause inadvertent interruption.) Fuses shall meet the requirements specified in 3.6.

**4.9.2 Current-carrying capacity.** Unless otherwise specified (see 3.1), fuses shall be subjected to an ac or dc current of 110 percent of rated current at any convenient voltage within the rating of the fuse. The current shall be maintained for not less than 30 minutes after the temperature of each fuse has stabilized, but shall be applied for not less than 90 minutes. It may be assumed that the temperature has stabilized when three consecutive temperature readings taken at 10-minute intervals show no rise in temperature. The temperature of the fuse case or body and of the terminals shall be measured by thermocouples (wire size 28 to 32 AWG) or by using the thermometer method. Each fuse shall be mounted in a standard single pole, open-type fuseholder having a corresponding electrical rating. Fuseholders and fuseclips may be selected from MIL-F-21346. When two or more fuses are tested in series, the fuseholders shall be located so that there will be a spacing of not less than 6 inches between any two fuses under test. The wire connecting the fuseholders, ammeter, and the source of supply shall be in accordance with J-C-30. The wire length and size shall be as shown in table XI. Fuses shall meet the requirements specified in 3.7.

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TABLE XI. *Size of test leads*

Fuse rating amperes	Wire		Circular-mil size
	Length (ft)	AWG size	
0 - 30	2	8	—
31 - 60	2	4	—
61 - 100	2	1	—
101 - 200	2	—	200,000
201 - 400	4	—	500,000
401 - 600	4	—	1,000,000

**4.9.3 Resistance.** Resistance shall be calculated from the voltage drop measured between the terminals of the fuse at 10 percent or less of rated current using a high impedance voltmeter, a double Kelvin Bridge, Wheatstone Bridge, or other measuring means. Fuses shall meet the requirements specified in 3.8.

**4.9.4 Terminal strength.** Unless otherwise specified (see 3.1), terminals shall be tested in accordance with method 211, as applicable, of MIL-STD-202. Forces shall be as specified (see 3.1), and shall be applied to individual terminals as follows:

- a. Pin type terminals - test condition A
  - (1) Along terminal axis
  - (2) Perpendicular to terminal axis
- b. Ferrule and knife blade type terminals - test condition E
  - (1) Torque

Fuse terminals shall meet the requirements specified in 3.9.

**4.9.5 Overload interrupt.** Fuses shall be subjected to the percentage of rated alternating current and voltage specified (see 3.1). Unless otherwise specified for qualification, first article and group B inspection, this test shall be performed at standard ambient conditions only. Opening time measurements shall be made with an oscillograph for periods shorter than 1 second; a synchronous timer may be used for measurements longer than 1 second and a stop watch is suitable for measurements of longer than 10 seconds. Unless otherwise specified (see 3.1), the number of fuses shall be divided evenly for various overloads and temperature conditions. For rated voltage test, the fuses shall be left in the energized circuit for 1 minute minimum after interruption without any indication of restrike. For qualification, first article and group B tests, fuses that have been subjected to the rated voltage tests shall be subjected to the insulation resistance test specified in 7.9.6 within 1 minute following the removal of the test voltage. Fuses shall meet the requirements specified in 3.10.

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**4.9.5.1 Overload test voltage.** For qualification, group C, and first article tests, half of the test samples shall be tested with a power supply having an open circuit voltage within 5 percent of the specified voltage rating for the fuse under test. No times shall be recorded but the fuses shall be examined to determine that they have opened the circuit. The power supply voltage of the other half of the samples and for group B tests may be of any value which is not less than 6 volts.

**4.9.5.2 Overload test currents.**

**4.9.5.2.1 135 percent tests.** For 135 percent rated current tests at either rated or reduced voltage, the current tolerance shall be zero to plus 10 percent.

**4.9.5.2.2 150, 200, and 300 percent tests.** For fuses not greater than 0.406-inch diameter, when tested at either rated or reduced voltage, the current tolerance shall be plus or minus 3 percent. For fuses greater than 0.406-inch diameter, when tested at either rated or reduced voltage, the test shall be conducted on a preset circuit or the current may be adjusted to the required test current at a uniform rate not exceeding 3 seconds.

