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MILITARY SPECIFICATION

BARRIER MATERIAL, WATERPROOFED, FLEXIBLE,

ALL TEMPERATURES, HEAT SEALABLE

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

1. SCOPE

1.1 Scope. This specification covers heat sealable, flexible waterproofed barrier materials for protection of Military supplies during handling, storage and transit in all climatic conditions (see 6.1).

1.2 Classification. The barrier materials covered by this specification shall be of the following types, styles and grades, as specified (see 6.2).

Types

B-2 - Interior wrapping and material for interior packaging bags

Style 1 - Stretchable

Style 2 - Non-stretchable

Grade A - Heavy duty

Grade B - Medium duty

Grade C - Light duty

B-3 - Material for interior packaging bags, stretchable

CW-2 - Case liners and wrappers, non-stretchable

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Natick Research and Development Command, Natick, MA 01760 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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2. APPLICABLE DOCUMENTS

2.1 Issues of documents. 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:

SPECIFICATIONS

FEDERAL

- P-C-451 - Cloth, Coated, Abrasive, Aluminum Oxide and Silicon Carbide.
- QQ-S-698 - Steel, Sheet and Strip, Low Carbon.
- TT-T-291 - Thinner-Paint, Volatile Spirits, Petroleum-Spirits.
- PPP-B-636 - Boxes, Shipping, Fiberboard.
- PPP-D-723 - Drums, Fiber.
- PPP-T-45 - Tape, Gummed, Paper, Reinforced and Plain, For Sealing and Securing.
- PPP-T-60 - Tape, Packaging, Waterproof.
- PPP-T-76 - Tape, Pressure Sensitive, Adhesive.

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- MIL-P-130 - Paper, Wrapping, Laminated and Creped.
- MIL-D-3716 - Desiccants, Activated for Dynamic Dehumidification.
- MIL-S-4461 - Sealing Machines, Heat; Hot Jaw and Continuous.

STANDARDS

FEDERAL

- FED-STD-101 - Preservation, Packaging, and Packing Materials: Test Procedures.
- FED-STD-191 - Textile Test Methods.

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- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-147 - Palletized and Containerized Unit Loads 40" x 48" Pallets, Skids, Runners, or Pallet-Type Base.

(Copies of specifications, standards, drawings, and publications required by contractors 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 otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply:

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI) PUBLICATIONS:

- | | |
|-------|--|
| T 402 | - Standard Conditioning and Testing Atmospheres For Paper, Board, Pulp, Handsheets and Related Products. |
| T 403 | - Bursting Strength of Paper. |
| T 404 | - Tensile Breaking Strength of Paper and Paperboard (Using Pendulum-Type Tester). |
| T 414 | - Internal Tearing Resistance of Paper. |
| T 456 | - Wet Tensile Breaking Strength of Paper and Paperboard. |
| T 457 | - Stretch of Paper and Paperboard. |
| T 487 | - Fungus Resistance of Paper and Paperboard. |

(Application for copies should be addressed to Technical Association of the Pulp and Paper Industry (TAPPI), 1 Dunwoody Park, Atlanta, GA 30341.)

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.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

- * 3.1 Qualification. The barrier material furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.3).

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3.2 Material. Waterproofed barrier material shall be made to ensure compliance with all the requirements of this specification. Type B-3 material shall be made from creped kraft paper containing 0.25 to 0.50 percent copper-8-quinolinolate, in soluble form, based on the bone dry weight of paper and coated on one side with a sufficient thickness of polyethylene to comply with the requirements of this specification. The test for copper content shall be as specified in 4.3.

3.3 Form. The barrier material shall be furnished in roll form. Unless otherwise specified (see 6.2), the rolls shall be 100 yards \pm 2 yards (91.4 m \pm 1.8 m) in length and 36 \pm 1/8 inches (914 \pm 3.2 mm) in width. Rolls shall be uniformly and evenly wound on non-returnable fiber cores having a minimum inside diameter of 3 inches (76 mm) with a plus 1/16 inch (1.6 mm) tolerance. Rolls shall be restrained to prevent unwinding. The length of the core shall be not less than the specified width of the roll nor greater by more than 1/2 inch (12.7 mm). No roll shall contain more than 2 splices (3 pieces) and no piece shall be less than 20 yards (18.3 m) in length. Splices shall be indicated on both sides of the roll and shall be evenly and neatly made over the entire width of the roll and shall not separate during unwinding.

3.4 Resistance to heat and humidity. The barrier material shall show no dimensional change in excess of 2 percent in either principal direction, no coating loss, delamination, ply separation, or cracking when tested as specified in 4.3.

3.5 Low temperature flexibility. The barrier material shall show no delamination, ply separation, cracking, or rupture in either principal direction when tested as specified in 4.3.

3.6 Waterproofness.

3.6.1 Water penetration. The barrier material, as received after aging and after low temperature flexing, shall show no evidence of water penetration for 72 hours when tested as specified in 4.4.3.

3.7 Water vapor transmission rate (type B-3, only). Type B-3 barrier material shall have a water vapor transmission rate no greater than 0.70 gram per 100 square inches (10.85 grams/m²) per 24 hours when tested as specified in 4.4.3.

3.8 Seam strength. Barrier material sealed before and after aging in accordance with commercial practice on commercially available heat sealing equipment shall provide a seam which shall withstand a static load of 2-1/2 pounds (1.1 kg) for 5 minutes at 23° \pm 2°C and a load of 10 ounces (0.3 kg) for 1 hour at 70° \pm 1.1°C with no seam separation, delamination, or loss of heat seal coating when tested as specified in 4.4.3.

3.9 Stretch type B-2, style - 1 and type B-3). The barrier material as received shall have the percent minimum average stretch specified in table I, when tested as specified in 4.4.3.

TABLE I. Minimum stretch

Type	Percent stretch <u>1/</u>
B-2, style - 1	10
B-3	13

1/ Unless otherwise specified, this requirement is applicable to one direction only (see 6.2).

3.10 Strength properties. The barrier material shall have the minimum strength properties specified in table II, when tested as specified in 4.4.3.

TABLE II. Minimum strength properties

Type	Bursting strength points		Tensile breaking strength, pounds/ inch width, (N/m) each direction		Tearing resistance grams, each direction
	Wet	Dry	Wet	Dry	Dry
B-2 <u>1/</u>					
Style 2					
Grade A	10	45	8 (1400)	30 (5253)	150
Grade B	8	30	5 (875)	20 (3502)	100
Grade C	6	25	3 (525)	10 (1751)	75
B-3	--	30	--	20 (3502)	100
CW-2	15	45	10 (1751)	30 (5253)	200

1/ B-2, style 1 material shall possess at least 85 percent of the values given for B-2, style 2.

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3.11 Puncture resistance (type B-3 only). When formed into bags, type B-3 barrier material shall be capable of being legibly imprinted by Addressograph Model 1900 machine, or equivalent equipment, without puncturing when tested as specified in 4.4.3.

3.12 Resistance to blocking. The barrier material shall show no delamination, loss of coating, or rupture when tested as specified in 4.4.3.

3.13 Contact corrosion (types B-2 and B-3 only). Steel test panels shall not corrode when subjected to contact with the barrier material as specified in 4.3.

3.14 Water resistance of sealed bags (types B-2 and B-3 only). The barrier material and sealed seams shall resist the penetration of water for a minimum of 72 hours when tested as specified in 4.4.3.

3.15 Pliability. The pliability of the barrier material shall not be greater than the applicable value in table III when tested as specified in 4.3.

TABLE III. Pliability

Type	Pliability maximum, pounds (kg)
B-2	
Grade A	14 (6.4)
Grade B	12 (5.4)
Grade C	10 (4.5)
B-3	7 (3.2)
CW-2	15 (6.8)

* 3.16 Storage (shelf-life). After storing as specified in 4.5.14, the barrier material shall be tested to determine compliance with all the qualification requirements, except resistance to heat and humidity, and shall retain 85 percent of the strength properties specified in table II.

