

EE-M-101J  
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 SUPERSEDING  
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## FEDERAL SPECIFICATION

### MATCHES, SAFETY: AND MATCHES, NONSAFETY (STRIKE-ANYWHERE)

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

#### 1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers two types of safety matches and one type of nonsafety (strike-anywhere) matches.

1.2 Classification. The matches shall be of the following types, classes, and sizes, as specified (see 6.2).

- |          |   |                                     |
|----------|---|-------------------------------------|
| Type I   | - | Wood, safety, in boxes.             |
| Type II  | - | Paper, safety, in books.            |
| Class 1  | - | 20 splint book.                     |
| Class 2  | - | 20 splint book, humidity-resistant. |
| Class 3  | - | 10 splint book, humidity-resistant. |
| Type III | - | Wood, strike-anywhere, in boxes.    |
| Class 1  | - | Commercial.                         |
| Size 1   | - | 2-3/8 inches (60 mm) length.        |
| Class 2  | - | Water-resistant.                    |

#### 2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

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Federal Specifications:

- MMM-A-260 - Adhesive, Water-Resistant (For Sealing Waterproofed Paper).
- PPP-B-26 - Bag, Plastic (General Purpose).
- PPP-B-566 - Boxes, Folding, Paperboard.
- PPP-B-601 - Boxes, Wood, Cleated-Plywood.
- PPP-B-636 - Boxes, Shipping, Fiberboard.
- PPP-B-665 - Boxes; Paperboard, Metal Edged and Components.
- PPP-B-676 - Boxes, Setup.
- PPP-B-1055 - Barrier Material, Waterproofed, Flexible.
- PPP-C-96 - Cans, Metal, 28 Gage and Lighter.

Federal Standards:

- FED-STD-101 - Preservation, Packaging, and Packing Materials:  
Test Procedures.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other Federal specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers, at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO, Ft. Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the DOD Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Standards:

- MIL-STD-105 - Sampling Procedures and Tables for Inspection  
by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.

(Copies of Military specifications and standards required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

National Motor Freight Traffic Association, Inc., Agent

National Motor Freight Classification

(Application for copies should be addressed to the American Trucking Associations, Inc., Traffic Department, 1616 P Street, N. W., Washington, DC 20036.)

Uniform Classification Committee, Agent

Uniform Freight Classification

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

3. REQUIREMENTS

3.1 Material. (See 6.5.)

3.1.1 Properties. The matches covered by this specification shall have the following properties:

3.1.2 Physical characteristics of sticks or splints. The sticks or splints of type I and type III matches shall be made of a good grade, long-fibered timber, and the splints of type II matches shall be made of splint board 0.0355 to 0.042 inch (0.9017 to 1.0066 mm) in thickness. The head material of all matches shall be applied evenly over end and sides of splint.

3.1.3 Performance. The matches shall ignite and burn without breakage of the splint or head, or without cracking, exploding or afterglow when tested as specified in 4.2.5.

3.1.3.1 Spontaneous ignition temperature. The matches shall not ignite when tested as specified in 4.2.5.

3.1.3.2 Nonignition (safety) (types I and II only). The matches shall be nonignitable when tested on sandpaper and when heads are rubbed together as specified in 4.2.5.

3.1.3.3 Water resistance (type III, class 2 only). The matches shall ignite and burn at least 1 inch (25 mm) of the splint when tested as specified in 4.2.5.

3.1.3.4 Blocking resistance (type III, class 2 only). The matches shall not stick together when heated and cooled as specified in 4.2.5.

3.1.3.5 Humidity resistance (type II, classes 2 and 3). The matches shall ignite and not fizz, blink (light, go out and relight), or lose the heads by exploding or flying off when tested as specified in 4.2.5.

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3.1.3.6 Resistance of striking surface to wet abrasion (type II, classes 2 and 3). The striking surface for the matches shall not peel or rub off and shall have a surface which will permit at least 30 matches for class 2 and 15 matches for class 3 to be ignited upon it when tested as specified in 4.2.5.

3.1.3.7 Resistance of match boxes to high humidity (type III, class 2). The match boxes shall show no signs of damage due to opening and closing the box a minimum of six cycles without binding when tested as specified in 4.2.5.

3.2 Type I and type III.

3.2.1 Splints or sticks.

3.2.1.1 Type I splint length. The length of the stick or splint with head shall be 1-3/4 inches + 1/8 inches (44 + 3 mm).

3.2.1.2 Type III, class 1, size 1 and class 2 splint length. The length of the stick or splint with head shall be 1-3/4 + 1/8 inches (44 + 3 mm).

3.2.2 Striking surface.

3.2.2.1 Box for type I. The sides of the outer box shall be coated with a preparation which will be used to ignite the matches when rapidly drawn across the coated surface. The total area of the coated surface applied to one or both sides shall contain sufficient area for striking not less than 50 percent more matches than are contained in the box when tested as specified in 4.3.1. The coating shall not be smeared over the edges, especially at the ends of the box.

3.2.2.2 Type III, class 1, size 1 and class 2. The outer box shall have a sanded striking surface 3/4 + 1/8 inch (19 + 3 mm) wide, positioned on one or both side panels so that it extends the entire length of the panel, or a sanded striking surface approximately 3/8 inch (10 mm) wide, positioned on both side panels, so that it extends the entire length of the panel.

3.2.3 Count, matches per box.

3.2.3.1 Type I. The average number of matches per box shall be not less than 34 matches per box, and no box shall contain less than 30 matches.

