SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-L-P-390A

Issued SEP 2000
Cancelled APR 2003

Superseding AMS-L-P-390

Plastic, Molding and Extrusion Material
Polyethylene and Copolymers (Low, Medium, and High Density)

CANCELLATION NOTICE

This specification has been declared “CANCELLED” by the Aerospace Materials Division, SAE, as of April, 2003, and has been superseded by ASTM D 4976, Polyethylene Plastics Molding and Extrusion Materials. The requirements of the latest issue of ASTM D 4976 shall be fulfilled whenever reference is made to the cancelled AMS-L-P-390. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications, noting that it is superseded by ASTM D 4976.

Cancelled specifications are available from SAE. Copies of ASTM D 4976 are available from ASTM, 100 Barr Harbor, West Conshohocken, PA 19428-2959 or www.astm.org.

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This document has been taken directly from U.S. Military Specification L-P-390C, Notice 1, Amendment 2 and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace L-P-390C, Notice 1, Amendment 2. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this SAE technical document.

1. SCOPE AND CLASSIFICATION:

1.1 Scope:

This specification covers low, medium, and high density polyethylene and copolymers molding and extrusion material for general purpose use, for use as dielectric material, and for weather-resistant applications (see 6.1). For the purpose of this specification, the term polyethylene is used when referring to any of the types, classes, grades, and categories.

1.1.1 Coverage: This specification does not cover all the types, classes, grades, and categories of polyethylene, but only those that are most generally used by the Federal Government.

1.2 Classification:

1.2.1 Types, classes, grades, and categories (see table III): Polyethylene shall be of the types, classes, grades, and categories shown in tables I and II, as specified (see 6.2).

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 U.S. Government Publications:

Available from DODSSP Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

Fed. Std. No. 123	Marking for Shipment (Civil Agencies)
Fed. Test Method Std. No. 406	Plastics: Methods of Testing
Fed. Test Method Std. No. 601	Rubber: Sampling and Testing
MIL-P-116	Preservation, Methods of
MIL-STD-45662	Calibration System Requirements
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

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor, West Conshohocken, PA 19428-2959.

ASTM D 746	Method of Test for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 1238	Method of Measuring Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D 1505	Method of Test for Density of Plastics by the Density-Gradient Technique

2.2 (Continued):

ASTM D 1531	Method of Test for Dielectric Constant and Dissipation Factor of Polyethylene by Liquid Displacement Procedure
ASTM D 1603	Method of Test for Carbon Black in Ethylene Plastics
ASTM D 1693	Method of Test for Environmental Stress-Cracking of Type I Ethylene Plastics
ASTM D 1928	Method for Preparation of Compression - Molded Polyethylene Test Samples
ASTM E 60	Recommended Practice for Photometric Methods for Chemical Analysis of Metals

TABLE I. Types, classes, and grades

Type	Application	Class 1/	Grade	Color
I	General purpose (see 6.1.1)	L and M	1 2	Natural and colors, including black
		H	1 2 3 4 5	Natural and colors, including black
II	Dielectric (see 6.1.2)	L	1 2 3 4	Natural Colors, including black Natural Colors, including black
		M	1 2	Natural Colors, including black
		H	1 2 3 4 5	Natural and colors, including black
III	Weather resistant (see 6.1.3)	L	1 2 3 4	Black (carbon 0.5 ±0.1 percent by weight) Black (carbon 2.50 ±0.5 percent by weight)
		M	1 2 3	Black (carbon 0.5 ±0.1 percent by weight) Black (carbon 2.50 ±0.5 percent by weight)
		H	1 2	Black (carbon 2.50 ±0.5 percent by weight)

1/ L = low density; M = medium density; and H = high density.

TABLE II. Categories

Category	Melt-index 1/ (nominal flow rate) grams/10 minutes
1	25
2	10 to 25, inclusive
3	1.0 to 10, inclusive
4	0.4 to 1.0, inclusive
5	0.4 maximum

1/ See 3.2.1.

2.3 Rural Electrification Administration (REA) Publication:

Available from United States Department of Agriculture, Rural Electrification Administration, Washington, DC 20402.

PE-200 Polyethylene Raw Material

3. REQUIREMENTS:

3.1 Material:

The material shall be virgin polyethylene or a copolymer of at least 90 percent ethylene and other olefin monomers, containing a lubricant if necessary, and formulated to meet the requirements of this specification. The material shall be suitable for molding or extrusion.

3.1.1 Color: Colors, as applicable (see table I), shall be as specified (see 6.2). Standards for color shall be in accordance with the color notations of REA Publication PE-200.

3.1.2 Transparency: Polyethylene shall be either translucent or opaque, as specified (see 6.2).

3.1.3 Form: Polyethylene shall be in the form of powder, granules, or pallets, as specified (see 6.2).

3.1.4 Contamination: When examined as specified in 4.6.3.1, polyethylene shall be free from contamination (dirt, foreign matter, and burnt, streaked, or off-color pellet).

3.1.5 Carbon-black: In accordance with suitable commercial milling procedures as recommended by the supplier, type III polyethylene shall contain uniformly well dispersed channel or furnace carbon-black.

3.1.5.1 Particle size: When tested as specified in 4.6.3.2, the average particle size shall be 20 nanometers (nm) or less.