3.17 Fungus proofing (type B-3 only).

3.17.1 Resistance to fungus growth. Type B-3 material shall show no growth of any organism when tested as specified in 4.3.

3.17.2 Corrosiveness of fungus proofing material. Metal disks which were in contact with fungus resistant type B-3 material shall not be corroded to

any greater extent than disks of like metals in contact with control material, when tested as specified in 4.3.

3.18 Identification markings.

3.18.1 Types B-2, and CW-2 only. Types B-2, and CW-2 waterproof barrier material shall be marked with black stripes composed of letters indicating the type of material. The letters shall be clear and distinct. Stripes shall be at least 1/8 inch (3.2 mm) wide and shall be located at $12 + 1/2$ inch ($50.8 + 13$ mm) intervals. Stripes shall be parallel to each other and to the machine direction of the material and shall be so placed that they do not interfere with markings specified in 3.18.3.

3.18.2 Type B-3 only. Type B-3 barrier material shall be marked with blue stripes. The markings shall be applied to the kraft paper beneath the polyethylene face of the barrier. The stripes shall be at least 1/8 inch (3.2 mm) wide and shall be spaced at $3 + 1/2$ inch ($76 + 13$ mm) intervals. Stripes shall be parallel to each other and to the machine direction of the material.

3.18.3 Legend. The barrier material shall be distinctly marked in black as follows:

Specification designation (revision letter not required).

Type, style and grade (as applicable).

Manufacturer's name.

Manufacturer's designation (trade name).

Month and year of manufacture.

The recommended heat seal procedure for use on:

- a. Jaw type heat sealer (temperature, pressure and dwell).
- b. Band type heat sealer (heat, speed and pressure).
- c. Rotary type heat sealer (preheat, speed and pressure).

The letters and figures of the markings shall be a minimum of 1/8 inch (3.2 mm) high, clear, permanent, legible and waterproof. If coated, the marking shall appear on the backing surface of the material. The complete markings shall appear on the center of the rolled material not more than 3 (914 mm) or less than 2 feet (609 mm) apart. Type B-3 material shall have this information printed on the kraft paper beneath the polyethylene coating.

3.19 Workmanship. The barrier material shall be uniformly constructed, and free of holes, tears, cuts, sharp wrinkles, or creases.

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4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, 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 assure supplies and services conform to prescribed requirements.

4.1.1 Certificate of compliance. When certificates of compliance are required, the Government reserves the right to check test the items for compliance (see 3.1 and 3.2).

* 4.2 Classification of inspection. The inspection and testing of barrier material shall be classified as follows:

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

* 4.3 Qualification tests. Qualification testing shall consist of an evaluation of all requirements of section 3 in accordance with the procedures specified in section 4. The contractor, upon authorization from the qualifying agency, shall be responsible for the performance of all qualification tests either in his laboratory or an outside laboratory approved by the qualifying agency. Requests for this authorization shall be addressed to the Commander, US Army Natick Research and Development Command, ATTN: DRXNM-VTE, Natick, MA 01760. The qualification test sample shall consist of one roll of barrier material, 100 yards (91.5 M) long and 36 inches (914 mm) wide for each type, class, and grade for which qualification is desired. Half of the material submitted for qualification shall be conditioned as specified herein and subjected to all tests listed in table IV. The remaining half of the material shall be stored for one year as specified in 4.5.17, conditioned and then subjected to all tests in table IV to determine the effect of shelf life except the determination of resistance to heat and humidity shall not be conducted. The number of specimens to be tested for each evaluation is listed in table IV. Any failures shall be cause for rejection of the lot.

4.3.1 Conditioning. All specimens shall be conditioned in accordance with TAPPI Method T 402 immediately prior to tests.

TABLE IV. Qualification tests

Characteristic	Requirement paragraph	Test paragraph	Number of determinations
Resistance to heat and humidity			
Cross direction	3.4	4.5.1	5
Machine direction	3.4	4.5.1	5
Low temperature flexibility			
Cross direction	3.5	4.5.2	10
Machine direction	3.5	4.5.2	10
Waterproofness			
Initial	3.6.1	4.5.3.2	20
After aging	3.6.1	4.5.3.3	20
After low temperature flexibility	3.6.1	4.5.3.4	20
Watervapor transmission rate	3.7	4.5.4	3
Seam strength			
Initial	3.8	4.5.5.2	2/load
Sealed before aging	3.8	4.5.5.3	2/load
Sealed after aging	3.8	4.5.5.4	2/load
Stretch			
Cross direction	3.9	4.5.6	10
Machine direction	3.9	4.5.6	10
Bursting strength			
Dry	3.10	4.5.7.1	10
Wet	3.10	4.5.7.2	10
Tensile breaking strength			
Dry			
Cross direction	3.10	4.5.8.1	10
Machine direction	3.10	4.5.8.1	10
Wet			
Cross direction	3.10	4.5.8.2	10
Machine direction	3.10	4.5.8.2	10
Tearing strength			
Cross direction	3.10	4.5.9	10
Machine direction	3.10	4.5.9	10
Puncture resistance (printing)	3.11	4.5.16	10
Blocking	3.12	4.5.10	10

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TABLE IV. Qualification tests (cont'd)

Characteristic	Requirement paragraph	Test paragraph	Number of determinations
Contact corrosion	3.13	4.5.11	3
Water resistance	3.14	4.5.12	5
Pliability	3.15	4.5.13	10
Storage (shelf life)	3.16	4.5.14	See 4.3
Type B-3 only			
Copper-8-quinolinolate	3.2	1/	--
Copper content	3.2	2050 2/	2
Fungus growth resistance	3.17.1	4.5.15.1	8
Corrosiveness of material	3.17.2	4.5.15.2	8 (two per metal)

1/ The contractor shall certify that only copper-8-quinolinolate in soluble form was used.

2/ Indicates test methods of FED-STD-191.

4.4 Quality conformance inspection. Except as specified herein, sampling for inspection shall be made in accordance with MIL-STD-105.

4.4.1 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 document.

4.4.2 End item inspection. The inspection lot shall consist of all the same items offered for inspection at one time. The sample unit shall be expressed in yards for examination in 4.4.2.1, in rolls for examination under 4.4.2.2 and 4.4.2.3 and in palletized unit loads for examination in 4.4.3.1.

4.4.2.1 Visual examination. The sample unit for this examination shall be 1 yard (0.9 m) of material the full width of the roll. No more than five sample units shall be taken from any roll. Defects of each type shall be scored only once within a sample unit. No sample unit shall be taken from the first or last convolution of the roll. Both sides of the material shall be examined. The inspection level shall be I and the acceptable quality level shall be 4.0.

TABLE V. Classification of visual defects

Examine	Defect	Classification	
		Major	Minor
Workmanship	Presence of any foreign matter, dirt, grit, sand or oil spots.	X	
	Blister, crack, cut, puncture, hole (including pinholes), tear, sharp creases or wrinkles, chafed spot or scuff mark.	X	
	Delamination or embrittlement.	X	
Construction	Not uniform; layer or section missing.	X	
	Not stretchable, when stretchable material is specified.	X	
	Stretchable, when nonstretchable material is specified.	X	
Color markings (stripes, as applicable)	Does not appear between the polyethylene face and kraft paper backing for B-3 material.	X	
	Not on backing surface for all other types of material.	X	
	Not a clear distinct blue color for B-3 material, or not a clear distinct black color for all other types of material; not continuous lengthwise, not parallel to each other and to machine direction of material.		X
Assembly of roll	Not suitably restrained to prevent unwinding.		X
	Material not wound uniformly and smoothly on roll, causing soft or uneven edges, or telescoping of roll.		X
	Edges not clean cut; ragged, nicked, or crushed edges.		X
	Not wound on a fiber core; core broken, crushed, collapsed, or mutilated.		X

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TABLE V. Classification of visual defects (cont'd)

Examine	Defect	Classification	
		Major	Minor
Unwinding of roll (examine both sides)	When unwound, material sticks together to the extent that unrolling causes tearing or injury to any surface.	X	
	Material not wound evenly causing wrinkles, sharp creases or folds within roll.		X
	Roll not continuous.		X
	More than 2 splices (3 pieces) in roll; any piece less than 20 yards (18.3 m) in length.		X
	Splices not evenly and neatly made; does not cover entire width of material; comes apart during unwinding.		X
	Splice not indicated on both sides of the roll.		X
Identification markings	Does not appear on kraft paper surface beneath the polyethylene facing for B-3 material or not on backing surface for all other material.	X	
	Not continuous.		X
	Illegible; incorrect; incomplete; omitted, or does not conform to legend in 3.18.3 not a clear distinct black color.	X	
	Not along center of roll.		X

4.4.2.2 Dimensional examination. The sample unit for this examination shall be one roll. The sample shall be examined for the defects listed in table VI. The inspection level shall be S-2 and the acceptable quality level (AQL) shall be 2.5.