3.2.3.2 Type III, class 1, size 1 and class 2. The average number of matches per box shall be not less than 250 and no box shall contain less than 230.

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### 3.3 Type II, classes 1, 2 and 3.

3.3.1 Splints. Class 1 and 2 widths of 10 splints shall be  $1\text{-}3/16 \pm 1/16$  inches ( $30 \pm 2$  mm), and each splint shall be  $1/10$  of the overall width. Class 3 width of 5 splints shall be  $5/8 \pm 1/16$  inch ( $16 \pm 2$  mm), and each splint shall be  $1/5$  of the overall width. The class 1, 2 and 3 lengths of the splints with head shall be  $1\text{-}3/8 \pm 1/8$  inch ( $35 \pm 3$  mm), and the total length of splint with head and base shall be  $1\text{-}7/8 \pm 1/8$  inches ( $48 \pm 3$  mm).

3.3.2 Count. Class 1 and 2 books shall contain 20 splints in 2 rows of 10 each. Class 3 books shall contain 10 splints in 2 rows of 5 each.

3.3.3 Cover. Class 1, 2 and 3 covers shall be made of single lined bending board or solid sulphite coverstock, 0.011 to 0.019 inch (0.2794 to 0.4826 mm) in thickness. The grain of the paperboard shall run the short way of the cover.

#### 3.3.3.1 Color.

3.3.3.1.1 Classes 1 and 2. When matches are procured for military use (see 6.2), the outer surface of the cover, except for the authorized printing, shall be a lusterless olive drab and the inner surface shall be a dark color.

3.3.3.1.2 Class 3. Unless otherwise specified (see 6.2), the outer surface of the cover, except for the authorized printing, shall be a lusterless olive drab color and the inner surface shall be a dark color.

3.3.4 Dimensions. Class 1, 2 and 3 covers shall be  $4\text{-}1/4 \pm 1/4$  inches ( $108 \pm 6$  mm) long. Class 1 and 2 covers shall be  $1\text{-}3/8 \pm 1/8$  inches ( $35 \pm 3$  mm) wide. Class 3 covers shall be  $3/4 \pm 1/16$  inch ( $19 \pm 2$  mm) wide.

3.3.5 Striking surface. Class 1, 2 and 3 covers striking surfaces shall be positioned near the base of the back of the finished cover (see 6.2), and shall be from  $6/32$  to  $12/32$  inch (5 to 10 mm) in width, extending the full width of the cover. The striking surface shall be resistant to peel-off or strike-through failure when tested as specified in 4.3.1 and shall contain sufficient striking chemicals to light at least 50 percent more matches than are contained in the book.

3.3.6 Assembly. Class 1 and 2 assemblies of the cover material and 2 strips of 10 splints each shall be securely fastened together with wire or any other material which will furnish equal performance. Class 3 assembly of cover material and two strips of 5 splints each shall be securely fastened together with wire or any other material which will furnish equal performance. Class 1, 2 and 3 covers shall, be positioned around the splint base with striking surface on the outside, have  $1/2 \pm 1/8$  inch ( $13 \pm 3$  mm), long lower flaps, have the cover fitting between the flap and splint board, and, have the splint board base and the match heads not extending beyond the cover material.

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3.3.6.1 Wire. Wire for class 1, 2 and 3 covers, if used, shall be not less than 0.018 nor more than 0.022 inch (0.46 to 0.56 mm) in diameter (26 to 24 B.W.G. gage). The ends of the wire shall be well clinched or flattened to prevent snagging. The fastening material shall be applied so as to center the strips of splints within the cover. The fastening wire shall be placed outside the striking area so as not to pierce or loosen the striking media.

3.4 Workmanship. The finished product shall be clean and uniform. The match splints shall not be broken, split, crushed, adhering, chipped or cracked.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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 assure that supplies and services conform to prescribed requirements.

4.2 Quality conformance inspection. Sampling for inspection shall be in accordance with the provisions of MIL-STD-105, except where otherwise indicated.

4.2.1 Component and material inspection. In accordance with 4.1, components and materials shall be inspected in accordance with all the requirements of referenced specifications, drawings and standards unless otherwise excluded, amended, modified, or qualified in this specification or applicable purchase documents.

4.2.2 Examination for count in shipping packages. An examination shall be made for defects in count of the end item in packages. The sample unit shall be one caddy of book matches or one package of box matches, as applicable. The lot size shall be the number of caddies of book matches or the number of packages of box matches, as applicable, of the same type, class, and size offered for inspection. The inspection level for this examination shall be S-2. The lot shall be unacceptable if the applicable defects listed below exceed the permissible limits of an acceptable quality level (AQL) of 2.5, expressed as defects per hundred units.

<u>Examine</u>	<u>Defect</u>
Count	
Type I (as applicable)	More or less than ten boxes per package (see 5.1.1.1.2)
	More or less than twelve boxes per package (see 5.1.1.1.3)
Type II, classes 1, 2 and 3	More or less than fifty books per tray or caddy (see 5.1.1.2)

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4.2.3 Inspection of the end item. The sample unit for end item inspection shall be one book or one box of matches, as applicable. Not more than one sample unit shall be used from any caddy or package to assemble the sample size. The lot size shall be the number of caddies of book matches or the number of packages of box matches, as applicable, of the same type, class and size offered for inspection.

4.2.3.1 Examination of the end item. The end item shall be examined for visual defects in physical characteristics, construction and workmanship as listed below. The inspection level shall be level I and the acceptable quality level (AQL) shall be 4.0, expressed as defects per hundred units.

