

INCH-POUND

MIL-I-24391C
9 March 1990
SUPERSEDING
MIL-I-24391B
17 June 1987
(see 6.68)

MILITARY SPECIFICATION

INSULATION TAPE, ELECTRICAL, PLASTIC, PRESSURE-SENSITIVE

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

1. SCOPE

1.1 Scope. This specification covers one type of plastic, electric, pressure-sensitive, self-extinguishing insulating tape for use at ambient temperatures of not less than minus 12 degrees Celsius (°C) nor more than 65°C.

1.2 Part or identifying numbers pins. Part numbers under this specification are formulated as follows (see 3.3.1 and 6.2):

M24391-00

Specification number _____

Size identifier (see 1.2.1) _____

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 5523, 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 5970

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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1.2.1 Size identifier. A two position field is used to identify size (see 3.3.1).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

- | | |
|-----------|--|
| TT-T-291 | - Thinner, Paint, Mineral Spirits, Regular and Odorless. |
| PPP-B-636 | - Boxes, Shipping, Fiberboard. |
| PPP-C-96 | - Cans, Metal, 28 Gage and Lighter. |
| PPP-F-320 | - Fiberboard; Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes. |
| PPP-T-60 | - Tape: Packaging, Waterproof. |

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| MIL-L-19140 | - Lumber and Plywood, Fire-Retardant Treated. |
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STANDARDS

MILITARY

- | | |
|----------------|--|
| MIL-STD-104 | - Limits for Electrical Insulation Color. |
| MIL-STD-2073-1 | - DoD Materiel Procedures for Development and Application of Packaging Requirements. |

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

2.2 Non-Government publications. The following 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

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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 618 - Standard Methods of Conditioning Plastics and Electrical Insulating Materials for Testing. (DoD adopted)
- D 1000 - Standard Methods of Testing Pressure-Sensitive Adhesive Coated Tapes Used for Electrical Insulation.
- D 3951 - Standard Practice for Commercial Packaging. (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.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. Tapes 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 4.3 and 6.4).

3.2 Material.

3.2.1 Backing. The backing shall consist of a plastic film which shall meet the requirements of this specification.

3.2.2 Adhesive. The adhesive shall be pressure-sensitive, water insoluble, homogenous, and coated in a smooth and evenly distributed layer on one side of the backing. The adhesive shall require neither solvent, heat, nor any other preparation prior to application.

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3.2.3 Recovered materials. Unless otherwise specified herein, all material, and articles incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from authorizing the use of 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 reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used products is allowed under this specification unless otherwise specifically specified.

3.3 Finished tape.

3.3.1 Width. The tape shall be furnished in the widths specified (see 6.2) in accordance with table I. The tape shall have a tolerance of plus or minus 0.03 inch.

TABLE I. Tape characteristics.

Dash number	Width (inch)	Spool inside diameter (inches)
01	0.50	1 + 1/16, - 0
02	0.75	
03	1.00	
04	1.50	1-1/2 + 1/16, -0

3.3.2 Length. Unless otherwise specified (see 6.2), the length of tape in the roll shall be a minimum of 36 yards.

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3.3.3 Thickness. The thickness of the tape shall be 0.0085 inch with a tolerance of plus or minus 0.001 inch.

3.3.4 Color. Unless otherwise specified (see 6.2), the color of the tape shall be black. Colors other than black shall conform to MIL-STD-104.

3.4 Rolls. Unless otherwise specified (see 6.2), the tape shall be uniformly and smoothly wound in rolls, with the adhesive side in, without liner or separator, no more than two splices per roll on cores in accordance with table I. The cores shall have sufficient rigidity to prevent distortion of the roll under normal conditions of use. The splices shall not separate when the roll is unwound in test or in use.

3.4.1 Marking of the rolls. Each roll of tape shall be marked inside the core or side of the tape with numerals or letters indicating the month and year of manufacture. In addition, "For direct Government acquisition", the contractor's name and designation of product shall be stamped inside the core.

3.5 Physical properties. The tape shall conform to the requirements specified in table II.

TABLE II. Physical properties for insulation tape.

Property	Units	Requirements
Breaking strength	Pounds/inch width minimum average	15
Dielectric break-down: After water immersion: After 4 hours at 70°C exposure:	Volts (minimum average reading per roll)	7000 6000

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TABLE II. Physical properties for insulation tape - Continued.

Property	Units	Requirements
Adhesion: At 23°C To steel To backing At minus 12°C: To steel To backing	Ounces/inch width minimum average	16 16 16 16
Unrolling: 23°C minus 12°C	Ounces/inch width (maximum individual reading)	64 128 No mass transfer or breaking
Elongation at minus 7°C	Percent (minimum individual reading)	100
Flexible at minus 12°C	Cracks or holes	None
Accelerated aging (7 days 65°C, 90 percent relative humidity)	Adhesion factor (percent minimum)	75
Shelf storage (2 years)	Shall conform to: Adhesion to backing, and unrolling at 23°C and breaking strength. No excessive adhesive flow on sides, no telescoping greater than 1/4 inch, no gapping more than 1/16 inch.	
Flammability	Self extinguishing time, seconds maximum, average	2
High humidity insulation resis- ance	Megohms, minimum	.25 x 10 ⁶

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3.6 Storage.