TABLE VI. Dimensional examination defects

Examine	Defect	Classification	
		Major	Minor
Width	Varies by more than plus or minus 1/8 inch (3 mm) from width specified.		X
Core	Length less than specified width of roll material or greater by more than plus 1/2 inch (13 mm).	X	
Color markings (stripes, as applicable)	Less than 1/8 inch (3 mm) in width. Distance between lengthwise group of stripes greater than 3 inches (76 mm) for B-3 material, or greater than 12-1/2 inches (318 mm) or less than 11-1/2 inches (292 mm) for all other types of material.	X	X
Length of roll	Not as specified.	X	
Identification markings	Lettering less than 1/8 inch (3 mm) in height. Distance between group of markings less than 2 feet (610 mm) or more than 3 feet (914 mm).		X

* 4.4.2.3 End item testing. Testing of the end item shall be performed for the applicable characteristics in table IX for each lot of the sample type, style, and grade of material presented for examination. When TAPPI Test Methods are specified, the sample size, number of determinations, and reporting of results shall be as specified herein. The material shall be conditioned as specified in 4.3.1. The sample unit shall be one piece of material the full width of the roll and of sufficient length to make a 12 square foot (1.1 sq meter) sample. No more than one sample unit shall be drawn from any one roll. The sample size shall be drawn in accordance with inspection level S-1 of MIL-STD-105. For the sample to be satisfactory, all sample unit results must meet requirements applicable to the sample unit, and average results must meet requirements applicable to the average. If a test sample fails to pass any of the tests required by this specification, the lot represented by the test sample shall be rejected.

4.4.2.3.1 Modified heat and humidity test. For the purpose of end item testing, the resistance to heat and humidity test (see 4.5.1), shall be modified by deleting the 116 hour humidity cabinet phase (when tests are required on aged material) and by deletion of all tests on low temperature

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flexed material. Material subjected to this modified exposure shall be conditioned for a minimum of 24 hours at a temperature of $23^{\circ} + 2^{\circ}\text{C}$ and a relative humidity of $50 + 2$ percent prior to tests specified. The material thus exposed and conditioned as specified herein shall be considered aged material for purposes of quality conformance testing.

- * 4.4.3 Inspection of packaging. An inspection shall be made to determine whether the preservation-packaging, packing and marking complies with the section 5 requirements. Defects shall be in accordance with table VII. The sample unit shall be one shipping container fully prepared for delivery with the exception that it need not be closed. Defects of closure listed below shall be examined on shipping containers fully prepared for delivery. The lot size shall be the number of shipping containers in the end item inspection lot. The inspection level shall be S-1 and the AQL shall be 2.5 defects per hundred units.

TABLE VII. Inspection of packing and marking

Examine	Defect
Marking (exterior and interior)	Omitted; incorrect; incomplete; illegible; of improper size, location, sequence or method of application.
Materials	Any nonconforming component; component missing, damaged, or not as specified.
Workmanship	Inadequate application of components, such as: Drum, fiberboard container, or wrap material not as specified; incomplete closure of container flaps, loose strapping, improper taping, inadequate stapling or reinforcing. Bulged or distorted container.

4.4.3.1 Examination for palletization. An examination shall be made to determine that the palletization complies with the section 5 requirements. Defects shall be in accordance with table VIII. The sample unit shall be one palletized unit load fully prepared for delivery. The lot shall be the number of palletized unit loads in the end item inspection lot. The inspection level shall be S-1 and the acceptable quality level (AQL) shall be 6.5 defects per hundred units.

TABLE VIII. Examination of palletization

<u>Examine</u>	<u>Defect</u>
Finished dimension	Length, width or height exceeds specified maximum requirement.
Palletization	Not as specified. Pallet pattern not as specified. Wood cap not used over and under the load. Load not bonded with required straps as specified.
Weight	Exceeds maximum load limits.
Marking	Omitted; incorrect; incomplete; illegible; of improper size, location, sequence or method of application.

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INSTRUCTIONS FOR TESTING				TABLE IX				AQL	
CHARACTERISTIC	Specification Reference		Requirements Applicable To		Number Determinations Per Sample Unit	Results Reported As			Inspect Level
	Requirement	Test Method	Individual Unit	Lot Aver		Pass or Fail	Numerically to Nearest		
Waterproofness As received After modified aging	3.6.1	4.5.3	X		10	2/	3/		
			X			X			
Watervapor transmission rate (Type B-3 only)	3.7	4.5.4		X	4		0.01 gm/ 100 sq in/ (0.06m ²) 24 hours		
Seam strength As received 10 ounces(0.28 kg)/1 hour/70°C. 2-1/2 pounds(1.13 kg)/5 minutes/23°C.	3.8	4.5.5 4.5.5.2	X	X	2	X			
			X	X		X			
Sealed then modified aging 1/ 10 ounces(0.28 kg)/1 hour/70°C. 2-1/2 pounds(1.13 kg)/5 minutes/23°C.		4.5.5.3	X	X	2	X			
			X	X		X			
Sealed after modified aging 1/ 10 ounces(0.28 kg)/1 hour/70°C. 2-1/2 pounds(1.13 kg)/5 minutes/23°C.		4.5.5.4	X	X	2	X			
			X	X		X			
Stretch (B-2, and B-3 only) Machine direction Cross direction	Table I	4.5.6	X	X	5		percent		
			X	X		X			
Strength properties Dry bursting strength Wet bursting strength	Table II	4.5.7.1	X		0		point		
			X			X			
	Table II	4.5.7.2	X		10		point		
								(one on each side)	
								(one on each side)	

TABLE IX (cont'd)

INSTRUCTIONS FOR TESTING

CHARACTERISTIC	Specification Reference		Requirements Applicable To		Number Determinations WORK	Results Reported As		Inspect Level	AQL
	Requirement	Test Method	Individual Unit	Lot Average		Pass or Fail	Numerically to Nearest		
Dry tensile Machine direction	Table II 4.5.8.1		X		10	2/	3/		
			X						
Cross direction	Table II 4.5.8.2		X		10				0.1 pound/ inch (17.5 N/mm)
			X						0.1 pound/ inch (17.5 N/mm)
Wet tensile Machine direction	Table II 4.5.8.2		X		10				0.1 pound/ inch (17.5 N/mm)
			X						0.1 pound/ inch (17.5 N/mm)
Cross direction	Table II 4.5.9		X	X	10				0.1 pound/ inch (17.5 N/mm)
			X	X					gram gram
Blocking resistance	3.12	4.5.10			10				
Face to face			X		2				
			X						
Water resistance of sealed bags	3.14	4.5.12		X	5				
				X					
Puncture resistance (printing)	3.11	4.5.16		X	2				
<p>1/ The term "after modified aging" under this heading refers to the material after it has undergone the modified resistance to heat and humidity test (see 4.5.1).</p>									
<p>2/ Where results are reported as pass or fail, all determinations must pass for the material to be considered satisfactory. If failure is indicated, report description of failure.</p>									
<p>3/ Test reports shall include all values on which results are based.</p>									

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4.5 Test methods.