<u>Examine</u>	<u>Defect</u>
Physical characteristics	
Splints (as applicable)	Not made of long-fibered timber. Not of splint board.
Match heads	Head material not properly and not evenly applied over end and sides of splint.
Construction	
Match splints (as applicable)	Improperly scored at base or alternate splints not indented.
Cover or outer box (as applicable)	Not material specified. Poor flexibility (cracks on bending). Color not as specified. Grain of cover doesn't run in specified direction. Does not overlap when closed. Cover-tray combination too loose.
Striking surface (as applicable)	Not near base of back or front of cover. Does not extend full width of cover. Not facing outside of cover. Extends over end edges of box. 3/8 inch (10 mm) width not positioned on both side panels of outer box.
Assembly (as applicable)	Not securely fastened. Strips of splints not centered within cover. Other than two strips of five each. Other than 2 strips of 10 each.

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ExamineDefectWire (as  
applicable)Not securely clinched or flattened.  
Wire piercing striking media.Printing (as  
applicable)Not as specified.  
Smeared or not legible.

## Workmanship

Matches

Not uniform in size; not clean.

Match splints

Broken, split or crushed.

Match heads

More than 5 percent missing or imperfect (crumbled,  
adhering, split, chipped or cracked).

4.2.3.2 Examination for count. The end item shall be examined for count defects. The inspection level for this examination shall be S-2. The lot shall be unacceptable if the average number of types I and III matches per box, of the samples examined, is less than specified, or if the applicable defects listed below exceed the permissible limits of an acceptable quality level (AQL) of 2.5, expressed as defects per hundred units.

ExamineDefect

## Count

Type I,

Less than 30 matches per box.

Type II,  
classes 1  
and 2Less than 10 splints per strip.  
Less than 2 rows of 10 splints each.  
Less than 20 matches per book.  
More than 20 matches per book.Type II,  
class 3Less than 5 splints per row.  
Less than 2 rows of 5 splints each.  
Less than 10 matches per book.  
More than 10 matches per book.Type III,  
class 1,  
size 1 and  
class 2

Less than 230 matches per box.



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4.2.3.3 Examination for dimensions. An examination shall be made for dimensional defects. The inspection level shall be S-2 and the acceptable quality level (AQL) shall be 4.0, expressed as defects per hundred units.

<u>Examine</u>	<u>Defect</u>
Splints (as applicable)	
Thickness	
Type II, classes 1, 2 and 3	More than 0.042 inch (1 mm) Less than 0.0355 inch (1 mm)
Width	
Type II, classes 1 and 2 (10 splints) per row	More than 1-1/4 inches (32 mm) Less than 1-1/8 inches (29 mm) More or less than 1/10 of overall width of 10 splint row
Type II, class 3 (5 splints) per row	More than 11/16 inch (17 mm) Less than 9/16 inch (14 mm) More or less than 1/5 of overall width of five splint row
Length	
Type I, with head	More than 1-7/8 inches (48 mm) Less than 1-5/8 inches (41 mm)
Type II, classes 1, 2 and 3	More than 1-1/2 inches (38 mm) Less than 1-1/4 inches (32 mm)
Overall length including base	More than 2 inches (51 mm) Less than 1-3/4 inches (44 mm)
Type III, class 1, size 1, and class 2 with head	More than 2-1/2 inches (64 mm) Less than 2-1/4 inches (57 mm)

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<u>Examine</u>	<u>Defect</u>
Cover (as applicable)	
Thickness	
Type II, classes 1, 2 and 3	More than 0.019 inch (1 mm) Less than 0.011 inch (1 mm)
Width	
Type II, classes 1 and 2	More than 1-1/2 inches (38 mm) Less than 1-1/4 inches (32 mm)
Type II, class 3	More than 13/16 inch (21 mm) Less than 11/16 inch (17 mm)
Length	
Type II, classes 1, 2 and 3	More than 4-1/2 inches (114 mm) Less than 4 inches (102 mm)
Striking surface (as applicable)	
Width	
Type II, classes 1, 2 and 3	More than 12/32 inch (10 mm) Less than 7/32 inch (6 mm)
Lower flaps (as applicable)	More than 5/8 inch (16 mm) Less than 3/8 inch (10 mm)
Wire (as applicable)	More than 0.022 inch (1 mm) (24 B.W.G. gage) Less than 0.018 inch (1 mm) (26 B.W.B. gage)

4.2.4 Examination of preparation for delivery. An examination shall be made to determine that packaging, packing, contents, weight, and marking comply with the requirements of section 5. The sample unit shall be one shipping container fully prepared for delivery, except it need not be closed. The lot size shall be the number of shipping containers offered for inspection. The inspection level shall be S-2 and the acceptable quality level (AQL) 4.0, expressed as defects per hundred units.

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<u>Examine</u>	<u>Defect</u>
Packaging (as applicable)	Not in accordance with packaging level specified. Unit package not packaged as specified. Packaging material not as specified. Closure not securely sealed along entire length of seam. Packages not in accordance with PPP-C-96 (where applicable).
Packing	Not in accordance with packing level specified. Container not as specified; closures not accomplished by specified or required methods or materials. Any nonconforming component; component missing or damaged. Inadequate application of component such as excess air not expelled from bag, contents loose, incorrectly fabricated bag or incomplete closure of bag. Bulged or distorted container.
Contents	Number of boxes per intermediate packages less than the specified or indicated quantity. Number of intermediate packages or boxes per shipping container is more or less than required (as applicable).
Weight	Net weight exceeds specified requirements (see 5.2.2.1).
Markings (exterior and interior, as applicable)	Incorrect; incomplete; illegible, omitted; of improper size, location, sequence, method of application or not in accordance with contract requirements.