**4.9.5.2.3 500 percent tests.** For 500 percent rated current tests at rated voltage, the current tolerance shall be zero to minus 5 percent; for reduced voltage tests, the test shall be conducted on a preset circuit adjusted to the required test current using a copper bar in the circuit. The copper bar shall then be replaced with the test fuse, the circuit turned on and readjusted to the required test current at a uniform rate not exceeding 3 seconds.

**4.9.6 Insulation resistance.** Fuses shall be tested in accordance with method 302 of MIL-STD-202. The following details shall apply:

- a. Test potential shall be the maximum rated voltage as specified (see 3.1), except that it shall be not less than 100 volts.
- b. Points of measurement — between terminals.

Fuses shall meet the requirements specified in 3.11.

**4.9.7 Short circuit interrupt.** Fuses shall meet the requirements specified in 3.12.

**4.9.7.1 AC tests.** Fuses shall be subjected to ac short circuit tests at the current and voltage specified (see 3.1). The tolerance on the short circuit current shall be zero to plus 20 percent. The tolerance on the voltage shall be zero to plus 10 percent. The ac tests shall be conducted using a supply of adequate capacity such as an ac generator and transformer bank, and shall be on a single phase basis. The current shall be applied within plus or minus 10 degrees of the voltage wave zero point. For characteristic A fuses tested at 450 volts, for characteristic BR fuses and for characteristic C fuses, the power factor shall be as specified (see 3.1). For other fuses, the power factor shall be 0.45 to 0.50 for current ratings not less than 100 amperes, or 0.85 to 0.95 power factor for current ratings not greater than 100 amperes. Fuses shall remain in the energized circuit

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for not less than 1 minute after interruption without any indication of restrike. Insulation resistance shall be tested as specified in 4.9.6 within 1 minute following removal of the fuse from the test circuit. Short circuit currents shall be determined by means of an oscillograph. Test circuits shall be calibrated for the specified current with the fuseholder short circuited.

**4.9.7.2 DC tests.** Fuses shall be subjected to dc short circuit tests when specified (see 3.1). The current and voltage shall be as specified (see 3.1). The tolerance on the short circuit current shall be zero to plus 20 percent. The tolerance on the voltage shall be:

- 1 to 100 volts dc, zero to plus 15 percent
- over 100 volts dc, zero to plus 5 percent

The dc test shall be made using a source of power with the rate of current rise for the test circuit adjusted for not less than  $2.92 \times 10^6$  amperes per second. The current rate of rise may be lower if the test station limitations preclude obtaining the stated value. Fuses shall remain in the energized circuit for not less than 1 minute after interruption without any indication of restrike. Insulation resistance shall be tested as specified in 4.9.6 within 1 minute following removal of the fuse from the test circuit. Short circuit currents shall be determined by means of an oscillograph. Test circuits shall be calibrated for the specified current with the fuseholder short circuited.

**4.9.8 Vibration.** When specified the fuses shall be subjected to vibration tests in accordance with method 204 of MIL-STD-202. The following details shall apply:

- a. *Mounting* — Fuses shall be mounted in appropriate fuseholders in accordance with MIL-F-21346, or other approved fuseholders.
- b. Test Condition A (except 5g at 500 hertz)
- c. One-half of the sample units shall be tested while carrying 80 percent of rated current and the remainder tested with no current. All fuses shall be tested for continuity as specified in 4.9.10 at the end of the test

The fuse shall meet the requirements of 3.13.

**4.9.9 Shock.** When specified fuses shall be subjected to shock tests in accordance with method 213, condition I, or method 207 of MIL-STD-202. The following details shall apply:

- a. Fuses shall be mounted in appropriate fuseholders in accordance with MIL-F-21346, or other approved fuseholders.

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- b. One-half of the sample units shall be tested while carrying 80 percent of rated current and the remainder tested with no current. All fuses shall be tested for continuity as specified in 4.9.1 at the end of the test.

The fuse shall meet the requirements of 3.14.

**4.9.10 Fuse label.** Fuse labels shall meet the requirements specified in 3.15.2 and 3.15.3.

**4.9.10.1 Moisture resistance (labels).** Fuses with attached labels shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

- a. Initial measurement – Labels shall be examined for lifting of ends, wrinkles, peeling, and legibility of ink
- b. Step 7b – Vibration is not required.
- c. Final measurement – After each cycle, labels shall be examined for lifting of ends, wrinkles, peeling, legibility of ink, and any change from initial measurement.