3.1.5.2 Concentration: When tested as specified in 4.6.3.3, the concentration shall be 0.5 ± 0.1 percent by weight for classes L and M, grade 1 and 2.50 ± 0.5 percent by weight or class L, grades 2, 3, and 4; class M, grades 2 and 3; and class H, grades 1 and 2 (see 6.1.3 and 6.3).

3.1.5.3 Absorption coefficient: When tested as specified in 4.6.3.4, the absorption coefficient shall be not less than 3200.

3.1.6 Antioxidant: Types II and III polyethylene shall contain an antioxidant for milling stability (see 3.2.2 and 6.4).

3.2 Property values:

Unless otherwise specified (see table III (brittleness)), the values obtained from each set of specimens for any property shall be averaged (see 4.6.2.3), and the results obtained shall meet the requirements specified in table III.

TABLE III. Property values

Property	Class	Value required															
		Type I					Type II					Type III					
		Grade					Grade					Grade					
		1	2	3	4	5	1	2	3	4	5	1	2	3	4		
Density, annealed, range, incl, D23C, g/ml 1/	L	0.910 to 0.925			---	---	0.910 to 0.925				---	0.910 to 0.925					
	M	0.926 to 0.940			---	---	0.926 to 0.940			---	---	0.926 to 0.940			---		
	H	0.941 to 0.985			---	---	0.941 to 0.985			---	---	0.941 to 0.985			---		
Tensile strength, minimum, lb/in2	L	1,200	1,400	---	---	---	1,400	1,400	1,400	1,400	---	1,400	1,400	1,400	1,400		
	M	1,600	1,800	---	---	---	1,800	1,800	---	---	---	1,800	1,800	1,800	---		
	H	2,800	2,800	3,500	3,500	4,000	2,800	2,800	3,500	3,500	4,000	2,800	3,500	---	---		
Ultimate elongation, minimum, percent	L	400	400	---	---	---	400	400	400	400	---	400	400	400	400		
	M	400	400	---	---	---	400	400	---	---	---	400	400	400	---		
	H	---	---	---	---	---	400	400	400	400	400	400	400	---	---		
Brittleness temperature °C, maximum	L	-50	-55	---	---	---	-60	-55	-60	-55	---	-50	-50	-50	-50		
	M	-50	-55	---	---	---	-60	-55	---	---	---	-50	-50	-50	---		
	H	-55	---	-55	---	---	-55	---	-55	---	---	-55	-55	---	---		
Dielectric constant, maximum, 1 MHz	L	---	---	---	---	---	2.35	2.35	2.35	2.35	---	2.50	2.75	2.75	2.75		
	M	---	---	---	---	---	2.35	2.35	---	---	---	2.50	2.75	2.80	---		
	H	---	---	---	---	---	2.38	2.38	2.38	2.38	2.38	2.75	2.75	---	---		
Dissipation factor, maximum, 1 MHz	L	---	---	---	---	---	0.0005	0.0005	0.0005	0.0005	---	0.003	0.007	0.007	0.01		
	M	---	---	---	---	---	0.0005	0.0005	---	---	---	0.003	0.007	0.01	---		
	H	---	---	---	---	---	0.0005	0.0005	0.0005	0.0005	0.0005	0.005	0.007	---	---		

1/ Uncolored, unfilled, specimens shall be used.

3.2.1 Melt-index: The melt-index (nominal flow rate) shall be within the ranges given for the specific category (see table II) for the type, class, and grade specified; and shall be as agreed to between the manufacturer and the purchaser (see 6.2). Melt-index values below 1.0 shall have ±30 percent tolerance and ±20 percent for values of 1.0 or greater. The values for each sample batch shall be recorded (see 6.5). For all wire and cable applications, all Types, Classes and Grades shall have a melt index in accordance with Category 4 or 5.

3.2.2 Milling stability: When specimens are prepared as specified in 4.6.3.10, these specimens shall meet the dielectric constant and dissipation factor requirements (see table III).

3.2.3 Crack resistance:

3.2.3.1 Crack failure (class L only): When tested as specified in 4.6.3.11.1, crack failure shall be as defined in ASTM method D 1693.

3.2.3.2 Crack failure (class H only): When tested as specified in 4.6.3.11.2, there shall be no cracks visible to the unaided eye. (For natural-color polyethylene specimens, flaws generally first appear as small white dots that are characteristic of a discontinuity in the refractive index and act like small scattering centers. The white area enlarges with time as the temperature is held constant and a crack appears within this region. This crack is always transverse to the direction of the applied stress and propagated in the same direction.)

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for inspection:

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may use his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.1.1 Test equipment and inspection facilities: Test equipment and inspection facilities shall be of sufficient accuracy, quality, and quantity to permit performance of the required inspection. The supplier shall establish calibration of inspection equipment to the satisfaction of the Government. Calibration of the standards that control the accuracy of the inspection equipment shall comply with the requirements of MIL-STD-45662.

4.2 Classification of examinations and tests:

The examination and testing of polyethylene shall be classified as follows:

a. Materials inspection (see 4.3).
b. Quality conformance inspection (see 4.5).

4.3 Materials inspection:

Materials inspection shall consist of certification supported by verifying data that the items listed in table IV are in accordance with the applicable referenced specifications or requirements.