4.2.4.1 Examination of shipping containers. When shipping is required to be in accordance with PPP-C-96, PPP-B-601 or PPP-B-636, examination for defects in closure, waterproofing, and reinforcing shall be in accordance with the applicable specification.

4.2.5 Testing of the end item. The end item shall be tested for performance of matches and test of striking surfaces as specified in 4.3 and for applicable characteristics as specified in table I for each lot offered for inspection. The lot size shall be the number of caddies of book matches or the number of packages of box matches, as applicable, of the same type, class and size. The inspection level shall be S-1 and the acceptable quality level (AQL) shall be 1.5, expressed as defects per hundred units, applicable to each test characteristic.

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TABLE I. Tests for end item 1/

Characteristic	Specification reference		Requirements applicable to Sample	Number determinations per unit
	Requirement	Test method		
Spontaneous ignition	3.1.3.1	4.3.2	as indicated in 4.3.2	1
Nonignition (safety), types I and II	3.1.3.2	4.3.3	10 matches and 20 matches	1
Water resistance, type III, class 2	3.1.3.3	4.3.4	100 matches	1
Blocking resistance, type III, class 2	3.1.3.4	4.3.5	1 box matches	1
Humidity resistance, type II, classes 2 and 3	3.1.3.5	4.3.6	200 matches	1
Striking surface, resistance to wet abrasion, type II, classes 2 and 3	3.1.3.6	4.3.7	1 book	1
Box resistance to high humidity, type III, class 2	3.1.3.7	4.3.8	1 box	1
Packing material (bag)				
Bending	5.2.1.1	4.3.9.1	1 bag	1
Delamination	5.2.1.1	4.3.9.2	1 bag	1
Leaks	5.2.1.1	4.3.9.3	1 bag	1

1/ If failure is indicated, report either description of failure or the numerical point of failure, as applicable.

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### 4.3 Test procedures.

4.3.1 Performance of matches and test of striking surfaces. Matches for performance and test shall be selected at random and in quantities as follows and as applicable:

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Type I	3 unopened boxes
Type II, classes 1 and 2	6 books
Type II, class 3	12 books
Type III, class 1, size 1 and class 2	100 matches

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The matches shall be conditioned for a minimum of 48 hours in an atmosphere maintained at  $50 \pm 4$  percent relative humidity at  $73.5 \pm 2^\circ\text{F}$  ( $22$  to  $24^\circ\text{C}$ ) and subjected to the test specified herein.

4.3.1.1 Performance test. Each match shall be held close to its head and firmly and rapidly struck against the striking surface. Continue striking until the match either ignites, breaks, or the matchhead separates from the splint. Type III matches may be struck on the sanded surface of the box, a dry wooden floor, or an equally rough surface. Each match shall ignite and burn halfway down the splint before it is extinguished to be considered satisfactory. Record as defective any match that fails to ignite and burn; any match that breaks or shows head separation; any match that cracks, explodes or shows afterglow for more than 3 seconds. Glowing under its head shall be disregarded.

TABLE II. Performance

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<u>Defect</u>	<u>Types I and II</u> <u>Maximum,</u> <u>percent</u>	<u>Type III</u> <u>Maximum,</u> <u>percent</u>
Failure to ignite and burn	4.0	2.0
Breakage of sticks or splints	4.0	2.0
Failure of match head	4.0	2.0
Cracking or exploding (drop of glowing particles)	1.0	1.0
Afterglow exceeding 3 seconds	5.0	5.0

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4.3.1.2 Test of striking surfaces. Additional matches shall be used to determine that there is no failure to meet the requirements of the striking surfaces of boxes and books as specified in 3.2.2, 3.3.5. The striking surface shall permit at least 45 matches of type I: 30 matches of type II, classes 1 and 2; and 15 matches of type II, class 3 to be ignited upon it.

4.3.2 Spontaneous ignition. Prepare a wooden block 7/8 inch (22 mm) thick and 2 inches (51 mm) square with a 1 inch (25 mm) hole in the center; completely fill the hole in the block with the matches from the test sample. The base of the matches shall be pressed flush with the bottom of the block. The bundle of matches shall be placed approximately in the center of a circulating hot air oven with the heads up. A temperature sensing device, thermometer or thermocouple in the range of 150 to 250°F (66 to 121°C) shall be placed not more than 1/2 inch (13 mm) and not less than 1/4 inch (6 mm) from the match heads on the same level. After the bundle of matches is properly placed and the door is closed, raise the temperature of the oven to  $194 \pm 2^\circ\text{F}$  ( $90 \pm 1^\circ\text{C}$ ). Expose the matches to this temperature for 2 hours. The matches shall not ignite during this period.

4.3.3 Nonignition (safety) (types I and II). Ten matches, taken from several packages, shall be used for this test. Each match shall be held close to its head (at a safe distance) and shall be drawn once over a sheet of sandpaper, grade 3/0. The average length of stroke as indicated by the mark on the sandpaper shall be 2 inches (51 mm). The matches shall not ignite when so tested. Ten pairs of matches, selected at random from five unopened boxes or books, shall not ignite when heads are rubbed together. Place a match in each hand, holding it close to the match head. Then rub the heads together at least five times. The matches shall not ignite when so tested.