4.5.1 Resistance to heat and humidity. Cut ten 12 by 36-inch $\pm 1/32$ inch (305 by 914 ± 0.8 mm) specimens from each principal direction. Hang the specimen by fastening one 12 inch (305 mm) edge of each specimen in suitable clamp(s) so that this entire edge is held straight and horizontal. Condition for not less than 24 hours at $23^{\circ} \pm 2^{\circ}\text{C}$ and 50 ± 2 percent relative humidity. Measure the specimens laterally and longitudinally to an accuracy of $1/32$ inch (0.79 mm). Condition the specimens for 116 hours in an oven maintained at a temperature of $70^{\circ} \pm 1.1^{\circ}\text{C}$. At the end of the conditioning period, remove specimens from the drying oven and place them in a humidity cabinet maintained at a temperature of $70^{\circ} \pm 1.1^{\circ}\text{C}$ and 60 ± 5 percent relative humidity for 116 hours. Remove from the humidity cabinet and condition for 24 hours at $23^{\circ} \pm 2^{\circ}\text{C}$ and 50 ± 2 percent relative humidity. The specimens shall be arranged and spaced in the drying oven and humidity cabinet so as to permit the free circulation of air around the entire surface of the specimens at all times. The air circulation shall maintain homogeneous conditions in the air around the samples, but shall not cause them to whip or flutter against each other or against the sides of the cabinets. Remove each specimen and calculate the percentage change in each dimension. Observe the specimens for any coating loss, delamination, rupture, cracking, or separation of plies. Evidence of failure shall be cause for rejection and further tests shall not be performed. Satisfactory specimens shall be retained for the tests specified in 4.5.3.3 and 4.5.5.4. For purposes of this test, delamination shall be defined as either ply separation at any given point extending in more than $1/2$ inch (12.7 mm) from the edge with an edge length separation greater than 1 inch (25.4 mm) or a ply separation which produces a discernible swelling or bubbling of one material away from the other in portions of the specimen other than at the edges. NOTE: 4.5.5.3 requires specimens to be sealed before aging.

4.5.2 Low temperature flexibility. Cut twenty 4 by 12 $\pm 1/32$ inch (100 by 305 ± 1.6 mm) specimens (half from each principal direction) and condition for not less than 3 hours at $-32 \pm 1.1^{\circ}\text{C}$. The specimens shall be arranged in the cabinet to allow circulation of air against all surfaces of the specimens. The circulation of air shall maintain homogeneous conditions in the air around the samples, but shall not cause them to whip or flutter against each other or against the sides of the cabinets. After conditioning, attach each specimen to suitable clamps and draw lengthwise at $5 \pm 1/2$ pounds (2.3 ± 0.23 kg) tension over a $1/4$ inch (6.3 mm) diameter stainless steel mandrel fixed on a suitable apparatus (see figure 1) at the conditioning temperature so that the specimen is subjected to a nominal 180° bend. Then let the weight draw the specimen back to its original position. Each back and forth passage of the specimen is one draw and shall take 2 to 3 seconds. The mandrel shall be placed in the low temperature cabinet for at least $1/2$ hour prior to the flexing operation. Each specimen shall be drawn lengthwise

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over the mandrel three times and then turned over so that the opposite face is toward the mandrel and the drawing process repeated. Evidence of delamination, separation of plys, cracking, or rupture shall be cause for rejection. Cut each specimen into 4 by 4-inch (102 by 102 mm) pieces, discard the two end pieces and retain the center section for the test specified in 4.5.3.4.

4.5.3 Waterproofness (see figure 2).

4.5.3.1 Preparation of reagent. Add 1 gram of dioctyl sodium sulfosuccinate to 500 ml of distilled water. Allow the reagent to stand for 24 hours, then stir to ensure complete solution.

4.5.3.2 As received material. Cut twenty 4 by 4 \pm 1/32 inch (102 by 102 \pm 0.79 mm) specimens and condition for not less than 16 hours at 23° \pm 2°C and 50 \pm percent relative humidity. Crease each specimen by placing the diagonally opposite corners together. Place the specimens in this condition on a flat, smooth glass surface and gently place a flat-bottomed 5-pound (2.3 kg) weight, 4 inches (102 mm) in diameter, on the fold so that it is centered. Allow the weight to act for 30 seconds; remove the weight; open the specimen; and refold by placing the diagonally opposite corners so that the fold formed is at right angles to the first one and the reverse side of the specimen is folded in. Apply weight as described above. After creasing, dip each specimen in a melted wax mixture of 60 parts of amorphous wax and 40 parts of paraffin wax to form an approximate 1/2 inch (12.7 mm) border of wax along each of the four edges. Place each of the prepared specimens with the heat sealable laminate up (if applicable) on a flat sheet of aluminum foil approximately 0.0015 inch (0.04 mm) thick and large enough to hold the specimens. Place a dry cellulose sponge on the center of each specimen. The approximate dimensions of the sponge shall be 2-1/4 inches by 2 inches by 1/4 inch (57 by 51 by 6.3 mm) thick. Add a 10 ml portion of the dioctyl sodium sulfosuccinate solution to each sponge. Cover each sponge with a weighted glass or metal cover weighing approximately 200 grams and fitted with an electrode of such length that the electrode touches the sponge and having the following approximate dimensions: outside diameter 3-3/16 inches (81 mm), inside diameter 3-1/16 inches (77.8 mm), height 1-5/16 inches (33.3 mm). At the end of 24 and 48 hours, remove the cover, add an additional 5 ml of the dioctyl sodium sulfosuccinate solution to each sponge and replace the cover. At the end of 72 hours, test each specimen for water penetration by clamping one of the lead wires from a D.C. microammeter (range 0 to 50 microamperes) with a variable resistor connected to a 67-1/2 volt battery to the aluminum foil and touching each protruding electrode in turn with the other lead wire. The resistance shall be adjusted so that when the two leads touch 90 to 100 percent full scale deflection of the microammeter is obtained. Any deflection of the microammeter needle shall indicate failure (water penetration). The test shall be conducted at a temperature of 23° \pm 2°C and 50 \pm 2 percent relative humidity.

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4.5.3.3 Aged material. The twenty specimens, aged as specified in 4.5.1, shall be conditioned and tested as specified in 4.5.3.2.

4.5.3.4 After low temperature flexing. The twenty specimens (half from each principal direction) which were drawn over a mandrel as specified in 4.5.2, shall be conditioned and tested as specified in 4.5.3.2 except that the specimens shall not be creased.

4.5.4 Watervapor transmission rate (type B-3 only).

4.5.4.1 Apparatus. Test apparatus shall consist of the following:

(a) A dish constructed of a corrosion-resistant impermeable material having a test area of not less than 50 square centimeters. The dish shall be of such size and shape that it can be readily accommodated on the pan of an analytical balance. The test dish shall be designed so that a wax seal can be made which will be impervious to the leakage of watervapor and which will define clearly the test area. The wax seal shall be such that the test area is the same on both sides of the specimen.

(b) A template for use in defining the test area and effecting the wax seal, consisting of a circular metal disk 1/8 to 1/4 inch (3.2 to 6.3 mm) thick with the edge bevelled to an angle of about 45°. The diameter of the bottom (smaller) face of the template is approximately equal to, but not greater than the diameter of the dish which contacts the specimen.

(c) A testing room or cabinet wherein the circulating air shall be maintained at $38^{\circ} \pm 1.1^{\circ}\text{C}$ and 90 to 95 percent relative humidity. The room or cabinet shall have suitable grills or racks to support the assembled specimen dishes, with means for continuously circulating the conditioned air over the entire exposed area of the test specimens. The design of the room or cabinet shall be such as to avoid condensation in the vicinity of the test specimens. If it is necessary to remove the test specimen assemblies from the room cabinet for weighing, tight covers must be provided for the test dishes.

(d) Desiccant - Anhydrous calcium chloride in the form of small lumps which will pass a No. 8 sieve and free of fines that will pass a No. 30 sieve. The desiccant shall be dried at 200°C before use.