TABLE IV. Materials inspection

Material	Requirement paragraph	Applicable specification
Percent content of ethylene and other olefin monomers	3.1	---
Color of material	3.1.1	PE-200

4.4 Inspection conditions:

Unless otherwise specified herein, all inspection shall be made under the conditions specified in Fed. Test Method Std. No. 406.

4.5 Quality conformance inspections:

4.5.1 Inspection of product for delivery: Inspection of product for delivery shall consist of batch inspection (see 4.5.1.2) and periodic-batch inspection (see 4.5.1.3).

4.5.1.1 Batch: A batch shall be defined as a unit of product prepared for shipment, and may consist of a uniform blend of two or more “production runs” of polyethylene of the same type, class, grade, category, color, transparency, and form.

4.5.1.2 Batch inspection: Batch inspection shall consist of the examination and tests specified in table V, as applicable.

TABLE V. Batch inspection

Examination or test	Applicability	Requirement paragraph	Method paragraph
Contamination	Type I, class L, grades 1 and 2. Types II and III, class L, grades 1 through 4. Types I and II, class M, grades 1 and 2. Type III, Class M, grades 1 through 3. Types I and II, class H, grades 1 through 5. Type III, class H, grades 1 and 2.	3.1.4	4.6.3.1
Brittleness	Type I, class L, grades 1 and 2. Types II and III, class L, grades 1 through 4. Types I and II, class M, grades 1 and 2. Type III, class M, grades 1 through 3. Types I and II, class H, grades 1 and 3. Type III, class H, grades 1 and 2.	(See table III)	4.6.3.7
Dielectric constant and dissipation factor	Types II and III, class L, grades 1 through 4. Type II, class M, grades 1 and 2. Type III, class M, grades 1 through 3. Type II, class H, grades 1 through 5. Type III, class H, grades 1 and 2.	(See table III)	4.6.3.8
Crack resistance	Types II and III, class L, grades 3 and 4. Types I and II, class H, grades 1 and 3. Type III, class H, grades 1 and 2.	3.2.3	4.6.3.11
Melt index	Type I, class L, grades 1 and 2 Types II and III, class L, grades 1 through 4. Types I and II, class M, grades 1 and 2. Types III, class M, grades 1 through 3. Types I and II, class H, grades 1 through 5. Type III, class H, grades 1 and 2.	3.2.1	4.6.3.9

4.5.1.2.1 Sampling plan: Batch sampling (see 4.6.1) and inspection shall be made on each batch (see 4.5.1.1), and shall be the basis for acceptance or rejection of the batch.

4.5.1.3 Periodic-batch inspection: Periodic-batch inspection shall consist of the examination and tests specified in table VI, as applicable.

4.5.1.3.1 Sampling and inspection frequency: Periodic-batch sampling and inspection shall be made on the first batch prepared for shipment (see 4.5.1.1) and on every 20th batch thereafter, or once every 2 years, whichever is more frequent (see 4.6.1).

4.5.1.3.2 Noncompliance: If a batch fails to pass periodic-batch inspection, the supplier shall take corrective action on the materials or process, or both, as warranted, and on all batches which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, periodic-batch inspection shall be repeated. Batch inspection may be reinstituted; however, final acceptance shall be withheld until the periodic-batch reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and the corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity.

4.5.1.3.3 Rejection: Failure to comply with any of the requirements of this specification shall be cause for rejection of the batch represented.

TABLE VI. Periodic-batch inspection

Examination or test	Applicability	Requirement paragraph	Method paragraph
Carbon-black particle size 1/	Type III, class L, grades 1 through 4. Type III, class M, grades 1 through 3. Type III, class H, grades 1 and 2.	3.1.5.1	4.6.3.2
Carbon-black concentration		3.1.5.2	4.6.3.3
Absorption coefficient		3.1.5.3	4.6.3.4
Density	Type I, class L, grades 1 and 2. Types II and III, class L, grades 1 through 4. Types I and II, class M, grades 1 and 2. Type III, class M, grades 1 through 3. Types I and II, class H, grades 1 through 5. Type III, class H, grades 1 and 2.	(See table III)	4.6.3.5
Tensile strength and ultimate elongation	Type I, class L, grades 1 and 2. Types II and III, class L, grades 1 through 4. Types I and II, class M, grades 1 and 2. Type III, class M, grades 1 through 3. Types I and II, class H, grades 1 through 5. Type III, class H, grades 1 and 2.	(See table III)	4.6.3.6
Milling stability	Types II and III, class L, grades 1 through 4. Type II, class M, grades 1 and 2. Type III, class M, grades 1 through 3. Type II, class H, grades 1 through 5. Type III, class H, grades 1 and 2.	3.2.2	4.6.3.10

1/ If it can be verified that the specified carbon-black is being used, the carbon-black particle size test need not be performed.

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

4.6 Methods of examination and test:

4.6.1 Sampling: Three containers (packages or drums) shall be selected at random from each batch (see 4.5.1.1). A sample shall be taken from the approximate center of each container. Three representative samples may be selected prior to packaging. For large quantity single-unit packaging such as hopper cars or sealed bins, the three random samples shall be selected during loading operations. The material from each sample shall be kept separate and shall not be mixed with material from the other two samples. Each such sample shall contain sufficient material for one composite sample (see 4.6.1.2) and for specimens as otherwise required in this specification (see table III and 4.6.2.3).