4.3.4 Water resistance (type III, class 2). Completely submerge one hundred loose matches in water maintained at  $90 \pm 2^\circ\text{F}$  ( $32 \pm 1^\circ\text{C}$ ). After 2 hours of submersion, remove 20 matches at a time from the water and rub each match rapidly between the fingers until excess water is removed from the surface. Within 1 minute after removal from the water, strike the matches on a hard dry surface. Repeat the procedure with the remaining matches. Each match shall ignite and burn not less than 1 inch (25 mm) of splint before it is extinguished. Matches fail this test if more than 5 percent fail to ignite and burn properly.

4.3.5 Match resistance to adhesion (type III, class 2). Place a full box of matches in an oven maintained at  $150 \pm 2^\circ\text{F}$  ( $45 \pm 1^\circ\text{C}$ ) for 18 hours. Remove the matches from the oven and cool the matches to room temperature  $75 \pm 5^\circ\text{F}$  ( $21 \pm 27^\circ\text{C}$ ). Matches shall not adhere or stick together.

#### 4.3.6 Humidity resistance (type II, classes 2 and 3).

##### 4.3.6.1 Apparatus.

4.3.6.2 Desiccator. A pyrex desiccator shall be used, having an inside diameter of 250 mm and an overall height of 305 mm. The cover of the desiccator shall be fitted with a stopcock to allow pressure equalization between the interior of the desiccator and the atmosphere surrounding the desiccator. The desiccator shall be provided with a porcelain plate (Coors 600) of 230 mm diameter, 5 mm thickness with 162.5 mm diameter perforations and a 23 mm diameter hole in the center.

4.3.6.3 Oven. The oven shall be double-wall, electrically-heated with forced circulation and with heater and temperature controls capable of maintaining a temperature of  $106 \pm 2^{\circ}\text{F}$  ( $40$  to  $42^{\circ}\text{C}$ ) uniformly throughout the interior of the oven.

4.3.6.4 Temperature recording device. The oven shall be provided with a recording device capable of producing a permanent record of the temperature maintained within the oven during the entire 14-hour conditioning and testing periods. The temperature record or chart shall be capable of showing temperature fluctuations of  $1^{\circ}\text{F}$  ( $0.56^{\circ}\text{C}$ ) and greater.

4.3.6.5 Test procedure. A sufficient amount of distilled water shall be placed in the bottom of the desiccator to obtain a 1-inch (25 mm) air space between the top surface of the water and the bottom surface of the porcelain desiccator plate. The desiccator, with desiccator cover in place and stopcock in desiccator cover opening, with water placed therein, shall be conditioned for at least 8 hours by placing in an oven maintained at  $106 \pm 2^{\circ}\text{F}$  ( $40$  to  $42^{\circ}\text{C}$ ). Stopcock grease shall be used to maintain airtight seals. The stopcock shall remain open during the first 15 minutes to permit pressure equalization. The stopcock shall then be closed. The conditioned desiccator shall be removed from the oven; 200 matches (10 books of 20 matches per book, or 20 books of 10 matches per book) shall be placed in the desiccator and the desiccator returned to the oven. Not more than 2 minutes shall elapse between removal of the conditioned desiccator for insertion of the matches and its return to the heated oven. The matches shall be placed on the desiccator plate so that each book is open and each book rests on its edge with the abrasive striking surface resting vertically upon the desiccator plate and so that each book is not closer than 1/2 inch (13 mm) to the walls of the desiccator. When the loaded desiccator is returned to the oven, repeat the process of pressure equalization specified above. Care shall be exercised when moving the desiccator to prevent the water in the desiccator from splashing and wetting the desiccator plate or the matches. After 6 hours of exposure to  $106 \pm 2^{\circ}\text{F}$  ( $40$  to  $42^{\circ}\text{C}$ ), the loaded desiccator shall be removed from the oven and placed in an area maintained at not less than 85 percent relative humidity and at a temperature of  $90$  to  $100^{\circ}\text{F}$  ( $32$  to  $37^{\circ}\text{C}$ ). Remove one book of matches without delay. The matches from this book shall be immediately and individually drawn

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across the striking surface of the book in an atmosphere of not less than 85 percent relative humidity and as specified in 4.3.1.1. The remaining books of matches shall be individually and quickly removed from the desiccator. The desiccator cover shall be replaced after each removal of matches for test. The 200 matches shall be tested within a period not exceeding 25 minutes. The number of matches which blink, fizz, do not ignite or whose heads fly off, shall be recorded. Matches fail the test if more than 30 percent (60 matches) fail to ignite satisfactorily.

4.3.7 Resistance of striking surface to moisture and abrasion (type II, classes 2 and 3).

4.3.7.1 Apparatus. The apparatus for this determination shall be constructed as specified in figure 1.

4.3.7.2 Preparation of wet abrasion surface. Soak the wool blanket pad (see figure 1) thoroughly with water, then invert the pad holder to permit the excess water to drain off. Turn the pad to an upright position and allow it to stand 1 minute so that surface water is absorbed. (Brush the residue of abraded material of the previous test from the pad before starting a new test.)

4.3.7.3 Procedure. Place a fresh book of matches on top of the pad prepared as specified in 4.3.7.2, with the striking surface facing the wet surface of the pad. Under the weight of 1 pound (0.45 kg), the striking surface of the book shall be given ten, 10-inch (254 mm) strokes across the wet blanket. Blot the striking surface dry and immediately strike each match, one at a time within 120 seconds, on the striking surface of the book in the same way as specified in 4.3.1.1. The striking surface shall be capable of igniting 30 matches for class 2 and 15 matches for class 3.