4.5.4.2 Specimen preparation. Cut three specimens not less than 3-1/2 inches (89 mm) square from the sample to be tested. Equidistant parallel folds approximately 5/8 inch (15.9 mm) apart shall be placed in each square by alternating the direction of each successive fold so that the apex of each successive fold faces an opposite side of the specimen - accordion style. Each folded square shall be creased by placing it between 6 by 10 inch (152 by 254 mm) flat rigid plates and applying a total weight of 6 pounds (677 N/m) per inch of fold length (including weight of plate) for 1 minute.

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The center of gravity of the weight shall be over the center of the sample. Each square shall then be opened and folding and creasing under weight process repeated, making the second series of folds perpendicular to the original folds. A circular specimen having an area of not less than 50 square centimeters and a diameter established by the dimension of test dish, shall be cut from the center of each of the creased squares.

4.5.4.3 Test procedure. Place approximately 3 to 4 grams of desiccant per square inch (m^2) of test area in the dish so that the bottom of the dish is evenly covered. Place the test specimen with the vapor barrier face toward the desiccant over the aperture of the dish and centered on the supporting ring or flange. Apply a thin film of petrolatum to the bevelled edge of the template. Wipe off any petrolatum which may have been deposited on the template's bottom face. Carefully center the template over the specimen and dish opening. Flow molten wax consisting of a mixture of 60 percent amorphous and 40 percent refined crystalline paraffin wax into the annular space surrounding the bevelled edge of the template until the wax is approximately level with the template's top face. A medicine dropper is a satisfactory dispenser for the molten wax. The template shall be removed as soon as the wax has cooled and solidified. Care shall be taken not to cool the dish too long as to make the wax hard and brittle. Remove the template by inserting a screwdriver under its edge and by giving a slight twist, tending to press the wax against the dish and at the same time raising the template. Examine the wax seal. If the wax has separated from the edge of the dish or there are air holes present in the seal, discard the specimen and prepare another. The assembly shall be weighed on an analytical balance to the nearest 0.001 gram. Care should be taken during weighing and subsequent handling such that the disturbance to the desiccant is minimized. Then the dish shall be placed on the rack inside the testing room or cabinet in an inverted position so that the layer of desiccant is in direct contact and evenly distributed over the inner face of the test sheet and so that free access of the conditioned circulating air is provided on the exposed surface of the sheet. The cabinet shall be maintained at $38^\circ \pm 1.1^\circ C$ and 90 to 95 percent relative humidity. For material with two plies, the dishes shall be kept in the cabinet for 24 hours and for material with three or more plies, for 48 hours. Any surface coating 0.001 inch (0.03 mm) or more in thickness shall be considered to be a ply. The dishes shall be removed from the humidity cabinet at the end of this time, cooled for 15 minutes in a room maintained at $23^\circ \pm 2^\circ C$ and 50 ± 2 percent relative humidity and reweighed. The dishes shall then be replaced in the humidity cabinet for a period of 72 hours, removed, cooled as before, and reweighed. Exposure in the humidity cabinet, cooling and weighing shall be repeated using exposure periods of 24 hours thereafter until two consecutive weighings indicate that a practically constant rate of watervapor transmission has been attained. The unit of watervapor transmission shall be grams of moisture per 100 square inches ($0.06 m^2$) of exposed area per 24 hours calculated as follows:

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$$\text{Transmission rate} = \frac{(W_2 - W_1) \times 2400}{T \times A}$$

Where:

W₁ = Weight (in grams) at the beginning of the exposure period.

W₂ = Weight (in grams) at the end of the exposure period.

T = Exposure period in hours (hours between the beginning of the exposure period).

A = Area exposed in square inches (mm²).

The results shall be averaged and recorded as the final result. If the results indicate inconsistent values between individual results (see 6.4), a duplicate set of tests shall be conducted to determine whether the variance is due to error in the procedure or to lack of uniformity in the sample submitted. If error in procedure is indicated, the results for the first set of specimens shall be disregarded and the results for the second set of specimens shall be averaged and recorded.

4.5.5 Seam strength.

4.5.5.1 Sealing equipment and instructions. All seals for test purposes shall be a minimum of 1 inch (25.4 mm) wide and shall be effected on a jaw type heat sealer conforming to MIL-S-4461, types I, II or III having one heated jaw and one resilient unheated jaw, utilizing the sealing conditions recommended by the manufacturer. The upper sealing condition limits on this type sealer, which are considered reasonable for production line sealing operations with respect to commonly available sealing equipment and commercially practical fabrication time are a temperature setting of 525°F (274°C), a 3 second dwell time and a pressure of 60 pounds per square inch (24.8 MPa).

4.5.5.2 As received material. Cut two 5 by 6-inch (127 by 152 mm) specimens from the samples to be tested. Fold the specimens heat seal face to heat seal face to provide specimens 2-1/2 by 6 inches (64 by 152 mm). Seal the edge opposite the fold according to recommended procedures and cut off the folded edge. From each test specimen cut six 1 inch (25.4 mm) wide pieces perpendicular to the seam and discard the two outer ones. Condition the specimens for 1 hour at 23° ± 2°C and 50 ± percent relative humidity. Unfold the specimens and clamp one end of each so that the outer end of the specimen hangs freely. Gently, so as not to impact, load the seal by attaching a 10-ounce (0.3 kg) weight to the free end of one half of the specimens and

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place them with weights attached into an oven maintained at $70^{\circ} \pm 1.1^{\circ}\text{C}$ for one hour. Gently attach a 2-1/2 pound (1.1 kg) weight to the remaining specimens and suspend them at $23^{\circ} \pm 2^{\circ}\text{C}$ for 5 minutes. At the end of the stipulated time, remove all specimens from the oven, detach the weights and examine for seam separation, delamination or loss of heat seal coating. Partial seam separation during the first 2 minutes of the 2-1/2 pound (1.1 kg), 5 minute test shall not be cause for rejection, provided no further separation occurs during the balance of the 5 minute test period and provided complete seam separation does not occur at any time.

4.5.5.3 Sealed before aging. Prepare and seal specimens as in 4.5.5.2. The sealed specimens shall be aged as specified in 4.5.1 and then conditioned and tested as specified in 4.5.5.2.

4.5.5.4 Sealed after aging. From material aged as specified in 4.5.1, prepare, condition, and test specimens as specified in 4.5.5.2.

4.5.6 Stretch (type B-2, style 1, and B-3 only). Type B-2, style 1 material shall be tested only when stretchable material has been specified. Using 1 inch (25.4 mm) wide specimens, the stretch shall be determined in accordance with TAPPI Method T 457, except that a pendulum type instrument shall be used and the stressing jaws shall be operated at a speed of 12 inches (0.3 m) per minute.

4.5.7 Bursting strength.

4.5.7.1 Dry bursting strength. Dry bursting strength shall be determined in accordance with TAPPI Method T 403.

4.5.7.2 Wet bursting strength. Ten specimens of material as received shall be immersed in distilled water at 21° to 26°C for 24 hours. At the end of the 24-hour period, the specimens shall be taken from the water, the excess water removed as specified in TAPPI Method T 456, and the wet bursting strength determined in accordance with 4.5.7.1.

4.5.8 Tensile breaking strength.

4.5.8.1 Dry tensile breaking strength. The dry tensile breaking strength shall be determined in accordance with TAPPI Method T 404 using 1 inch (25.4 mm) wide specimens, except that a pendulum type instrument shall be used and the stressing jaw shall be operated at a speed of 12 inches (0.3 m) per minute.

4.5.8.2 Wet tensile breaking strength. Wet tensile breaking strength shall be determined in accordance with TAPPI Method T 456, except that a pendulum type instrument shall be used and the stressing jaws shall be operated at a speed of 12 inches per minute (0.005 m/s). Specimens shall be immersed in distilled water at 21° to 26°C for 24 hours prior to testing.

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4.5.9 Tearing resistance. The tearing resistance shall be determined in accordance with TAPPI Method T 414, except that ten specimens from each direction shall be tested; half of the specimens from each direction with one face toward the knife and the other half with the opposite face toward the knife.