4.6.1.1 Handling of containers: The containers shall be opened carefully, making sure there is no contamination from scale, paint, shattered heads, torn liners, or any other cause. The material removed from each container shall be transferred to a dry metal or glass container that can be tightly closed.

4.6.1.2 Composite sample: The three samples shall be individually quartered and one quarter of the material from each sample shall be placed in a dry metal or glass container and mixed to form a composite sample.

4.6.2 Specimens:

4.6.2.1 Preparation: Unless otherwise specified herein, specimens shall be die cut or machined, as applicable, from compression-molded blanks that shall have been prepared in accordance with procedure C of ASTM method D 1928. No preparation is required when powder, granules, or pellets, as applicable, are used directly in the melt-index test.

4.6.2.2 Form: The form of specimens shall be as specified in the applicable examination or test method. Unless otherwise specified herein, the thickness shall be 0.075 ± 0.010 inch.

4.6.2.3 Number: Except for contamination, melt-index, brittleness, crack resistance, and absorption coefficient, five specimens shall be molded from the composite sample for each examination and test, as applicable. For contamination and melt-index, a quantity of material (see 4.6.3.1 and 4.6.3.9) shall be taken from each container sample. For brittleness and crack resistance, ten specimens shall be molded and tested from each container sample. For absorption coefficient, three specimens shall be prepared from the composite sample and tested.

4.6.2.4 Conditioning: Unless otherwise specified, specimens shall be conditioned for a minimum of 40 hours at 23° ± 2 °C and 50 ± 5 percent relative humidity, and tested under those conditions.

4.6.3 Examination and test methods:

4.6.3.1 Contamination (see 3.1.4 and table V): The procedure shall be as follows:

a. Measure out 8 ounces of material
b. Spread the material, a small portion at a time, on a piece of clean, white paper, 8-1/2 inches by 11 inches. Spread in a thin layer so that none of the powder, granules, or pellets, as applicable, is hidden from view.
c. View the material from normal reading distance (approximately 14 inches).
d. Turn the paper around and view the material from the other side.

Polyethylene shall be free of contamination.

4.6.3.2 Carbon-black particle size (see 3.1.5.1 and table VI): The average carbon-black particle size shall be determined by using an electron microscope.

4.6.3.3 Carbon-black concentration (see 3.1.5.2 and table VI): The carbon-black concentration shall be determined in accordance with ASTM method D 1603.

4.6.3.4 Absorption coefficient (see 3.1.5.3 and table VI):

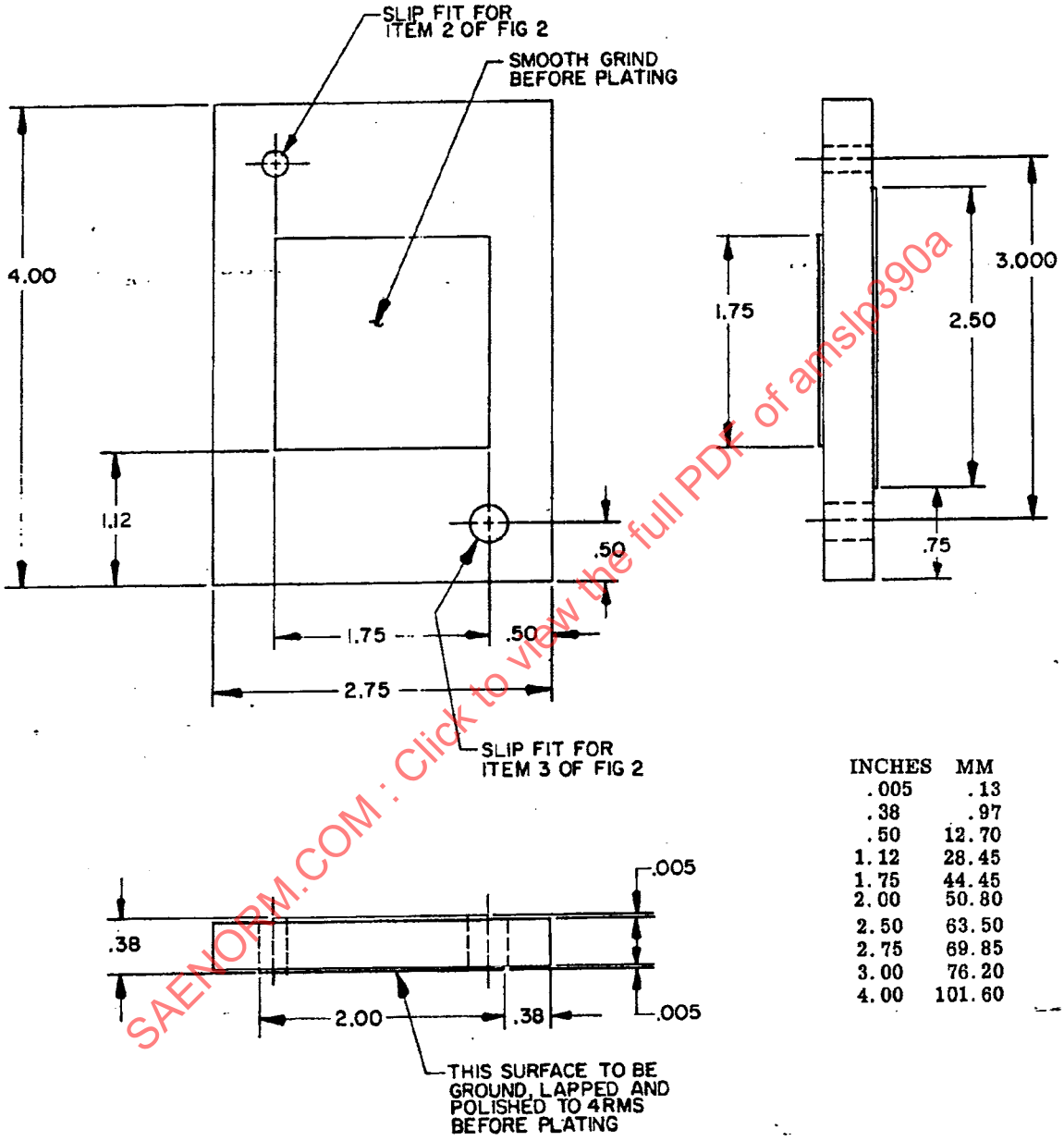
4.6.3.4.1 Apparatus (see 6.6): The specimens shall consist of the following:

a. A spectrophotometer conforming to ASTM method E 60.
b. A reference standard having an absorbance value of approximately 1.0 at 375 nm as measured by the instrument used for testing.
c. A mold in accordance with figures 1 and 2. The mold shall be made of Ketos steel or equivalent, hardened to Rockwell C45 and the mold surfaces chromium plated to 0.0002 inch minimum thickness.
d. A specimen holder consisting of two concentric rings cut from phenolic-paper laminate or other suitable material to the dimensions shown in figure 3. These rings should make a snug slip-fit, one within the other.

4.6.3.4.2 Specimen preparation: Specimens shall be prepared by hot-pressing the plastic at a suitable temperature between highly polished plates, such as those shown in figures 1 and 2, using a charge sufficient to yield a specimen 4 to 5 centimeters (cm) in diameter and approximately 0.01 mm in thickness. The preparation of satisfactory specimens may be expedited by double pressing (pressing to approximately 0.05 mm thickness and then pressing a section of that sheet to the required 0.01 mm thickness). The use of a silicone mold release agent is recommended. The specimen shall be carefully transferred to the inner ring of the specimen holder (ring 1 of figure 3). With the specimen positioned concentrically over the inner ring, the outer ring (ring 2 of figure 3) shall be carefully pressed down over the inner ring to complete the mounting operation. The specimen should be firmly mounted, taut, and wrinkle-free. The mounted specimen shall be uniform in color and free of clear spots or holes when visually examined against a suitable light source. The outer ring of the specimen shall have three points marked and identified approximately 120 degrees apart.