**4.9.10.2 Label conditions.** Results of fuse label conditions shall be recorded.

**4.10 Inspection of packaging.** Sample packages and packs, and the inspection of the preservation, packing, and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified herein.

## 5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the packaging requirements of referenced documents listed in section 2, see 6.2.)

**5.1 Navy fire-retardant requirements.** For Navy acquisitions, the following shall apply:

- (1) *Lumber and plywood.* Unless otherwise specified (see 6.2.j), all lumber and plywood including laminated veneer material used in shipping container construction members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows:

Levels A and B – Type II – weather resistant  
Category 1 – general use

Level C – Type I – non-weather resistant  
Category 1 – general use

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- (2) *Fiberboard.* Unless otherwise specified (see 6.2.k), fiberboard used in the construction of class-domestic, non-weather resistant fiberboard and cleated fiberboard boxes including interior packaging forms shall meet the flamespread and the specific optic density requirements of PPP-F-320 and amendments thereto.

**5.2 Preservation.** Preservation shall be level A or C, as specified (see 6.2).

**5.2.1 Level A.**

**5.2.1.1 Cleaning.** Fuses shall be cleaned in accordance with MIL-P-116, process C-1.

**5.2.1.2 Drying.** Fuses shall be dried in accordance with MIL-P-116.

**5.2.1.3 Preservative application.** Preservatives shall not be used.

**5.2.1.4 Unit packaging.** Fuses shall be packaged in accordance with the methods of MIL-P-116 specified herein to ensure conformance to the general requirements paragraph under methods of preservation (unit protection) and the physical protection requirements paragraph therein. Unless otherwise specified (see 6.2), the quantity per unit package (QUP) shall be as follows:

0-60 amperes - QUP 5 to 10 each as specified  
61-100 amperes - QUP 1 or 5 each as specified  
101-600 amperes - QUP 1 each

**5.2.1.4.1 Fuses with silver-plated terminals.** Unless otherwise specified (see 5.2.1.6 and 6.2), fuses with silver-plated terminals shall be packaged in accordance with MIL-P-116 submethod IA-8 or IA-15.

**5.2.1.4.2 Other fuses.** Fuses with other than silver-plated terminals shall be packaged in accordance with method III.

**5.2.1.5 Intermediate packaging.** Fuses, packaged as specified in 5.2.1.4, shall be placed in intermediate containers conforming to PPP-B-566 or PPP-B-676. Intermediate containers shall be uniform in size, shape and quantities, shall be of minimum tare and cube and shall contain multiples of five unit packages, not to exceed 100 unit packages. No intermediate packaging is required when the total quantity shipped to a single destination is less than 100 unit packages.

**5.2.1.6 Weather resistance.** All unit and intermediate containers shall either be weather (or water) resistant or overwrapped with waterproof barrier materials. Containers conforming to PPP-B-566 or PPP-B-676 shall be overwrapped with waterproof barrier materials (see 5.2.1.4 and 5.2.1.5).



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**5.2.2 Level C.** Fuses shall be clean, dry, and packaged in a manner that will afford adequate protection against corrosion, deterioration and physical damage during shipment from supply source to the first receiving activity.

**5.3 Packing.** Packing shall be level A, B, or C, as specified (see 6.2). Exterior containers shall be of minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent practicable.

**5.3.1 Level A.** The packaged fuses shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistant, style optional, special requirements. In lieu of the closure and waterproofing requirements in the appendix of PPP-B-636, closure and waterproofing shall be accomplished by sealing all seams, corners, and manufacturer's joint with tape, 2 inches minimum width, conforming to PPP-T-60, class 1, or PPP-T-76. Banding (reinforcement requirements) shall be applied in accordance with the appendix to PPP-B-636 using nonmetallic or tape banding only.

**5.3.2 Level B.** The package fuses shall be packed in fiberboard containers conforming to PPP-B-636, class domestic, style optional, special requirements. Closures shall be in accordance with the appendix thereto.