3.6.1 Performance. Following a 2 year storage period, the tape shall meet the shelf storage requirements of table II.

3.7 Workmanship. The pressure-sensitive adhesive tape shall be uniformly constructed and free from defects which impair the intended usefulness of the material. The adhesive coating shall be uniform, covering the entire area of one side of the tape. Edges shall be clean cut, straight, and unbroken. Rolls shall be evenly wound and the finished product shall conform to the levels of quality established herein.

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 (see 6.3).

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 (see 6.3).

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

- (a) Qualification inspection (see 4.3).
- (b) Quality conformance inspection (see 4.4).

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4.3 Qualification inspection. Qualification inspection shall include the submission of samples as specified in 4.3.1 and the qualification tests as specified in 4.3.2.

4.3.1 Qualification samples. Qualification inspection samples shall consist of 10 rolls of 1-inch wide tape.

4.3.2 Qualification tests. The qualification tests of the insulation tape shall consist of the tests as specified in 4.6 through 4.6.10. Five rolls of tape shall be used for the initial qualification tests; the remaining five rolls shall be reserved for tests after 2 year shelf storage. Unless otherwise specified herein, a minimum of three specimens shall be run for each test. Failure of any averaged test results to conform to the requirements of this specification shall be cause for rejection of a qualification approval.

4.4 Quality conformance inspection.

4.4.1 Inspection lot. For sampling purposes, an inspection lot for examinations and tests shall consist of all material of the same type, width, and color submitted for inspection and delivery at the same time. A lot is defined in to 10 rolls of tape.

4.4.2 Inspection of the end item. For examinations specified in 4.4.2.1, 4.4.2.2, and 4.4.2.3, sample units shall be rolls of tape. For examination specified in 4.4.2.4, shipping containers shall be designated as the sample units.

4.4.2.1 Examination of the end item for defects in appearance and construction. Sample tape selected in accordance with table III shall be examined for the following defects:

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Examination 1Defects

Appearance Any tears, cuts, or holes, blisters, creases, folds or puckers, adhesive missing, presence of dirt, foreign material or imbedded particles.

The outside turn of tape shall be omitted from examination.

TABLE III. Sampling for defects in appearance and construction.¹

Lot size	Sample size
2 - 25	3
26 - 150	8
151 - 280	13
281 - 500	20
501 - 1200	32
1201 - 3200	50
3201 - 10000	80
10001 - 35000	125
35001 - over	200

¹/ All defective items shall be replaced with acceptable items.

- ° All defective items shall be replaced with acceptable items prior to acceptance.
- ° Inspect sample size until reject criteria is reached
- ° Reject lot may be screened and resubmitted for inspection and retest.

4.4.2.2 Examination of the end item for dimensional tests.
Sample tape selected in accordance with table IV shall be examined for any of the following dimensional defects:

ExaminationDefects

Width	Varies by more than plus or minus 0.03 inch from width specified (see 3.3.1).
Length	(See 3.3.2).
Thickness	Varies by more than 0.001 inch (see 3.3.3).
Core	Core not within tolerance specified in table I. Month and year of manufacture not specified (see 3.4.1).

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The outside turn of tape shall be omitted from examination.

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TABLE IV. Sampling for dimensional examination and examination workmanship and appearance. 1/

Lot size	Sample size
2 - 15	3
16 - 50	5
51 - 150	7
151 - 500	8
501 - 3200	18
3201 - 10000	22
10001 - over	29

1/ All defective items shall be replaced with acceptable items.

- ° All defective items shall be replaced with acceptable items prior to lot acceptance.
- ° Inspect sample size until reject criteria is reached
- ° Reject lot may be screened and resubmitted for inspection and retest.

4.4.2.3 Examination of the assembled roll tape for defects in workmanship and appearance. The assembled roll tape selected in accordance with table IV shall be examined for defects in workmanship and appearance as follows.

ExaminationDefects

Workmanship

Adhesive coating not evenly and smoothly applied over entire area of one side of backing; any bare spots or lumps.

Appearance

Roll telescoped, uneven, presence of liner, adhesive side exposed on roll. Roll not tightly wound, gaps in adjacent turns. Roll contains more than two splices.

- ° All defective items shall be replaced with acceptable items prior to lot acceptance.
- ° Inspect sample size until reject criteria is reached
- ° Reject lot may be screened and resubmitted for inspection and retest.

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4.4.2.4 Examination of packaging. An examination shall be made to determine that the packaging, packing and marking conform to the requirements of section 5 of this specification. The sample unit for this examination shall be one shipping container, fully packed, selected just prior to the closing operation. Shipping containers fully prepared for delivery shall be examined for closure defects.

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<u>Examination</u>	<u>Defects</u>
Preservation	Level other than specified, not in accordance with contract requirements (see 5.2). Material and construction of container not as specified.
Packing	Level other than specified, not in accordance with contract requirements (see 5.3). Material and construction of shipping container not as specified, not in accordance with contract requirements. Any component nonconforming, missing, damaged or otherwise defective affecting serviceability.
Marking	Interior and exterior markings (as applicable) omitted, incomplete, illegible, incorrect or not in accordance with contract requirements (see 5.3.3). Less than the indicated or specified quantity packed in any one intermediate container. Less than the indicated or specified quantity of intermediate containers in shipping containers, as applicable.