4.6.3.4.3 Procedure: The procedure shall be as follows:

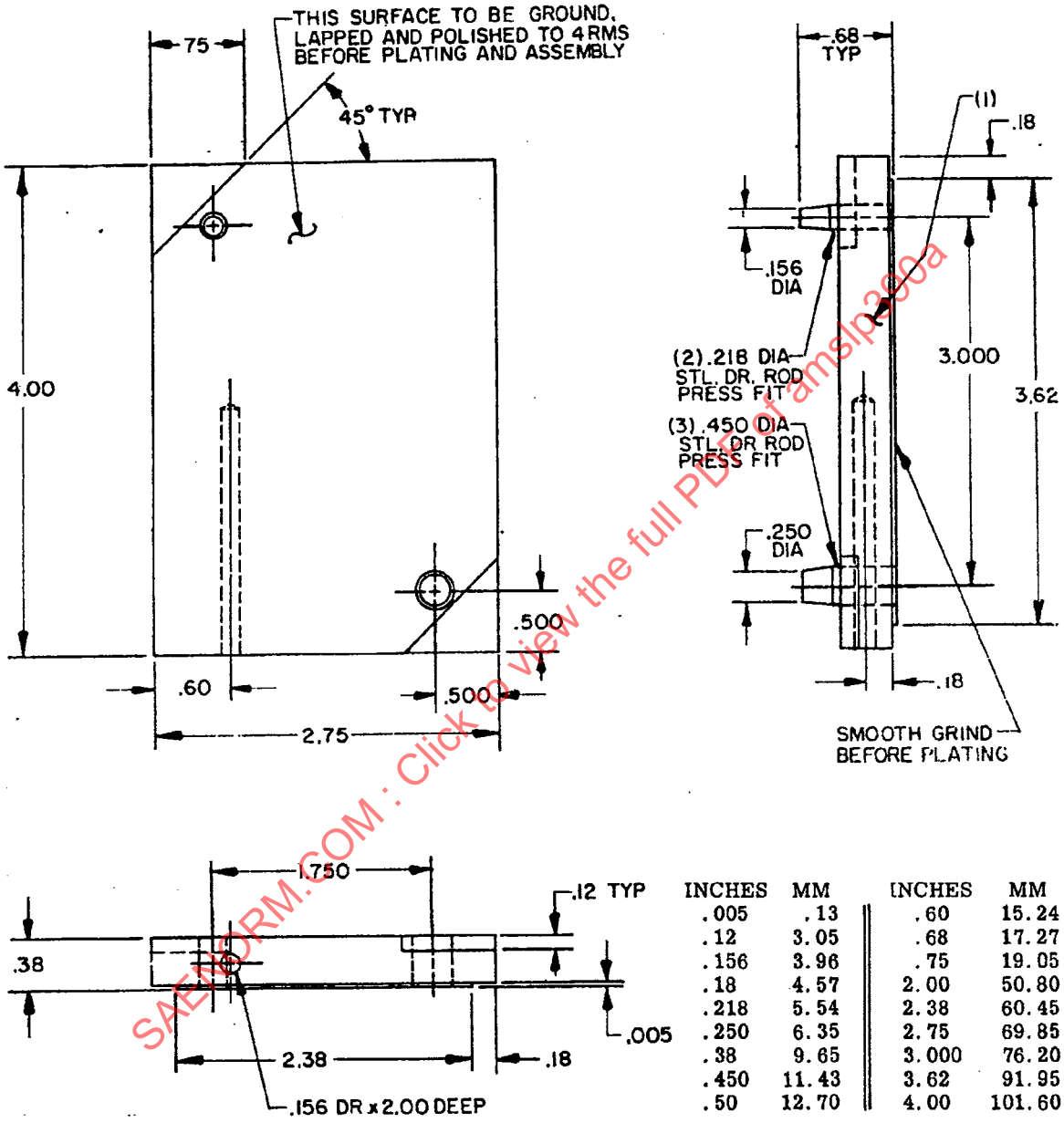
a. After allowing the spectrophotometer to stabilize thermally, with the sensitivity control on position 1 and the shutter open, bring the meter to zero on the absorbance scale by adjusting the slit width.
b. Close the shutter and adjust the dark current control so that the meter reads infinity on the absorbance scale (zero transmittance) at positions 1 to 4 on the sensitivity scale.
c. Repeat steps (a) and (b) until stable values are obtained for both zero and dark current.
d. Place the mounted reference standard in one of the outer positions of the specimen holder of the instrument as close to the receiver as possible. (The reference standard may be left in that position.)
e. Read and record the absorbance value using that setting of the sensitivity control which brings the value nearest to zero on the absorbance scale.
f. With the reference standard still in the beam and the sensitivity control set at position 2, readjust the slit width to bring the meter to zero absorbance. Recheck the dark current value.
g. Bring the mounted specimen into measuring position using the remaining outer position of the specimen holder, keeping the specimen as close to the receiver as possible. Position the specimen with one of the 120 degree marks at the top.
h. Open the shutter, read and record the absorbance value. The absorbance value recorded is equal to that indicated on the meter plus the measured value for the reference standard.
i. Close the shutter and recheck the reference standard.
j. Repeat steps (g) to (i) inclusive for each of the other two 120 degree marks. Average the absorbance values for the three positions. If any one value differs from the average by more than 10 percent, discard the specimen and replace it.
k. Remove the film from the specimen mounting rings by cutting carefully along the boundary between the two rings. The No. 11 Bard-Parker scalpel blade (or equal) in a suitable handle has been found very effective for the cutting operation.
l. Weigh the film to the nearest 0.0001 gram.
m. Measure the diameter of the film in centimeters.



INCHES	MM
.005	.13
.38	.97
.50	12.70
1.12	28.45
1.75	44.45
2.00	50.80
2.50	63.50
2.75	69.85
3.00	76.20
4.00	101.60

NOTES:
1. Dimensions are in inches.
2. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
3. Tolerances are ±.005(.13 mm) for three place decimals and ±.02(.51 mm) for two place decimals.