**5.3.3 Level A and B packing.** For level A packing when quantities per destination are less than a unitized load, the fiberboard containers shall not be banded but shall be placed in a close fitting box conforming to PPP-B-601, overseas type; PPP-B-621, class 2, style 4, or PPP-B-585, class 3, style 2 or 3. Closure and strapping shall be in accordance with applicable container specification except that metal strapping shall conform to QQ-S-781, type I, finish B. When the gross weight exceeds 200 pounds or the container length and width is 48 by 24 inches or more and the weight exceeds 100 pounds, 3- by 4-inch skids (laid flat) shall be applied in accordance with the requirements of the container specification. If not specified in the container specification, the skids shall be applied in a manner which will adequately support the item and facilitate the use of material handling equipment. For level B packing, fiberboard boxes shall be weather resistant as specified in level A and the containers shall be banded (see 5.3.1 and 5.3.2).

**5.3.4 Level C.** The packaged fuses shall be packed in shipping containers in a manner that will afford adequate protection against damage during direct shipment from the supply source to the first receiving activity. These packs shall conform to the applicable carrier rules and regulations

**5.3.5 Unitized loads.** Unitized loads, commensurate with the level of packing specified in the contract or order, shall be used whenever total quantities for shipment to one destination equal 40 cubic feet or more. Quantities less than 40 cubic feet need not be unitized. Unitized loads shall be uniform in size and quantities to the greatest extent practicable.

**5.3.5.1 Level A.** Fuses, packed as specified in 5.3.1, shall be unitized on pallets in accordance with MIL-STD-147, load type I, with a fiberboard cap (storage aid 4) positioned over the load.

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**5.3.5.2 Level B.** Fuses, packed as specified in 5.3.2, shall be unitized as specified in 5.3.5.1, except that the fiberboard caps shall be class domestic.

**5.3.5.3 Levels A and B unitization.** For level A and B unitization, the fiberboard caps shall be weather resistant and softwood pallets in accordance with NN-P-71, type IV, size 2 shall be used. The loads shall be bonded to the pallets by strapping in accordance with QQ-S-781, type I, finish A or shrink film (see 5.3.5.1 and 5.3.5.2).

**5.3.5.4 Level C.** Fuses, packed as specified in 5.3.4, shall be unitized with pallets and caps of the type, size, and kind commonly used for the purpose and shall conform to the applicable carrier rules and regulations.

**5.4 Marking.** In addition to any special marking required by the contract or purchase order (see 6.2), each unit package, intermediate and exterior container, and unitized load shall be marked in accordance with MIL-STD-129. Interior package marking shall include the complete type designation, source code, data code, and lot symbol in accordance with MIL-STD-1285 and in accordance with the special marking requirements of MIL-STD-129.

## **6. NOTES**

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

**6.1 Intended use.** The fuses are intended for the protection of electrical and electronic equipment.

**6.1.1 Characteristic A fuses.** Normal blowing characteristic A fuses are intended for general circuit protection when only nominal short circuit currents are available. Where higher interrupting capacity is desirable, use characteristic C fuses.

**6.1.2 Characteristic C fuses.** Normal blowing characteristic C fuses are intended for general circuit protection where there is a possibility of extremely high short circuit currents. Characteristic C fuses can be substituted for characteristic A fuses, however, the reverse is not true.

**6.1.3 Characteristic B fuses.** Time delay characteristic B fuses are intended for use in circuits containing motors and other circuits where provision must be made for momentary surges. The fuses should be used only when nominal short circuit currents are available. Consideration should be given to using characteristic BR fuses in lieu of characteristic B fuses wherever possible. Characteristic B fuses cannot be used in rejection type fuseclips intended for characteristic BR fuses.

**6.1.4 Characteristic BR fuses.** Time delay characteristic BR fuses are intended for use in circuits containing motors and in other circuits where provision must be made for momentary surges. These fuses are capable of interrupting extremely high short circuit currents. They have a

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"rejection" feature which when used with "rejection" type fuseclips will prevent fuses such as the characteristic A, B, or C from being substituted. Characteristic BR fuses can be substituted for characteristic B fuses in all applications even when standard fuseclips are use.