4.3.8 Resistance of match boxes toward high humidity (type III, class 2). Expose an empty match box to a relative humidity of  $90 \pm 5$  percent at  $100 \pm 2^\circ\text{F}$  ( $36$  to  $38^\circ\text{C}$ ) for 48 hours. Examine the box to determine effect of exposure by opening and closing the box by pushing on the ends of the box as specified in 3.1.3.7.

4.3.9 Packing materials.

4.3.9.1 Bending. The bending test shall be determined in accordance with method 244 of FED-STD-101.

4.3.9.2 Delamination. The bonded specimens shall be suspended within an air circulating oven or cabinet maintained at  $158$  to  $162^\circ\text{F}$  ( $70$  to  $72^\circ\text{C}$ ) for 24 hours. Specimens shall be examined visually for evidence of adhesive flow and separation.



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4.3.9.3 Leaks in containers. The leak test shall be determined in accordance with method 241 of FED-STD-101.

## 5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A, B, or Commercial, as specified (see 6.2).

### 5.1.1 Level A.

#### 5.1.1.1 Unit packaging. Type I.

5.1.1.1.1 Packaging of matches in paperboard trays with covers. Matches of one type shall be packaged in paperboard trays with either wooden or commercial paperboard slide cover. The slide cover shall fit sufficiently tight so that the tray will not fall out when the closed box of matches is held in a vertical position.

5.1.1.1.2 Wrapping of boxed matches. Unless otherwise specified in the contract or order (see 6.2), ten single boxes of type I safety matches, packaged as specified in 5.1.1.1.1, shall be wrapped in minimum 25-pound basis weight (41 g/m<sup>2</sup>) paper (24 by 36-500) which shall be securely sealed with an adhesive to make a tight package.

5.1.1.1.3 Type I, (boat box equipment). When specified (see 6.2), twelve boxes of type I safety matches, packaged as specified in 5.1.1.1.1 shall be packaged in an oblong sanitary style can conforming to type I of PPP-C-96. The can shall be provided with a suitable scored key opening band near the top, and a corrosion resistant key shall be affixed to one end. The exterior protective coating shall be plan B (see paragraph 3.2.2.2 of PPP-C-96). The inside dimensions of the can shall be approximately 3-11/16 by 2-5/8 by 4-1/2 inches (94 by 67 by 114 mm).

5.1.1.2 Type II, classes 1, 2 and 3. Fifty books of matches of one class only shall be packaged in a paperboard box or tray containing two rows of 25 books with each book alternatively positioned for safety and conservation of space. When packaged in trays, each tray shall be wrapped in a bleached kraft paper which shall be securely pasted or glued to make a tight package.

5.1.1.3 Type III, class 1, size 1 or class 2. Matches of one class, arranged in two nearly equal portions with the heads of the two portions placed in opposite directions, shall be packaged in a snug-fitting setup paperboard box conforming to type IV, variety 1, class C, style 3 of PPP-B-676, except that the minimum thickness of paperboard shall be 0.018 inch (1 mm). A center strip approximately 6-1/8 inches (156 mm) long by 1-5/8 inches (41 mm) wide shall be placed over the matches in the tray to hold the matches in position in accordance with commercial practice. Alternative to the center strip for holding the matches in position, a snug-fitting corrugated fiberboard pad shall be placed over the matches in the tray.

#### 5.1.2 Intermediate packaging.

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5.1.2.1 Type I. One hundred and twenty boxes (12 unit packages) of type I matches, unit packaged as specified in 5.1.1.1.1, shall be wrapped in minimum 30-pound basis weight (49 g/m<sup>2</sup>) paper (24 by 36-500), securely pasted or glued to make a tight intermediate package.

5.1.2.2 Type III, class 1, size 1 or class 2. Unless otherwise specified (see 6.2), three or six boxes of matches of one class only, unit packaged as specified in 5.1.1.3, shall be intermediately packaged in accordance with the industry's practice.

5.1.2.2.1 Type III, class 1, size 1. When specified (see 6.2), three boxes of type III, class 1, size 1 matches, unit packaged as specified in 5.1.1.3, shall be intermediately packaged in a minimum 0.0015 inch (1 mm) thick polyethylene bag conforming to type I, style 1 of PPP-B-26. Prior to or during the heat sealing operation, excess air within the bag shall be expelled.

### 5.1.3 Level B.

5.1.3.1 Type I. Type I wood matches shall be packaged in paperboard trays with either commercial wooden or paperboard slide covers. The slide covers shall fit the trays tight enough to prevent the tray from falling out when the closed box of matches is held in a vertical position. Ten individual boxes of type I safety matches shall be unit packaged in a commercial wrap or carton and securely glued or sealed to provide a tight package.

5.1.3.2 Type II. Type II, class 1 paper matches in books shall be unit packaged in quantities of fifty books in a paperboard box or caddy containing two rows of twenty-five books with each book alternatively positioned for safety and conservation of space.

5.1.3.3 Intermediate packages. Twelve unit packages of type I matches (120 boxes) shall be intermediate packaged in a snug-fitting paperboard or fiberboard box conforming to PPP-B-566, PPP-B-665, PPP-B-676, or PPP-B-636, class domestic. Boxes shall be closed in accordance with the applicable box specification.

5.1.4 Commercial. The matches shall be packaged to afford adequate protection against deterioration and physical damage during shipment from the supply source to the first receiving activity. The supplier may use his standard practice when it meets these requirements.

5.2 Packing. Packing shall be level A, B, or Commercial, as specified (see 6.2).

### 5.2.1 Level A.

5.2.1.1 Type I, (except boat box equipment).

Type II, classes 1, 2, and 3.

Type III, class 1, size 1, except polyethylene bagged and class 2.