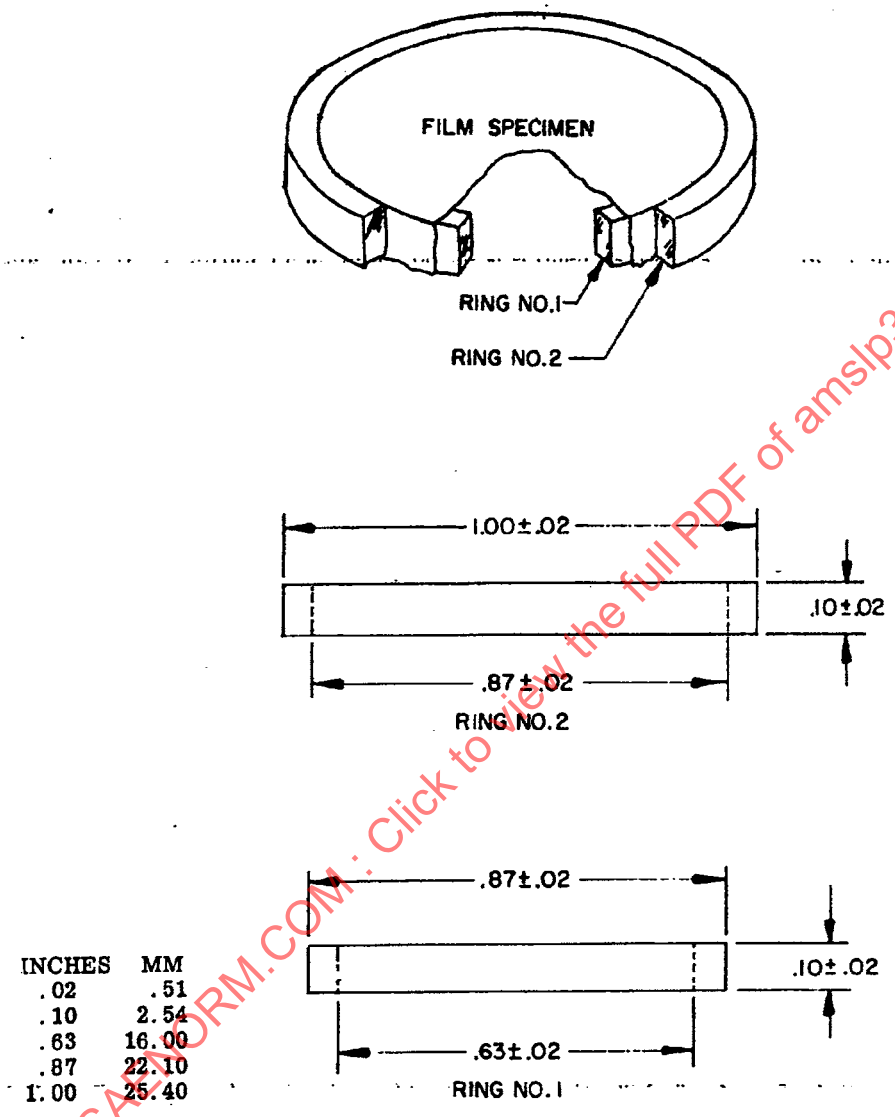
FIGURE 1. Mold, top platen



INCHES	MM	INCHES	MM
.005	.13	.60	15.24
.12	3.05	.68	17.27
.156	3.96	.75	19.05
.18	4.57	2.00	50.80
.218	5.54	2.38	60.45
.250	6.35	2.75	69.85
.38	9.65	3.000	76.20
.450	11.43	3.62	91.95
.50	12.70	4.00	101.60

NOTES:
1. Dimensions are in inches.
2. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
3. Tolerances are ±.005(.13 mm) for three place decimals and ±.02(.51 mm) for two place decimals.

FIGURE 2. Mold, bottom platen



INCHES	MM
.02	.51
.10	2.54
.63	16.00
.87	22.10
1.00	25.40

NOTES:
1. Dimensions are in inches.
2. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.

FIGURE 3. Specimen mounting rings

4.6.3.4.4 Calculations:

a. Determine the equivalent thickness of the specimen as follows:

$$t = \frac{4W}{\pi (d \times D^2)}$$

Where: t = Equivalent thickness of the specimen in centimeters.
W = Weight of film in grams as determined in 4.6.3.4.3(1).
d = Density in grams per cubic centimeter as determined in 4.6.3.6.
D = Diameter of film in centimeters as determined in 4.6.3.4.3(m).

b. Determine the absorption coefficient of the specimen as follows:

$$a = \frac{2.30 \times A}{t}$$

Where: a = Absorption coefficient at 375 nm.
A = Average absorbance value as determined in 4.6.3.4.3(j).
t = Equivalent thickness as calculated above.

4.6.3.5 Density (see tables III and VI): The density shall be determined in accordance with ASTM method D 1505. Duplicate determinations shall be made using two separate specimens of the same molding or from two moldings. Specimens 0.075 ± 0.010 inch thick shall be molded as specified in 4.6.2.1 and conditioned as specified in 4.6.2.4. Uncolored, unfilled specimens shall be used. Method 5011 of FED-STD-406 may be used as an alternate method.

4.6.3.6 Tensile strength and ultimate elongation (see tables III and VI): The tensile strength and ultimate elongation shall be determined in accordance with method 1011 of FED-STD-406. Speed D shall be used for class L and speed C for classes M and H. Specimens shall be cut using die III of method 4111 of FED-STD-601. Brenchmark separation shall be 1.000 ± 0.003 inches. The ultimate elongation shall include the cold-drawing distance.

4.6.3.7 Brittleness (see tables III and V): The brittleness temperature shall be determined in accordance with procedure A of ASTM method D 746. The bath temperature shall be controlled within +0, -2° C at the maximum brittleness temperature specified for the particular type, class, grade, and category.

4.6.3.8 Dielectric constant and dissipation factor (see tables III and V): The dielectric constant and dissipation factor shall be determined in accordance with ASTM method D 1531.

4.6.3.9 Melt-index (see 3.2.1 and table V): The melt-index shall be determined in accordance with ASTM method D 1238.

4.6.3.10 Milling stability (see 3.2.2 and table VI): Approximately 400 grams of material from the composite sample (see 4.6.1.2) shall be milled for 3 hours ± 5 minutes in a two-roll laboratory rubber mill at 160° ± 5° C. The mill shall have rolls 6 inches in diameter and 13 inches in length turning at the rate of 25 to 30 revolutions per minute, with the distance between the rolls adjusted so that the charge will maintain a uniform rolling bank. Any other size or type of two-roll laboratory rubber mill may be used, provided the charge is adequate to maintain a uniform rolling bank on the rolls and furnish sufficient material for the specimen. These specimens shall then be subjected to the dielectric constant and dissipation factor tests specified in 4.6.3.8.