**6.1.5 Fuse selection.** The following steps should apply in the selection of a fuse for any application:

- a. *Step 1.* Select a fuse with a voltage rating equal to or in excess of the circuit voltage (see 6.1.5.1).
- b. *Step 2.* The short circuit interrupting rating of the fuse should be checked to determine that it is adequate to protect against the short circuit currents that the particular equipment or circuit can be exposed to.
- c. *Step 3.* The ambient temperature in which the fuse is to be used should be compared to the curves shown on figure 1 or 2 to determine the effect the ambient will have on the current rating. For example, if a characteristic A fuse is to be used in a 60 °C ambient, it will only carry 95 percent of its normal rating. a fuse which is used in a minus 20 °C ambient will carry 107 percent of its nominal rating.
- d. *Step 4.* A fuse rating should be selected on the basis of equipment ampere load with compensation made for ambient temperature (see figures 1 and 2). Characteristics A and C fuses should not be loaded to more than 80 percent of the fuse rating (or 80 percent of the adjusted rating based on ambient temperature consideration) to avoid nuisance openings caused by inrush currents and other harmless overloads. Time lag (characteristic B or BR) fuses can be loaded to a higher level because of the ability to override harmless overloads, transients, and inrush currents of short duration.

**6.1.5.1 Low voltage applications.** Problems can arise when fuses are used at voltages considerably lower than their rated voltage. Due to the increase of the voltage drop when the element of a fuse approaches its melting point, care should be taken to ensure that there is sufficient circuit voltage available to cause the fuse to interrupt the current when an electrical fault occurs. Furthermore, fuses of the same type and rating may, due to difference in design or element material, have different voltage drops and may therefore not be interchangeable in practice when used in applications with low circuit voltages. A minimum low voltage test (3.10.1) is specified (see 3.1) for those fuses which are most likely to be effected when used in very low voltage circuits. However, caution should be used in applying a fuse in any circuit with a voltage considerably lower than the fuse voltage rating.

**6.1.5.2 Selected items.** Equipment designers should refer to MIL-STD-1360 for a selection of fuse types preferred for use in new equipment design.

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**6.2 Acquisition requirements.** Acquisition documents must 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 2.1.1 and 2.2).
- c. Title, number, and date of the applicable specification sheet or detail specification with the fuse type designations (see 1.2.1 and 3.1)
- d. Style (see 1.2.1.1)
- e. Characteristic (see 1.2.1.2)
- f. Voltage rating (see 1.2.1.3)
- g. Current rating (see 1.2.1.4)
- h. When silver plating is required (see 1.2.1.5)
- i. Whether first article inspection is required (see 3.3)
- j. When lumber and plywood do not require fire retardant treatment (see 5.1.1)
- k. When fiberboard does not have to meet the flamespread requirement (see 5.1.2)
- l. Level of preservation and packing required (see 5.2 and 5.3)
- m. Quantity per unit package of fuses 0 to 100 amperes (see 5.2.1.4)
- n. Special marking, if required (see 3.15.3 and 5.3).

**6.3 Consideration of data requirements.** The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
4.4	DI-E-2121	Certificate of compliance	—

The above DID's were those cleared as of the date of this specification. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

**6.4 First article.** When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the items should be a preproduction sample, a first article sample, a first production item, a standard production item from the contractor's current inventory (see 3.3), and the number of items to be tested as specified in 4.6. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such

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production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

**6.5 Qualification.** With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List No. 15160 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, 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 purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 and information pertaining to qualification of products may be obtained from that activity. Application for qualification tests must be made in accordance with "Provisions Governing Qualification SD-6" (see 6.5.1).

**6.5.1** 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.

**6.6 Definitions.** The term "relative overload interrupt time" refers to relative blowing time, and "overload interrupt" refers to overload blowing.

**6.7 Subcontracted material and parts.** The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

**6.8 Subject term (key word) listing.**

- Nonrenewable fuse
- Normal blowing fuse
- Overload interrupt
- Power surge
- Short circuit
- Time delay fuse

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**6.9 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.

**Custodians:**

Army – ER  
Navy – SH  
Air Force – 85

**Preparing activity:**

Navy – SH  
(Project 5920-0447)