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Seven hundred and twenty boxes (6 intermediate packages) of type I; 2500 books (50 unit packages) of type II; or 144 boxes (24 or 48 intermediate packages) of type III matches, packaged as specified in 5.1, shall be prepacked in a snug-fitting waterproofed bag. The bag shall be a flat or envelope style bag fabricated from flexible waterproofed barrier material conforming to class H-5 of PPP-B-1055. All seams of the bag shall have a minimum width of 3/4 inch (19 mm) and sealed with waterproof adhesive conforming to MMM-A-260. The bag opening shall be provided with a continuous strip of pressure-sensitive waterproof adhesive around the inside edge of the bag closure opening. This strip shall be covered with a removable protective film. The seal shall be effected without heat by pressure rollers and shall not break when tested as specified in 4.3.9.1. The bag shall not delaminate at seams and closures when tested as specified in 4.3.9.2. The packed assembly of packages in the sealed bag shall then be packed in a snug-fitting fiberboard shipping container conforming to style RSC, grade V2s of PPP-B-636. Alternatively, shipping containers shall conform to overseas type, type 2 load of PPP-B-601. Each shipping container shall be closed and reinforced with flat strapping or tape banding in accordance with the appendix of the box specification.

5.2.1.2 Type I (boat box equipment). Matches, packaged as specified in 5.1.1.1.3, shall be packed as specified for level A shipment in the appendix of PPP-C-96.

5.2.1.3 Type III, class 1, size 1 polyethylene bagged matches. One hundred and forty-four boxes (48 intermediate boxes) of matches, packaged as specified in 5.1.2.2.1, shall be packed in a snug-fitting fiberboard shipping container as specified in 5.2.1.1, except that the waterproof bag shall be omitted and the container shall be waterproofed with tape in accordance with the appendix of PPP-B-636.

#### 5.2.2 Level B.

5.2.2.1 Type I. Type I wood matches, packaged as specified in 5.1.3.1 and intermediate packaged as specified in 5.1.3.3, shall be packed in quantities of six intermediate packages (720 boxes) in a snug-fitting fiberboard box conforming to PPP-B-636, class domestic. Closure shall be in accordance with method II as specified in the appendix to PPP-B-636.

5.2.2.2 Type II. Type II paper matches packaged as specified in 5.1.3.2 shall be packed in quantities of fifty boxes or caddies (2500 books) in a snug-fitting fiberboard box conforming to PPP-B-636, class domestic. Closure shall be in accordance with method II as specified in the appendix to PPP-B-636.

5.2.2.3 Type III. Type III, nonsafety matches in quantities as specified (see 6.2), packaged as specified in 5.1.1.3 and 5.1.2.2 of the one class and size only, shall be packed in a snug-fitting fiberboard box conforming to PPP-B-636, class domestic, grade 275. The box shall be closed in accordance with method II as specified in the appendix to PPP-B-636.

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5.2.3 Commercial. Matches, packaged as specified in 5.1, shall be packed in a manner to insure carrier acceptance and safe delivery at destination at the lowest transportation rate for such supplies. Containers shall be in accordance with Uniform Freight Classification or National Motor Freight Classification, as applicable.

5.2.4 Standard pack (civil agencies). The standard packaging and packing for civil agencies shall be as specified in 5.1.1 and 5.2.2, respectively, for type I and type II matches.

### 5.3 Marking.

#### 5.3.1 Civil agencies, and military requirements, interior packages.

5.3.1.1 Type I. Each box and package shall be marked with the name of the commodity, and the name of the manufacturer or dealer, or the trademark or brand of the match. No commercial advertising shall appear on the tray or outer cover.

5.3.1.2 Type II. Each book and each wrapped tray shall be plainly marked with the name of the manufacturer or dealer, or trademark of brand of match, and the outer face of the cover of each book shall be legibly marked with the warning "CLOSE COVER BEFORE STRIKING". No commercial advertising shall appear on the cover.

5.3.1.2.1 Type II, classes 2 and 3 only. In addition to the information required in 5.3.1.2, each book and each box or wrapped tray of humidity resistant matches shall bear the following legend:

"THESE MATCHES ARE DESIGNED ESPECIALLY FOR  
DAMP CLIMATES, BUT THEY WILL NOT LIGHT WHEN  
WET, OR AFTER LONG EXPOSURE (SEVERAL WEEKS)  
TO VERY DAMP AIR."

5.3.1.3 Type III, class 1, size 1. The matches for military and civil agencies shall be marked in accordance with the industry's practice. Matches for military use, packaged in intermediate packages as specified in 5.1.2.2.1, shall in addition, be marked in accordance with MIL-STD-129.

5.3.1.4 Type III, class 2 military requirements. The top of each box shall specify the following:

Matches, Strike-Anywhere  
Fed. Spec. EE-M-101  
Stock No.  
Manufacturer's name and address  
Contents - 250 matches

Important instructions. Especially for use in damp climates. Keep as dry as possible. These matches are water-resistant, not waterproof. If matches will not light, dry them in sunlight or in a warm dry place. Strike on any hard, dry surface. If damp before striking, remove surface moisture by shaking vigorously or wiping dry.

### 5.3.2 Shipping containers.

5.3.2.1 Civil agencies. In addition to any special marking required by the contract or order, marking shall be as specified in the contract or order.

5.3.2.2 Military. Each shipping container shall be marked in accordance with MIL-STD-129. In addition, each shipping container, containing matches packaged as specified in 5.1.2.2.1, shall be marked as follows:

"FOR PROTECTION AGAINST MOISTURE, CONTENTS IN UNITS OF  
THREE ARE PACKAGED IN A POLYETHYLENE BAG."