4.4.3 Quality conformance tests. The end item shall be tested for the applicable characteristics as indicated in table VI for each lot submitted for inspection. The sample test unit shall be one roll of tape. The lot size shall be expressed in units of rolls of tape. Sample size shall be as specified in table V.

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TABLE V. Sampling for quality conformance testing.1/

Lot size	Sample size
2 - 50	5
51 - 150	13
151 - 280	32
281 - 500	50
501 - 1200	80
1201 - 3200	125
3201 - 10000	200
10001 - 35000	315
35001 - over	500

1/ Defective items shall be replaced with acceptable items.

2/ Rejected lots may be screened and resubmitted for inspection and retest.

TABLE VI. Instructions for testing (sample unit).

Characteristic	Specification		Requirements applicable to individual unit	Results determined as		
	Requirement	Test method		Pass or fail	Numerically to nearest	
Breaking strength	Table II	4.6.2	X		-	0.1 pound per inch width
Dielectric breakdown after 70°C exposure	Table II	4.6.3	X		-	25 volts
Adhesion to backing at 23°C	Table II	4.6.4	X		-	0.1 pound per inch width

See footnotes at end of table.

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TABLE VI. Instructions for testing (sample unit) - Continued.

Characteristic	Specification		Requirements applicable to individual unit		Results determined as	
	Requirement	Test method			Pass or fail	Numerically to nearest
High-humidity resistance	Table II	4.6.8	X		-	Megohms
Flammability	Table II	4.6.9	X		-	Seconds
Visual examination	-	-	-		3/ 1/	-

1// Visual examination for excessive adhesive flow and telescoping of 1/4 inch maximum.

4.5 Conditioning of test specimens.

4.5.1 Nomenclature. The designation indicating conditioning of test specimens shall be in accordance with ASTM D 618.

4.5.2 Temperature and humidity tolerances. Temperatures and relative humidities shall be maintained within the tolerances shown in table VII.

TABLE VII. Tolerances.

Temperature		Relative humidity	
°C	±°C	Percent	Percent (plus or minus)
23 to 180	2	50	5
181 to 300	3	96	2

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4.5.3 Preparation for testing. Preparation for testing shall be in accordance with ASTM D 1000. Materials shall be conditioned 24 hours at standard laboratory conditions before being tested.

4.6 Test procedures.

4.6.1 Dimensional measurements. Dimensional measurements shall be made in accordance with ASTM D 1000.

4.6.1.1 Core gaps. A rule, graduated in 1/32 inch increments, shall be placed along the diameter of the tape core, and used to measure the height of the gap.

4.6.2 Breaking strength and elongation. Determinations shall be made in accordance with ASTM D 1000. Elongation shall also be measured (see 6.3) after conditioning 1 hour at minus $7 \pm 1.1^{\circ}\text{C}$.

4.6.3 Dielectric breakdown. Determinations shall be made in accordance with ASTM D 1000. Dielectric breakdown shall also be measured (see 6.3) after conditioning 4 hours at $70 \pm 1.1^{\circ}\text{C}$.

4.6.4 Adhesive strength.

4.6.4.1 Method A, flat plate (180 degrees peel). The apparatus shall conform to ASTM D 1000.

4.6.4.2 Adhesion to steel and backing. Determinations shall be made in accordance with ASTM D 1000.

4.6.4.3 Adhesion to steel and backing at 23 and minus 12°C .

4.6.4.3.1 Procedure. Sample rolls of tape, stainless steel panels as specified in 4.6.4.2, the taped panels for the backing test, a hand-operated tape application device, a knife, and a motor-driven removal device shall be placed in a test chamber. In lieu of the test chamber, a walk-in cold room may be utilized. Figure 1 illustrates a typical test assembly. The motor-driven device shall remove the tape at a speed of 12 inches per minute. The edge of the drum and the tape shall be vertically aligned. For the minus 12°C test, the chamber shall be closed and the chamber reduced to the test temperature. The rolls of tape shall remain at this temperature for a minimum of 2 hours before removal of the tape from the roll. The relative humidity in the test chamber shall be maintained below the point which would cause ice formation at the test temperature. Gloves shall be worn to prevent warming of the test components. The tape shall be removed from the roll, using the knife edge for starting if needed, and placed lengthwise in the center of the steel panel with at least 1 inch of the running end beyond the panel end without the hole. The tape application device shall be propelled

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lengthwise once back and forth at a rate of approximately 12 inches per minute. The 1 inch piece of tape beyond the panel edge shall then be wrapped into the back of the panel or cut flush with the edge. Enough tape shall be stripped from the roll to allow insertion in the slot of the drum of the removal device when the panel is in position for test. After a 10 minute dwell time, the steel panel shall be on the hook of the recording gauge and the gauge shall be zeroed. The hole in the panel and the size of the hook shall be such as to permit the panel to swing freely. The free end of the tape shall be inserted in the slot on the drum; the drum shall be revolved, and the average tension to remove the tape, discounting the first and last inch, shall be measured (see 6.3). For the adhesion to backing test, a piece of tape shall be applied to the panel prior to the start of the conditioning period. After the 2 hour conditioning period, a piece of tape shall be removed from the roll and placed upon the tape backing surface previously applied. This piece of tape shall be rolled with the application device. The test procedure shall be repeated.