4.5.10 Resistance to blocking. Cut twenty specimens, each 4 inches (102 mm) square, from the samples to be tested. Prepare 5 assemblies from the specimens by placing one specimen face to face with another. Make 5 assemblies from the remaining specimens by placing one specimen face to back with another specimen. Lay these assemblies on a smooth flat glass surface and place a 2 by 2 by 1/4 inch (51 by 51 by 6 mm) felt pad in the center of each assembly. Then apply a static load of 3 pounds per square inch (1.4 kg/m²) evenly distributed on the entire area of each felt pad and place the complete assemblies in the air circulating oven maintained at 70° ± 1.1°C for 2 hours. At the end of this time, remove the assemblies from the oven, remove the weight, cool to 23° ± 2°C at 50 ± 2 percent relative humidity for 15 minutes and rapidly pull the two sheets of each assembly apart by hand. Examine the material for delamination or rupture. For the purpose of this test, the "face" side of class 1 material shall be considered to be the heat sealable side.

4.5.11 Contact corrosion.

4.5.11.1 Apparatus and material.

a. Test panels - 2 by 4 inch (51 by 102 mm) steel panels conforming to condition E of QQ-S-698. Panel edges shall be rounded slightly to eliminate sharpness.

b. Mounting bars - 3 by 1 by 1 inch (76 by 25.4 by 25.4 mm) bars made from series 300 stainless steel. The edges of the bars shall be slightly rounded.

c. Tape, pressure sensitive adhesive conforming to PPP-T-60, 1/2 ± 1/32 inch (12.7 ± 0.79 mm) wide.

d. Circulating air temperature cabinets or ovens with temperature ranges of 65° ± 2°C and 50° ± 2°C.

e. Desiccator with perforated plate.

f. Desiccator: Scheibler or Fruehling and Schultz type or equal, 250 mm size, with perforated plate with handle.

g. Miscellaneous.

- (1) Cloth, abrasive, aluminum oxide, 240 grit, conforming to P-C-451.
- (2) Mineral spirits, grade 1, of TT-T-291.
- (3) Methanol (95 percent).
- (4) Methanol (absolute).
- (5) Surgical gauze.
- (6) Glycerin-water solution, specific gravity 1.170 to 1.175 at 23°C, solution to contain 0.1 percent copper sulfate as fungicide.
- (7) Desiccant, conforming to MIL-D-3716.
- (8) Surface roughness standard block (12 micro inch surface finish), or a standard profilometer.

4.5.11.2 Preparation of test panels. The test panels shall be polished to eliminate pitting and other surface irregularities. Finish polishing shall be done by hand using abrasive cloth in the lengthwise direction of the panels so that a surface finish duplicating the roughness standard block is obtained in each panel. Panels shall then be wiped clean, using surgical gauze and the surface finish carefully checked. Panels shall be scrubbed while immersed in warm (approximately 65°C) mineral spirits using a surgical gauze swab; then immersed successively in clean hot mineral spirits, boiling methanol, (95 percent) and boiling methanol (absolute). Panels shall be dried using a clean piece of surgical gauze and immediately placed within a desiccator on a clean perforated plate above activated desiccant. Care shall be taken that the steel panel surfaces do not become contaminated at any time by finger contact. Panels shall be used for testing within 24 hours after being cleaned and sealed within the desiccator. If stored for a longer period, the surface treatment shall be repeated, beginning with the hand polishing operation.

4.5.11.3 Assembly. Each 3 by 2 inch (76 by 51 mm) test specimen shall be placed waterproof side down on a clean, dry, flat surface. A smooth, flat, clean and dry mounting bar shall be placed upon each specimen so that the longitudinal center line of the bar coincides with that of the specimen. Each side of the specimen extending from under the mounting bar shall be folded against the sides of the bar and secured with tape. The test panels shall be removed, one at a time from the desiccator, a mounted specimen shall be placed crosswise upon each panel and the position of the specimen shall be marked with a lead pencil.

4.5.11.4 Exposure. The assemblies shall be preheated on the 250 mm desiccator plate for 1/2 hour within a circulating air cabinet or oven maintained at $65 \pm 2^\circ\text{C}$. The plate and contents shall then be transferred

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to the desiccator containing an approximate 1/2 cm depth of the glycerin water solution. The desiccator shall then be sealed and placed within the air circulating cabinet or oven maintained at $50^{\circ} + 2^{\circ}\text{C}$ for 20 hours. When that time period has elapsed, the assemblies shall be removed from the oven, the desiccator opened and the test panels examined for corrosion.

4.5.11.5 Interpretation of pass or fail.

a. Any traces of corrosion in the test area of any specimen shall constitute failure to pass the requirements and shall be cause for rejection of the barrier material.

b. Any trace of corrosion in the control areas shall invalidate the test; (may be caused by contamination of the test panels or specimens or by excessive condensation in transfer from the temperature cabinets). The test shall be repeated using a new set of assemblies.

4.5.12 Water resistance of sealed bag (type B-2, and B-3 only).

4.5.12.1 Preparation of reagent. Prepare a dye solution in the following proportions: 98 ml of distilled water, 1 gram of Aerosol OT, and 1 gram of Erythrosin B. Allow the mixture to stand with occasional shaking for 4 hours.

4.5.12.2 Test procedure. Cut ten specimens, each 6 by 8 inches, (152 by 203 mm) from the barrier material as received. Form bags by placing specimens heat seal face to heat seal face and sealing in accordance with recommended procedure, along one 6-inch (152 mm) edge and both 8-inch (203 mm) edges. The seals shall be uniform, continuous and without pipes or channels, and shall have a minimum width of 1/2 inch (12.7 mm). The bags shall be comfortably filled (but not to the extent of placing a strain on the material or seams) with shredded white Whatman No. 2 filter paper and sealed. The sealed bags shall be immersed for 72 hours under a 1-inch (25.4 mm) head of water maintained at a temperature of $23^{\circ} + 2^{\circ}\text{C}$ to which has been added the reagent specified in 4.5.12.1 in the proportions of 1 part (by volume) of reagent to 4 parts (by volume) of water. At the end of 72 hours, remove the bags from the water, allow them to drain, cut open one edge, and examine the shredded paper for staining. Staining of the shredded paper shall constitute a failure.

* 4.5.13 Pliability. Pliability shall be determined in accordance with the procedure specified in Method 2071 of FED-STD-101.

4.5.14 Storage (shelf life). Upon receipt of the material for one half of the material received shall be packaged with the degree of protection required in section 5 of this specification. It shall then be stored for 1 year from date of receipt of material, under conditions equivalent to ambient warehouse storage. At the end of this period, the package protection and the outer 5 yards (4.6 m) of the material shall be removed, discarded, and the remainder conditioned for one week at $23^{\circ} + 2^{\circ}\text{C}$ and 50 ± 2 percent relative humidity. The conditioned material shall then be tested to determine compliance with all the requirements.

4.5.15 Fungus proofing (type B-3 only).

4.5.15.1 Resistance to fungus growth. Resistance to fungus growth shall be determined in accordance with the Spore-Mycelial procedure of TAPPI Method T 487.

4.5.15.2 Corrosiveness of fungus proofing material.

4.5.15.2.1 Apparatus and materials. The following apparatus and materials are required for the testing of the corrosiveness of the fungus proofing materials:

a. Thirty-two disks, 1-1/2 inch (38.1 mm) in diameter, made from American Institute Steel No. 1018 and weighing 50 ± 5 grams. Eight steel disks not plated and the other disks electroplated on each side as follows: with an 0.008 to 0.0010 inch (.20 mm to .03 mm) thickness of copper, 8 with the above thickness of cadmium and 8 with same thickness of zinc. Instead of electroplated disks, bar stock of the above metals may be used.

b. A desiccator, the flooring of which is large enough to contain the control and test assemblies required so that the assemblies are not touching.

c. Sufficient potassium chromate to provide a saturated solution at least 1 inch in depth in the bottom of the desiccator.

d. The chamber or room maintained at $23^{\circ} + 2^{\circ}\text{C}$ for storing of the desiccators.