## 6. NOTES

6.1 Intended use. Type I, type II, class 1 and type III, class 1, size 1 matches are intended for use in temperate climates. Type II, classes 2 and 3 and type III, class 2 matches are intended for use in tropical or very damp climates where exposure to high humidity renders ordinary matches unfit for use.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents:

- (a) Title, number, and date of this specification.
- (b) Type, class, and size required, as applicable (see 1.2).
- (c) Color of outer cover surface if other than specified (see 3.3.3.1).
- (d) Selection of applicable levels of packaging and packing (see 5.1 and 5.2).
- (e) If boat box is desired (see 5.1.1.1.3).
- (f) Whether units of 3 boxes shall be waterproofed (see 5.1.2.2.1).
- (g) If other than specified packaging required (see 5.1.1.1.2 and 5.1.2.2).

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6.3 Recycled material. It is encouraged that recycled material be used when practical as long as it meets the requirements of the specification (see 3.1.1).

6.4 Metric equivalents. Metric equivalents, indicated in parentheses throughout this document, are based on practices, conversion factors, and symbols specified in ASTM E 380 Standard for Metric Practice, and are for information only. In each instance, the value stated in US customary units shall be controlling.

**Custodians:**

Army - GL  
Air Force - 99

**Review activity:**

Army - MD

**User activities:**

Navy - MC  
DPSC-SS

**Preparing activity:**

Army - GL

**Civil Agency Coordinating Activities:**

Commerce- NBS  
GSA-FSS  
VA-DMS

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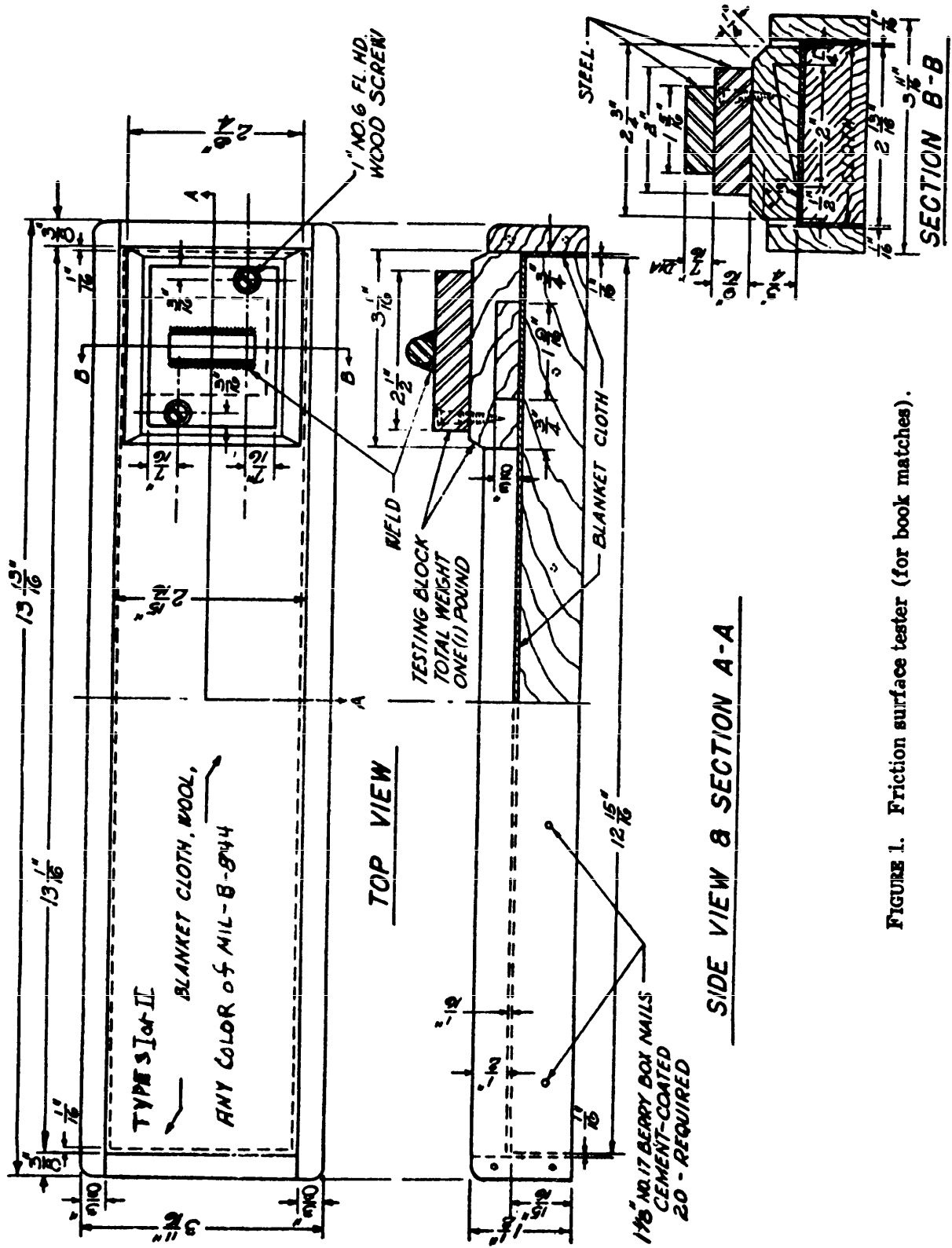


FIGURE 1. Friction surface tester (for book matches).