4.6.5 Unrolling at 23 and minus 12°C.

4.6.5.1 Procedure. Sample rolls of tape, a knife, a holding jig, and a motor-driven removal device shall be placed in a test chamber. Figure 2 illustrates a typical test assembly. The motor-driven device shall remove the tape at a speed of 12 inches per minute. The edge of the drum and the point where the tape is removed from the roll shall be vertically aligned. For the minus 12°C test, the chamber shall be closed and the chamber reduced to the test temperature. The rolls of tape shall remain at this temperature for a minimum of 2 hours before removal of the tape from the roll. To prevent warming of the tape, gloves shall be worn. The tape shall be started from the roll, using the knife edge if needed, and enough tape removed to allow insertion in the slot of the drum of the removal device when the tape roll is in position for test. The tape roll shall be placed in the holding device; the device shall be hung on the hook of the recording gauge; and the gauge shall be zeroed. The free end of the tape shall be inserted in the slot on the drum, and the drum shall be revolved until a minimum of 10 inches of tape is removed from the roll. The maximum tension shall be measured (see 6.3).

4.6.6 Flexibility at minus 12°C.

4.6.6.1 Apparatus. The apparatus shall consist of a device, similar to that shown on figure 3, which shall apply the tape to a cable in such a manner as to ensure a 14 to 15 revolutions per minute (r/min) cable speed, approximately a 50 percent overlap and a tension of 10 pounds. The cable shall be 5/8 inch inside diameter (id) flexible steel conduit having 35 turns to the foot. The conduit

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shall be approximately 19 inches long, to which collars have been added at both ends to facilitate proper positioning on the support bar, giving a total length of 20 inches. The conduit shall possess enough flexibility to permit a 180 degree bend without binding.

4.6.6.2 Procedure. The cable shall be cleaned with tertiary butyl alcohol followed by cleaning with solvent conforming to TT-T-291, grade 1 and thoroughly dried. The cable shall be placed on the support bar in such a manner that the rib opening is on the right, the positioning slot of the one collar aligned with the pin in the bar, and the bar inserted into the drive mechanism. The cable shall then be compressed to allow insertion of the other holding pin in the positioning slot after which the cable is tightened by rotating the left side collar 180 degrees. A roll of tape, at room temperature, shall be positioned on the holding spindle and the tensioning device adjusted to give a 10 pound reading to remove the tape from the roll. The running end of the tape shall be removed from the top of the tape roll and applied to the top of the cable on the right hand side and the cable revolved until a complete wrap has been made (see figure 3). The cable shall be removed from the support bar and placed in a chamber at minus 12°C and allowed to remain for 2 hours before flexing in the chamber at this temperature. The cable shall be flexed by grasping the collars, one in each hand, and bending to bring the collars into contact within 3 seconds. With the cable held in this position, the outer surface shall be examined for evidence of cracks or holes. Three specimens shall be used.

4.6.7 Shelf storage. Five rolls of tape in the container to be used shall be placed unopened in a room conditioned at 23°C temperature and 50 percent relative humidity with tolerances specified in 4.5.2, for a period of 2 years. At the end of the storage period, the tape shall be examined for telescoping, gapping, and excessive adhesive flow on the sides of the roll. The tape shall then be subjected to the adhesive to backing at 23°C and minus 12°C (see 4.6.4.3), unrolling at 23°C (see 4.6.5), and breaking strength tests (see 4.6.2).

4.6.8 High humidity resistance. The tape shall be tested for high humidity resistance in accordance with ASTM D 1000.

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4.6.9 Flammability.

4.6.9.1 Apparatus. The apparatus shall consist of a winding fixture which shall support a brass rod by the ends and a crank or other device to rotate the rod from either end so that strips of tape may be rotated to the proper angle to achieve a one-half lap in winding the tape. The brass rods shall be 1/8 inch in diameter and 12 inches long and shall be free from any burned material. Enough weights shall be required to provide 150 grams for each 0.001 inch nominal over-all thickness of tape and a means for attaching these weights to the end of the tape in order to provide a winding tension. A Bunsen burner having a 3/8 inch id gas flow cylinder shall be required.

4.6.9.2 Procedure. The tape shall be cut into six strips of the required length. For 1 inch wide tape, the required length shall be 15 inches. A brass rod shall be placed in a horizontal position in the winding fixture. One end of a strip of tape shall be secured near one end of the rod. The weight required by the nominal thickness shall be attached to the lower end of the tape. The tape shall be allowed to remain under tension for 1 minute; the fixture shall be slowly tilted; and the rod shall be rotated so that the tape may wrap on the rod with a one-half lap for a length of $10 \pm 3/8$ inches. The weight shall be removed; the rod reversed in the fixture, and the procedure repeated so that a second strip of tape is wrapped over the first strip in the opposite direction. The test specimen shall be supported in a level horizontal position in a draft-free area and the Bunsen burner adjusted to produce a flame with a 5 inch outer cone and a 1-1/2 inch inner cone. The Bunsen burner flame shall be applied vertically to the specimen so that the tip of the inner cone touches the center of the specimen. At the instant that the flame is applied to the specimen, a stopwatch shall be started; the flame shall be allowed to remain in contact with the specimen for 30 seconds. After 30 seconds, the gas shall be immediately turned off. When the specimen ceases to burn, the stopwatch shall be stopped. Thirty seconds shall be subtracted from the total time. The time in excess of 30 seconds shall be the self-extinguishing time of the test specimen. Three specimens shall be tested.