**Review Activities:**

Army – MI, AR  
Navy – AS, OS, YD  
Air Force – 17, 99  
DSA – ES

**User Activities:**

Army – ME, AT  
Navy – MC, CG  
Air Force – 19



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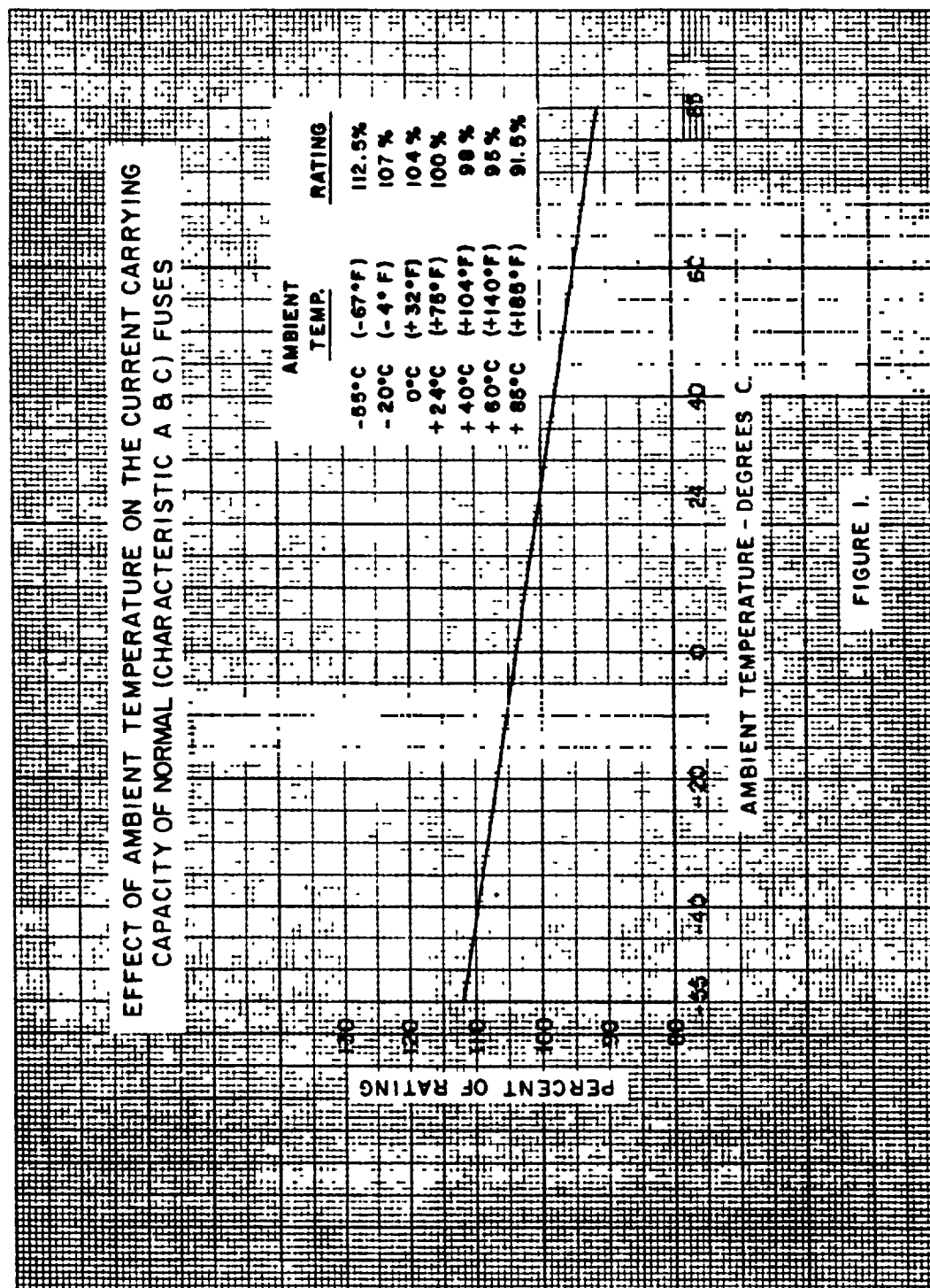


FIGURE 1. Effect of ambient temperature on the current carrying capacity of normal (characteristic A and C) fuses.