4.6.3.11 Crack resistance (see 3.2.3 and table V):

4.6.3.11.1 Crack resistance (class L only) (see 3.2.3.1): The crack resistance for class L shall be determined in accordance with ASTM method D 1693, except that the stress cracking reagent for type III, grade 4 specimens shall be a 10 percent solution (by volume) of alkyl aryl polyethylene glycol, “Igepal CO-630” obtainable from the General Dyestuff Corporation, New York, N. Y., or equal. Not more than two specimens out of ten shall fail the test.

4.6.3.11.2 Crack resistance (class H only) (see 3.2.3.2): The crack resistance for class H shall be determined by exposing helically-bent, stabilized specimens (strips) to a thermal environment.

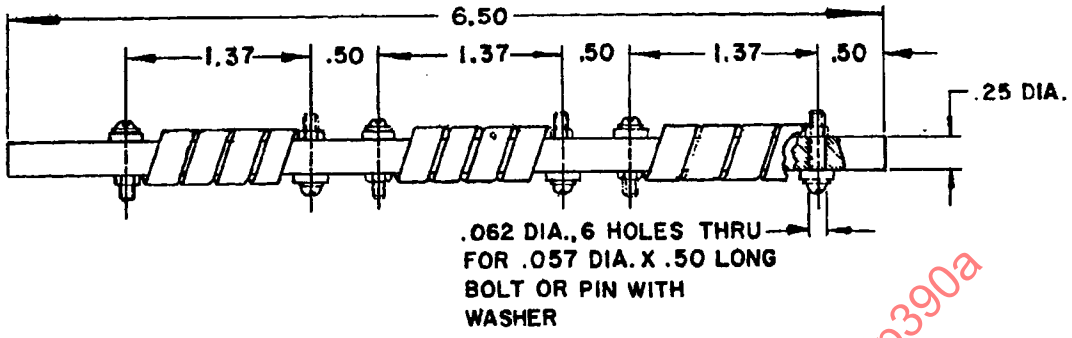
4.6.3.11.2.1 Apparatus:

a. Blacking die - A rectangular die capable of producing cleancut specimens 5 inches by 0.25 ± 0.02 inch (see figure 4).
b. Mandrel - A length of brass or stainless-steel rod 6.5 ± 0.2 inches by 0.25 ± 0.02 inch in diameter (see figure 4).
c. Test tube - A glass tube nominally 200 millimeters (mm) long with an outside diameter of 32 mm.
d. Stopper - A stopper fitted with a venting device.
e. Constant-temperature bath or circulating-air oven - A constant-temperature bath or circulating-air oven capable of controlling the temperature at 100° ± 1 °C.
f. Test-tube rack - A test-tube rack to hold the test tubes while immersed in the bath or placed in the oven.

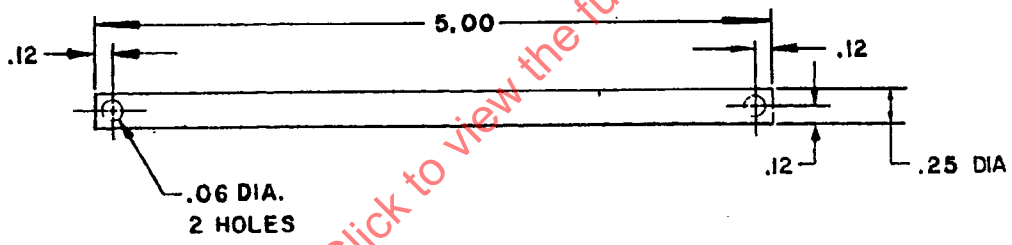
4.6.3.11.2.2 Specimen preparation: Specimens shall be strips 5 inches by 0.25 ± 0.02 inch by 0.05 inch (see 4.6.3.11.2 and figure 4) cut from blanks molded as specified in 4.6.2.1.

4.6.3.11.2.3 Conditioning: Specimens shall be conditioned as specified in 4.6.2.4.

4.6.3.11.2.4 Procedure: A specimen shall be closely-wrapped four and one-half turns helically around the mandrel, and fastened to the rod at both ends by drilling holes in the ends of the strip and through the mandrel. The strip shall be secured to the mandrel by inserting a small brass bolt or pin with washer through the strip and mandrel (see figure 4). A second and a third specimen shall be wrapped around the same mandrel. Care must be taken that the three specimens do not touch each other. Two more mandrels shall be prepared, making a total of nine specimens to be tested from each container sample. Each mandrel shall be placed in a test tube and the stopper inserted. The test tubes shall then be placed in a rack in a bath or oven having a temperature of 100° ± 1 °C. The bath or oven shall be maintained at this temperature for 96 hours. The test tubes shall then be taken from the bath or oven. The specimens shall be removed from the test tubes and examined for crack failure. Not more than four specimens out of nine shall fail the test.



ASSEMBLY
(HELICALLY WRAPPED SPECIMENS ON MANDREL)



SPECIMEN

INCHES	MM
.057	1.45
.06	1.52
.062	1.57
.12	3.18
.25	6.35
.50	12.70
1.37	34.93
5.00	127.00
6.50	165.10

NOTES:
1. Dimensions are in inches.
2. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
3. Tolerance is ±.02(.51 mm).

FIGURE 4. Assembly and specimen for class H crack resistance check