4.6.10 Accelerated aging factor. Each of ten 7 inch lengths of tape specimens shall be applied, adhesive side down, to an individual glass plate, and the ends shall be wrapped around the plate to secure them firmly. The glass plates shall be approximately 1/8 inch thick by 2 inches wide by 4 inches long. A 10-inch length of tape shall be applied directly on top of each strip of tape adhering to the glass plates. Each specimen shall be rolled back and

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forth once with the tape application device. An adhesion to backing measurement shall be obtained on the top layer of tape on five of the specimens as follows: The free end of the tape shall immediately be doubled back at 180 degrees and 1 inch of the applied tape peeled off the panel surface at the free end. The end of the glass panel from which the tape has been pulled back shall be clamped in the lower jaw of a tensile testing machine and the free end of the tape shall be clamped in the upper jaw. The tensile machine shall be operated at a speed of 12 inches per minute. The pawls on the pendulum arm shall be taped back in an open position. The tensile tester shall be of such capacity that the test values will be read when the pendulum hangs between 9 and 45 degrees from the vertical. The tension to remove the first and final inch of the tape from the panel during the test shall not be considered in determining the average tension required to remove the remainder of the tape. The other five panels shall be placed in a desiccator containing a glycerine-water solution having a specific gravity of 1.079 at 24°C to effect an atmosphere of 90 ± 2 percent relative humidity. The desiccator shall be sealed and conditioned at a temperature of 65°C for 7 days. After the conditioning period, the specimens shall be removed from the desiccator, allowed to cool at room temperature for 4 hours, and the top layer of tape tested for adhesion to backing as indicated above. The accelerated aging factor shall be calculated as follows:

Accelerated aging factor in percent =

$$\frac{\text{Average adhesion to backing (aged tape)}}{\text{Average adhesion to backing (new tape)}} \times 100$$

4.7 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 therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition.)

5.1 General.

5.1.1 Navy fire-retardant requirements.

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

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- Levels A and B - Type II - weather resistant.
Category 1 - general use.
- Level C - Type I - non-weather resistant.
Category 1 - general use.

5.1.1.2 Fiberboard. Fiberboard used in the construction of class-domestic, non-weather resistant fiberboard and cleated fiberboard boxes shall meet the flammability and smoke requirements of PPP-F-320

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

5.2.1 Level A.

5.2.1.1 Individual rolls. Each roll wound on cores as specified (see 3.4) shall be individually packed in a metal, fiber or other suitable container. Rolls narrower than 3/4 inch may be packed two rolls per container. Containers shall contain tape of one width and thickness only. Individual rolls of tape, unit packed as above, shall be further packed 12 rolls in a fiberboard box conforming to PPP-B-636 class weather-resistant. Boxes shall be closed in accordance with method V of the appendix to the box specification.

5.2.1.2 Multiple rolls. Multiple quantities of rolls, without individual containers, as specified (see 6.2), shall be furnished in full slip cover cans conforming to type VI of PPP-C-96 and sealed with pressure sensitive tape conforming to PPP-T-60, or in a fiberboard box conforming to PPP-B-636 class weather-resistant, with box closure in accordance with method V of the appendix to the box specification. Where containers coated with a suitable release agent are used, a coated separator shall be provided between rolls. Uncoated containers shall be equipped with coated separators between rolls and the container top and bottom to prevent sticking.

5.2.2 Level C. Individual and multiple rolls shall be unit protected as specified for level A except that fiberboard boxes shall be of the domestic type or class and box closure shall be in accordance with method I of the appendix to the box specification.

5.2.3 Commercial. Preservation shall be in accordance with ASTM D 3951.

5.3 Packing. Packing shall be level A, B, C, or commercial as specified (see 6.2).

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5.3.1 Levels A, B, and C. Insulation tape preserved as specified in 5.2 shall be packed in accordance with the exterior shipping containers tables of MIL-STD-2073-1, for the level of packing specified (see 6.2). Containers shall be furnished with blocking such as partitions or separators between individual cans to prevent movement and internal damage to the cans. Container selection shall be at the option of the contractor with gross weight not to exceed the limits imposed by the tables in MIL-STD-2073-1.

5.3.2 Commercial. Insulation tape preserved as specified in 5.2 shall be packed in accordance with ASTM D 3951.

5.3.3 Marking. In addition to any special marking required (see 6.2), level A, B and C interior packs and exterior shipping containers shall be marked in accordance with MIL-STD-2073-1. Commercial interior packs and exterior shipping containers shall be marked in accordance with ASTM D 3951. Interior packs and exterior shipping containers shall include applicable bar code marking.

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 pressure-sensitive tape covered by this specification is suitable for the insulation of electrical conductors and splices in electrical wiring within an application temperature range of minus 12 to 65°C and is intended for use where a self-extinguishing tape is required.