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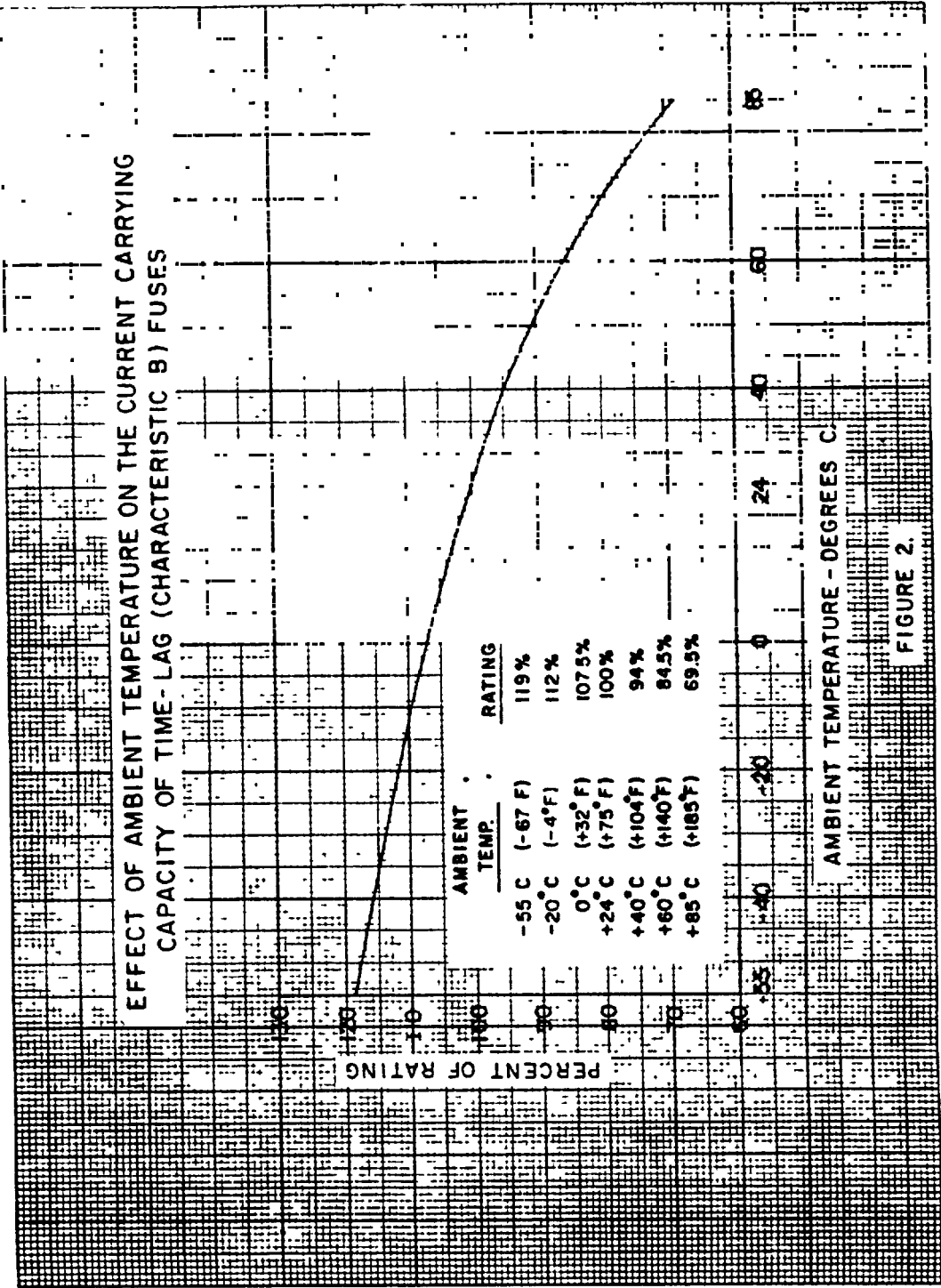


FIGURE 2. Effect of ambient temperature on the current carrying capacity of time-lag (characteristic B) fuses.



# 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.

### 1 RECOMMEND A CHANGE:

1. DOCUMENT NUMBER  
MIL-F-15160G

2. DOCUMENT DATE (YYMMDD)

### 3. DOCUMENT TITLE

FUSES: INSTRUMENT, POWER, AND TELEPHONE

### 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)

7. DATE SUBMITTED (YYMMDD)

(1) Commercial  
(2) AUTOVON  
(If applicable)

### 8. PREPARING ACTIVITY

a. NAME Technical Point of Contact (TPOC)  
r. R. Kumar (SEA 56234)

b. TELEPHONE (Include Area Code)  
(1) Commercial

(2) AUTOVON

PLEASE ADDRESS ALL CORRESPONDENCE AS FOLLOWS:

TPOC: 703-602-3474

8-332-3474

c. ADDRESS (Include Zip Code)

Commander, Naval Sea Systems Command  
Department of the Navy (SEA 5523)  
Washington, DC 20362-5101

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