4.5.15.2.2 Test specimen preparation. Circles 1-1/2 inches (38 mm) in diameter shall be cut at random from the sample of barrier material presented for qualification and from type B-2 grade A material of the same class of the material being tested. Care shall be taken that the test surfaces of the circles are not touched by hand.

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4.5.15.2.3 Disk cleaning procedure.

4.5.15.2.3.1 Zinc cadmium and steel disks. Place each disk in a beaker of boiling naphtha and allow the disk to remain until it attains the temperature of the bath. Remove the disk and allow it to flash dry. Dip the disk in boiling anhydrous methanol. Allow the disk to flash dry and place it in a desiccator to cool.

4.5.15.2.3.2 Copper disks. Dip each disk into the following acid mixture: One part concentrated nitric acid, one part concentrated hydrochloric acid, fifty parts distilled water. Allow each disk to remain until reaction has ceased or until stains are no longer visible. Rinse immediately and thoroughly in running distilled water. Place each disk in boiling distilled water until the disk attains the temperature of the bath. Remove the disk and place it on kraft paper which conforms to MIL-P-130 in an oven maintained at 99°C until the disk is dry. Place the disk in a desiccator to cool.

4.5.15.2.4 Test procedures. Prepare a desiccator by placing a saturated solution of potassium chromate in the bottom of the desiccator to a depth of at least 1 inch (25.4 mm). Place the clean steel, copper, cadmium and zinc disks on the desiccator flooring in such a way that the disks do not touch. Throughout the test, the surfaces of the disks shall not be touched by hand. Place a circle of barrier material on each disk with the paper side up. Place on this a second disk of the same metal as the lower disk. The disks and the circle of barrier material shall be concentric. Grease the desiccator lid and place it tightly on the desiccator. Place the entire assembly in a chamber or room maintained at $23^{\circ} \pm 2^{\circ}\text{C}$ for 60 days. Control assemblies with each metal shall be included. No desiccator assembly shall be opened during the 60 day test exposure. After 60 days, open the desiccator and examine the test and control assemblies. If corrosion on the test assembly disks is more severe than on the control assembly disks of the same metal, the barrier material being tested shall be considered corrosive.

4.5.16 Puncture resistance. The barrier material (type B-3 only) shall be formed into ten bags and legibly imprinted using an Addressograph Model 1900 Machine, or equivalent equipment. The printed bags shall be examined for evidence of puncture of the material and if present shall be cause for rejection.

5. PACKAGING

5.1 Preservation-packaging. Not applicable.

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

5.2.1 Level A. Each roll of barrier material shall be packed in a snug-fitting fiber drum conforming to type III, grade D of PPP-D-723; or fiberboard shipping container conforming to style RSC, grade V2s of PPP-B-636.

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Each fiber drum shall be closed with pressure-sensitive tape conforming to type IV of PPP-T-60 or PPP-T-76 in accordance with the applicable requirements of PPP-D-723. Each fiberboard shipping container shall be closed in accordance with method III, waterproofed in accordance with method V and reinforced as specified in the appendix of PPP-B-636.

5.2.2 Level B. Each roll of barrier material shall be packed in a snug-fitting fiber drum conforming to type I, grade D of PPP-D-723; or snug-fitting fiberboard shipping container conforming to style RSC, type CF (variety SW) or SF, class domestic, grade 200 of PPP-B-636; or wrapped overall with 80-pound minimum basis weight (24 by 36-500) heavy duty kraft wrapping paper. Each fiber drum shall be closed in accordance with the applicable requirements of PPP-D-723. Each fiberboard shipping container shall be closed in accordance with method II as specified in the appendix of the container specification. Each paper wrapped roll shall be closed at the ends by means of inside and outside headers made of the same material as the wrapper. Seams and headers shall be securely sealed with an adhesive commercially used for this purpose or by 2-inch minimum width gummed paper tape conforming to type III, grade C of PPP-T-45. Wrapped rolls may have the cores plugged.

5.2.2.1 Weather-resistant fiberboard containers. When specified (see 6.2), the shipping container shall be a grade V3c, V3s, or V4s fiberboard box fabricated in accordance with PPP-B-636 and closed in accordance with method III as specified in the appendix of the box specification.

5.2.3 Level C. Barrier material shall be packed in a manner to insure carrier acceptance and safe delivery to 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.

5.3 Palletization. Where specified (see 6.2), barrier material of one description only, packed as specified in 5.2, shall be palletized in accordance with load type XIII of MIL-STD-147. Rolls of barrier material shall be stacked vertically in a single course with a wood cap over and under the load. A strap shall be positioned around the load outside of and at the vertical center of the rolls of the barrier material and shall be the first strap applied to the load. Each prepared load shall be bonded with primary and secondary straps in accordance with bonding means K and L.

5.4 Marking. In addition to any special marking required by the contract or order, fiber drums, shipping containers, wrapped rolls (as applicable) and palletized unit loads shall be marked in accordance with MIL-STD-129.

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5.4.1 Precautionary marking. The following precautionary marking shall appear on each fiber drum, shipping container and wrapped roll, (as applicable) in capital letters not less than 3/4-inch in height:

"STAND ON END
KEEP COOL AND DRY"

6. NOTES

6.1 Intended use. Barrier materials covered herein should not be used for subsistence items.

6.1.1 Type CW-2. Type CW-2 barrier material is intended for use in packaging, shipping, and storage of military supplies and equipment where the use of a waterproof barrier material is required.

6.1.2 Type B-2. Type B-2 material is intended for fabrication into interior packaging bags conforming to class B of MIL-B-117 and for use as an intimate wrap.

6.1.3 Type B-3. Type B-3 barrier material is used when fungus proofing is required. It is used with semi-automatic packaging machine and as such is required to be puncture resistant and have a greater degree of stretch than type B-2, style 1 stretchable material.

6.1.4 Only types B-2 and B-3 barrier materials should be used in direct contact with metals since these are the only types which have a contact corrosion requirement.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type, style, and grade required, as applicable and if type B-2, whether or not stretchable material is required (see 1.2).
- (c) Length and width of rolls if other than specified in 3.3.
- (d) When other stretch characteristics are required (see 3.9).
- (e) Selection of applicable level of packing (see 5.2).
- (f) When weather-resistant grade fiberboard shipping containers are required for level B packing (see 5.2.2.1).
- (g) When palletization is required (see 5.3).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested as approved for inclusion in the applicable

Qualified Products Lists whether or not such products have been actually so listed by that date. The attention of the contractor is called to this requirement, the manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is Commander, U.S. Army Natick Research and Development Command, Natick, MA 01760, ATTN: DRXMN-CCP, and information pertaining to qualification of products may be obtained from that activity.

6.4 Value. If an individual value is suspected of being inconsistent, the following test 1/ may be employed to determine if a duplicate set of tests will be conducted: Take the difference between the suspected value and the value nearest it in magnitude. Divide this difference by the range of values (difference between the greatest and least value). If this quotient exceeds 0.94, conduct a duplicate set of tests.

1/ This test is adapted from "Simplified Statistics for Small Number of Observations,": R.B. Dean and W.J. Kixon, Anal. Chem. Vol. 23, 1951, pp. 636-8.

6.5 Changes from previous issue. The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

6.6 Test organisms. Test organisms may be obtained from the Northern Utilization Research Branch, United States Department of Agriculture, Agricultural Research Service, Peoria, IL; from the American Type Culture Collection, 2029 M Street, N.W., Washington, DC, or for service use from the U.S. Army Natick Research and Development Command, Natick, MA 01760; and the Institute of Paper Chemistry, Appleton, WI.