6.2 . Acquisition requirements. Acquisition documents must specify the following:

- (a) Title, number, and date of this specification.
- (b) Quantity desired.
- (c) Part number (see 1.2).
- (d) 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).
- (e) Width desired (see 3.3.1).
- (f) Length, if other than 36 yards minimum in roll (see 3.3.2).
- (g) Color, if other than specified (see 3.3.4).
- (h) Inside diameter of core, if other than specified (see 3.4).
- (i) For Navy, when lumber and plywood does not require fire retardant treatment (see 5.1.1.1).

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- (j) Levels of preservation and packing required (see 5.2 and 5.3).
- (k) When individual packaging containers are not required (see 5.2.1.2).
- (l) Special marking required (see 5.3.3).

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.

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
4.1	DI-R-4803	Inspection System Program Plan	
4.1.1	DI-E-2121	Certificate of compliance	
4.6.2, 4.6.3,	DI-T-2072	Report, test	---
4.6.4.3.1, and	DI-T-5329	Inspection and test	
4.6.5.1		reports	

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 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. 24391 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 5523, 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

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accordance with "Provisions Governing Qualification SD-6" (see 6.4.1).

6.4.1 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.

6.5 Limited storage stability. When ordering tapes under this specification, buyer should be aware of its limited storage cite. Contracting activity should avoid storage exceeding 2 years.

6.6 Acceptance and rejection levels.

6.6.1 Appearance and construction. The acceptance and rejection levels for the examination for appearance and construction (see 4.4.2.1) are as listed in table VIII.

TABLE VIII. Acceptance levels for examination for appearance and construction.

Lot size	Sample size	Accept	Reject ^{1/} ^{2/}
2 - 25	3	0	1
26 - 150	8	0	1
151 - 280	13	1	2
281 - 500	20	2	3
501 - 1200	32	3	4
1201 - 3200	50	5	6
3201 - 10000	80	10	11
10001 - 35000	125	10	11
35001 - over	200	21	22

^{1/} Inspect sample size until reject criteria is reached.

^{2/} Rejected lots may be screened and resubmitted for inspection and retest.

6.6.2 Dimensional examination and examination of workmanship and appearance. Acceptance and rejection levels for dimensional examination and examination of workmanship and appearance (see 4.4.2.2) are as listed in table IX.

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TABLE IX. Acceptance levels for dimensional examination and examination of workmanship and appearance.

Lot size	Sample size	Accept	Reject ^{1/} ^{2/}
2 - 15	3	0	1
16 - 50	5	0	1
51 - 150	7	0	1
151 - 500	8	0	1
501 - 3200	18	0	1
3201 - 10000	22	0	1
10001 - over	29	0	1

^{1/} Inspect sample size until reject criteria is reached.

^{2/} Rejected lots may be screened and resubmitted for inspection and retest.

6.6.3 Quality conformance testing. Acceptance and rejection levels for quality conformance testing (see 4.4.3) are as listed in table X.

TABLE X. Acceptance levels for quality conformance testing.

Lot size	Sample size	Accept	Reject ^{1/} ^{2/}
2 - 50	5	0	1
51 - 150	13	0	1
151 - 280	32	1	2
281 - 500	50	2	3
501 - 1200	80	3	4
1201 - 3200	125	5	6
32001 - 10000	200	10	11
10001 - 35000	315	14	15
35001 - over	500	21	22

^{1/} Inspect sample size until reject criteria is reached.

^{2/} Rejected lots may be screened and resubmitted for inspection and retest.

6.7 Subject term (key word) listing.

Adhesive
Adhesives, self-extinguishing
Conductors
Splices
Wiring

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6.8 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 - 11

Preparing activity:

Navy - SH
(Project 5970-1053)