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Custodians:

Army - GL
Navy - SA
Air Force - 69

Preparing activity:

Army - GL
Project No. 8135-0477

Review activities:

Army - EA, SM, MI
Navy - AS
Air Force - 99
DOD/NASA - DS, NS
DLA - GS

User activities:

Army - AT
Navy - MC, OS, SH

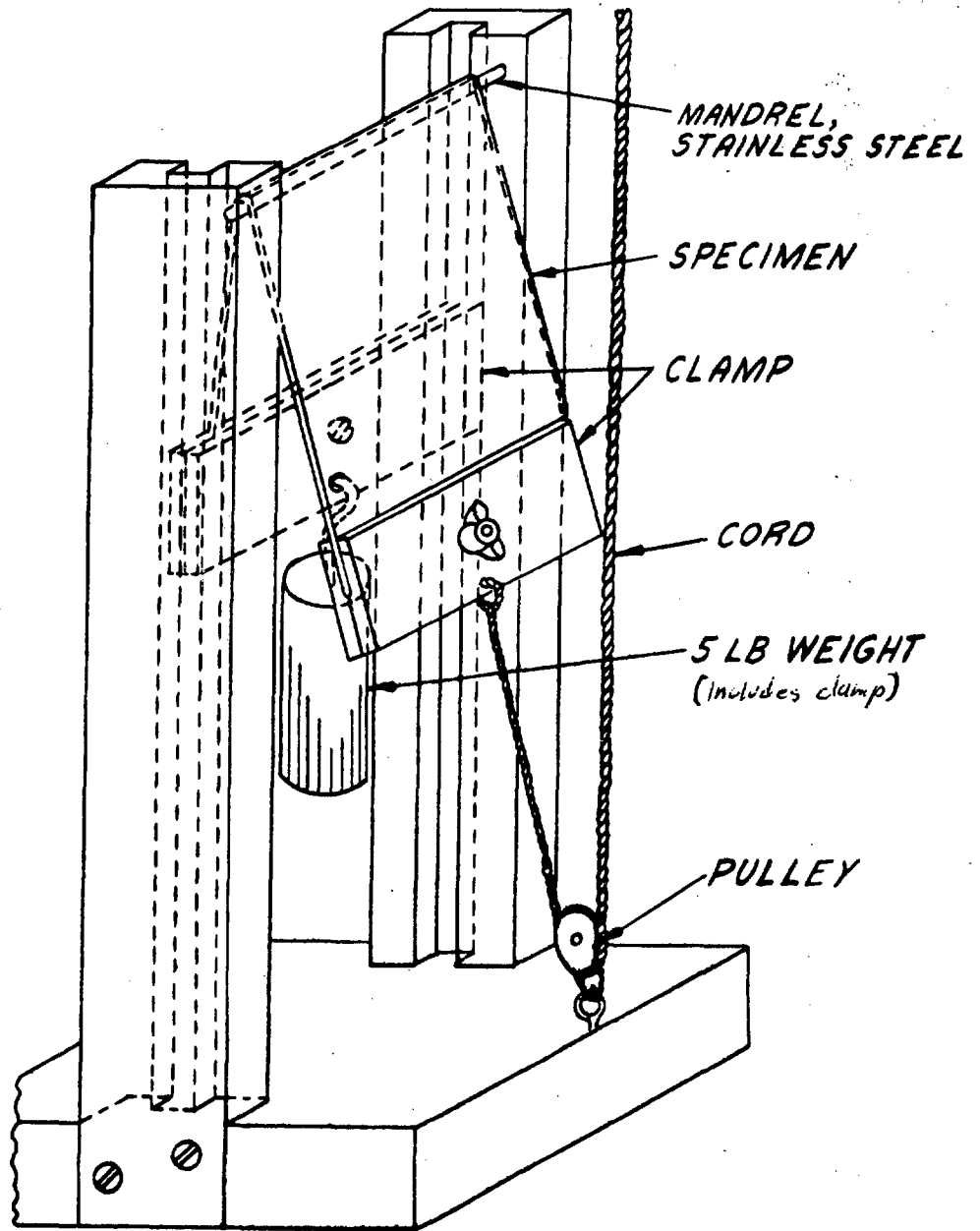


FIGURE 1 LOW TEMPERATURE FLEXING DEVICE

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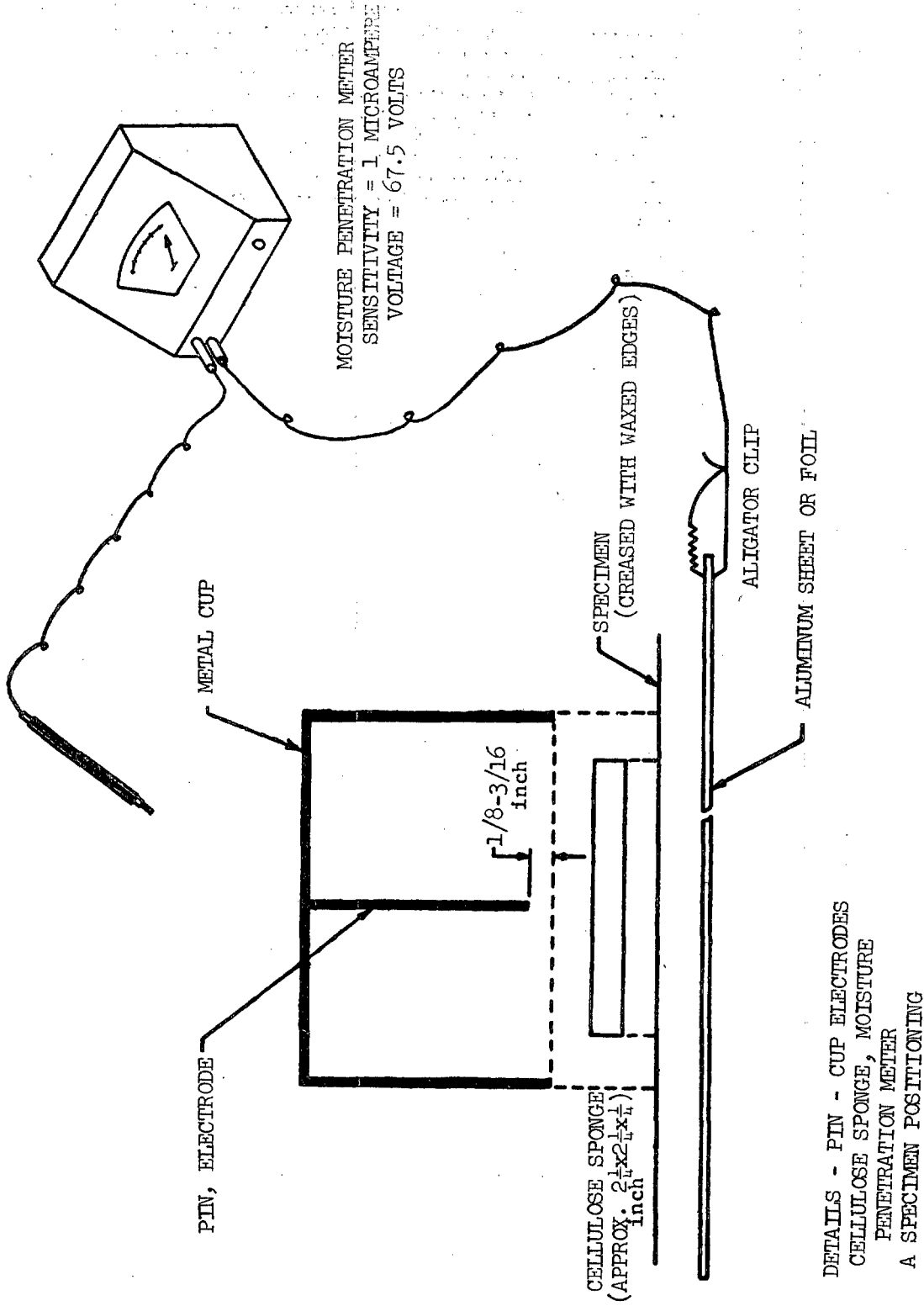


FIGURE 2. Pin-cup electrode waterproofness test assembly.

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DOCUMENT IDENTIFIER (Number) AND TITLE

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NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER neat Sealable

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