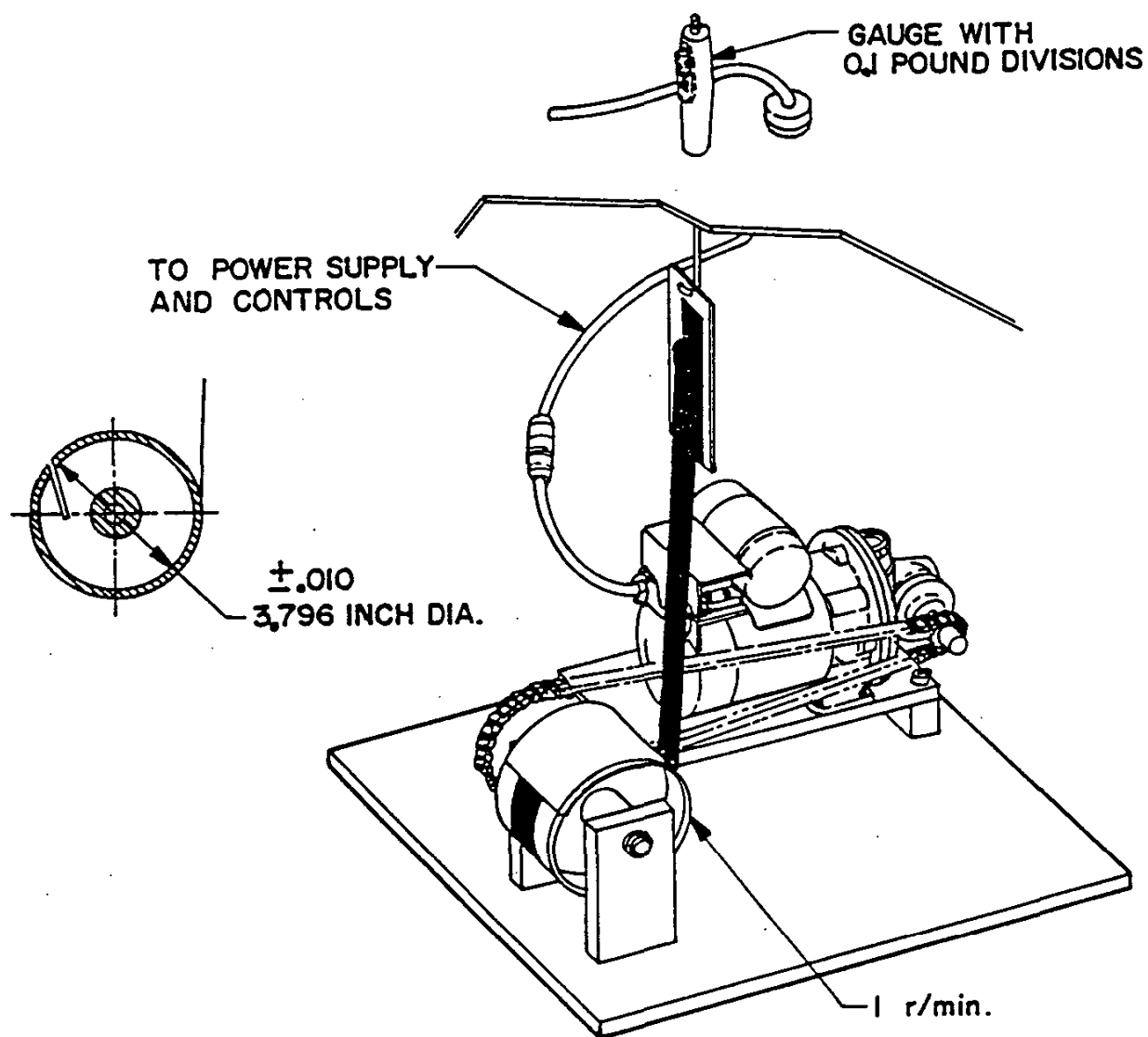
Review activities:

Army - EA, MI
Navy - EC, OS
DLA - GS
NASA - DS

User activities:

Army - ME
Navy - MC, YD, CG

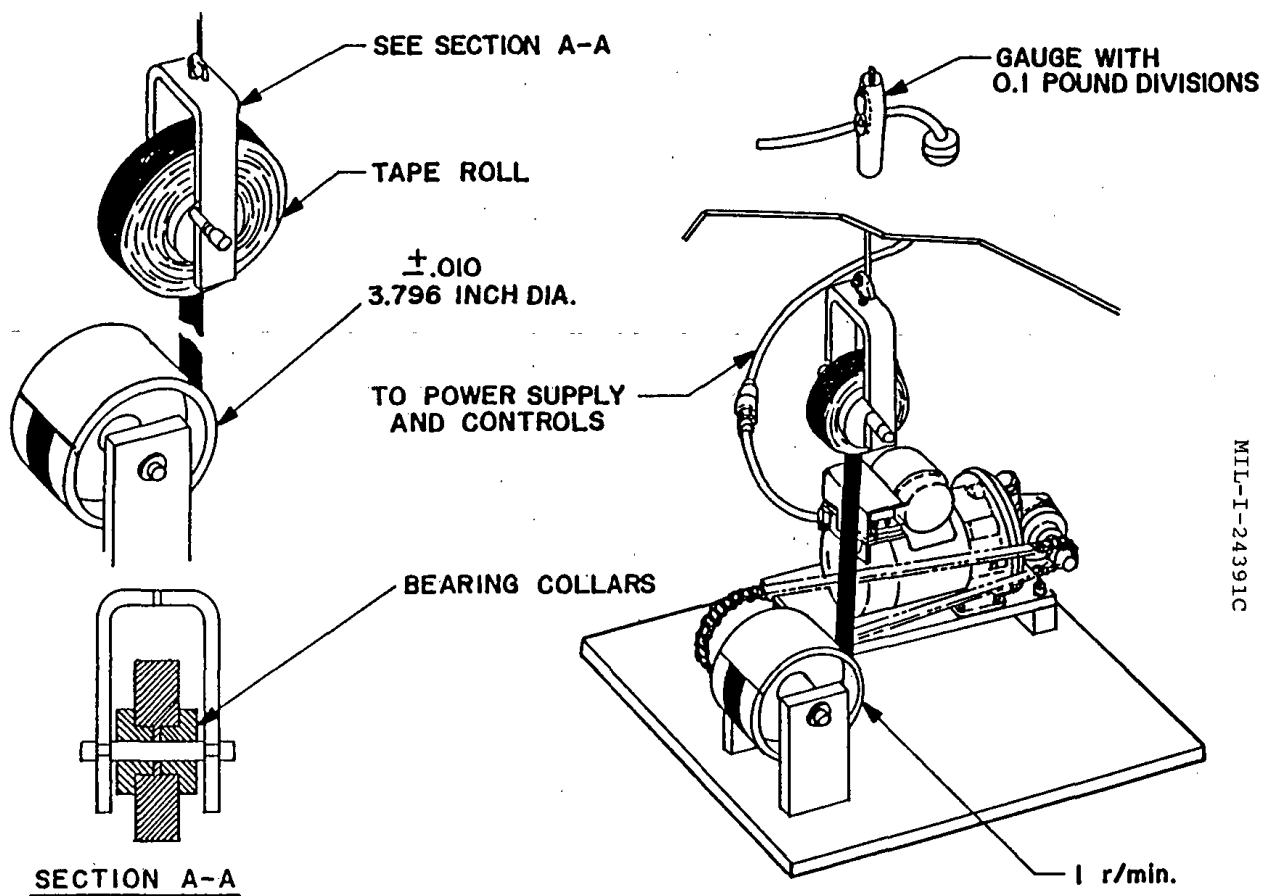
MIL-I-24391C



SH 13202731

FIGURE 1. Adhesion test assembly.

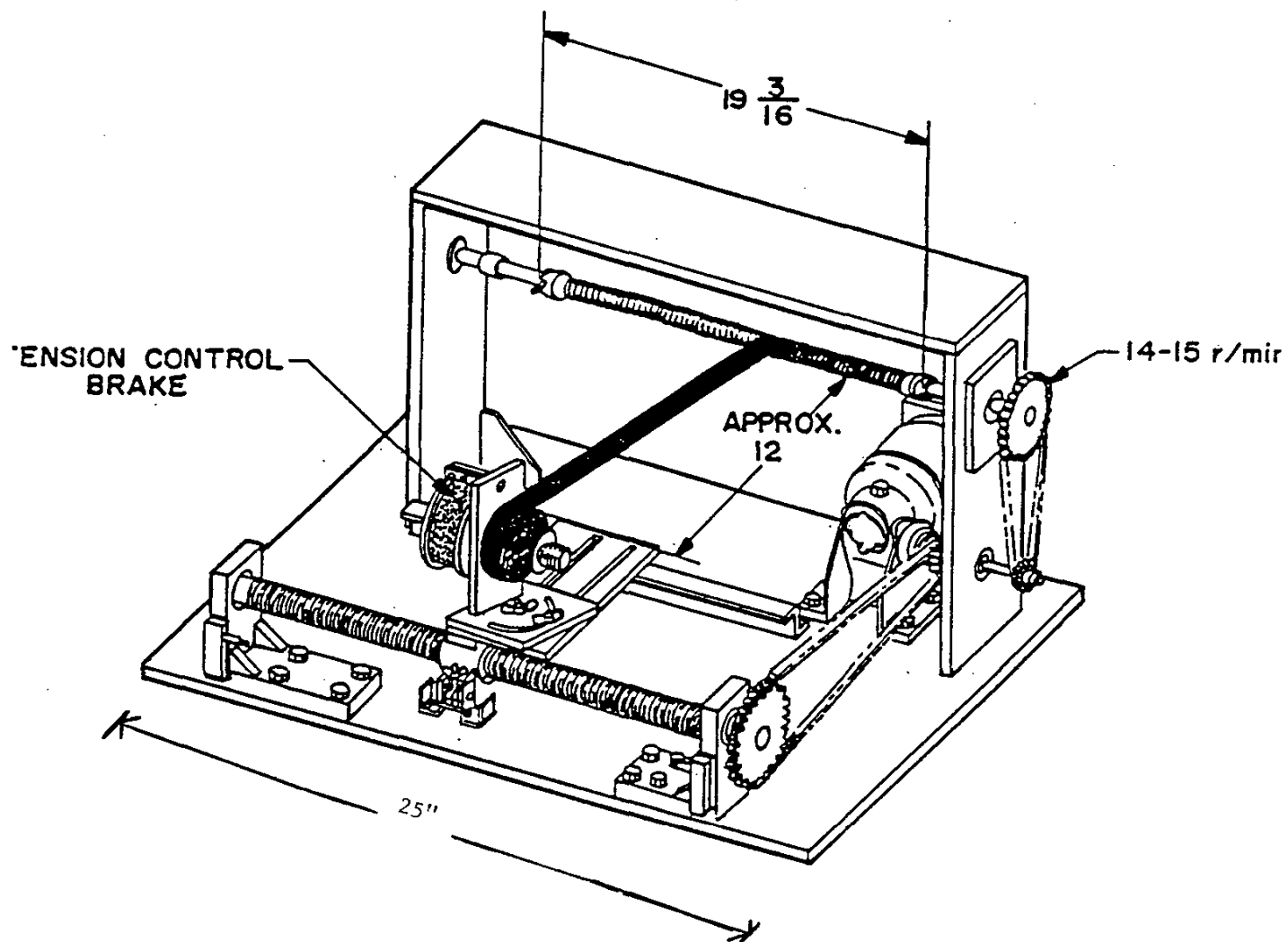
28



SH 13202732

FIGURE 2. Unrolling test assembly.

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SH 13202733

FIGURE 3. Flexibility test assembly.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER MIL-I-24391C		2. DOCUMENT TITLE INSULATION TAPE, ELECTRICAL, PLASTIC, PRESSURE SENSITIVE	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> OTHER (Specify): _____	
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		b. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		8. DATE OF SUBMISSION (YYMMDD)	

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)