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AEROSPACE MATERIAL SPECIFICATION

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Superseding AMS3601D

Plastic Sheet, Copper Faced Glass Fabric Reinforced Epoxy Resin Hot Strength Retention

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

STABILIZED NOTICE

This document has been declared "Stabilized" by SAE AMS P, Polymeric Materials Committee, and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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1. SCOPE:

1.1 Form:

This specification covers epoxy-resin-impregnated glass laminates in the form of sheets clad on one or both sides with electrolytic copper foil.

1.2 Application:

This product has been used typically in the fabrication of etched, printed circuits for electrical and electronic equipment where a combination of low moisture absorption, hot strength retention, and bond strength are required, but usage is not limited to such applications.

1.3 Classification:

Product covered by this specification is classified as follows:

Type 1 - Copper clad on one face
Type 2 - Copper clad on both faces

1.3.1 The type supplied shall be the type ordered.

1.4 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

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 ASTM Publications:

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

ASTM D 149	Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
ASTM D 150	A-C Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials
ASTM D 229	Testing Rigid Sheet and Plate Materials Used for Electrical Insulation
ASTM D 495	High-Voltage, Low Current, Dry Arc Resistance of Solid Electrical Insulation
ASTM D 568	Rate of Burning and/or Extent and Time of Burning of Flexible Plastics in a Vertical Position
ASTM D 570	Water Absorption of Plastics
ASTM D 618	Conditioning Plastics and Electrical Insulating Materials for Testing
ASTM D 709	Laminated Thermosetting Materials
ASTM D 790	Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D 790M	Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials (Metric)
ASTM D 1825	Etching and Cleaning Copper-Clad Electrical Insulating Materials and Thermosetting Laminates for Electrical Testing
ASTM D 3636	Sampling and Judging Quality of Solid Electrical Insulating Materials
ASTM G 21	Determining Resistance of Synthetic Polymeric Materials to Fungi

2.2 U.S. Government Publications:

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

MIL-STD-2073-1 DOD Materiel, Procedures for Development and Application of Packaging Requirements

2.3 The Institute for Interconnecting and Packaging Electronic Circuits (IPC) Publications:

Available from IPC, 7380 North Lincoln Avenue, Lincolnwood, IL 60646

IPC-CR-150	Copper Foil for Printed Wiring Applications
IPC-S-804	Solderability Test Methods for Printed Wiring Boards

2.4 Other Publications:

Available from Underwriters' Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60602.

UL94 Flammability of Plastic Materials for Parts in Devices and Appliances

3. TECHNICAL REQUIREMENTS:

3.1 Material and Fabrication:

The sheets shall be constructed of laminations of glass fabric thoroughly impregnated with an epoxy resin and properly cured. Face sheets of copper may be applied to one or both faces during the original cure of the laminate or in a subsequent operation.

3.1.1 Color of Plastic Laminate: Shall be natural.

3.1.2 Copper Faces: Shall be electrolytically deposited copper foil conforming to IPC-CR-150, Class 1.

3.1.3 Designations: Sheet shall be designated according to the following numbering system:

a. Material, ASTM D 709, FR-5
b. Copper foil weight, ounces per square foot (kg/m^2)
c. Base laminate thickness, inch (mm)
d. Thickness tolerance required, Normal (N) or Close (C)
e. Number of sides laminated with copper foil

Example: FR-5 2-0.062C-1 (FR-5 0.6-1.57C-1)

Describes: Sheet, copper-faced epoxy glass laminate, hot strength retention 2 ounces per square foot (0.6 kg/m^2), 0.0028 inch (0.071 mm) thick copper foil, nominal base thickness of 0.062 inch (1.57 mm) without cladding, close thickness tolerances, and copper foil on one side.

3.2 Properties:

Sheet shall conform to requirements shown in Table 1 and 3.2.9 through 3.2.19; tests shall be performed on the sheet supplied and in accordance with listed test methods, insofar as practicable. Specimens shall be conditioned in accordance with ASTM D 618, Procedure A, prior to being tested. For specimens requiring removal of copper faces before testing (See 4.5.1), the conditioning shall follow removal of the copper. Where requirements vary with thickness, use the value for the next lower thickness for thicknesses not specified.

TABLE 1 - Properties

Paragraph	Property	Requirement	Test Method
3.2.1	Dielectric Strength, perpendicular to laminations (when specified), Short Time Test, minimum, for nominal thickness inch (mm)		ASTM D 149
3.2.1.1	0.031 (0.79)	600 V/mil (23.6 kV/mm)	
3.2.1.2	0.062 (1.57)	500 V/mil (19.7 kV/mm)	
3.2.1.3	0.125 (3.18)	425 V/mil (16.7 kV/mm)	
3.2.1.4	0.250 (6.35)	400 v/mil (15.7 kV/mm)	
3.2.2	Dielectric Strength, parallel to laminations, stepwise test, minimum		ASTM D 229
3.2.2.1	As Received	45 kV/inch (1.77 kV/mm)	
3.2.2.2	After 48 hours immersion in distilled water at 50 °C ± 2.2 (1.22 °F ± 4)	30 kV/inch (1.18 kV/inch)	
3.2.3	Dielectric Constant at 1 MHz, maximum	5.2	ASTM D 150
3.2.4	Power Factor at 1 MHz, maximum	0.020	ASTM D 150
3.2.5	Arc Resistance, minimum	100 seconds	ASTM D 495
3.2.6	Insulation Resistance, minimum	1000 megohm	4.5.2
3.2.7	Flexural Strength, flatwise, minimum		ASTM D 790 or ASTM D 790M
3.2.7.1	At 25 °C (77 °F)	50.0 ksi (345 MPa)	
3.2.7.2	At 149 °C (300 °F) after one hour at 149 °C (300 °F)	50% of value at 25 °C (77 °F)	
3.2.8	Compressive Strength, flatwise, minimum	30.0 ksi (207 MPa)	ASTM D 229

3.2.9 Peel Strength: Sheet, as received, after solder bath resistance test, and after temperature cycling resistance test, shall have peel strength not lower than shown in Table 2, determined in accordance with 4.5.3.

TABLE 2 - Peel Strength

Nominal Foil Weight Ounces/square foot	Nominal Foil Weight kg/m^2	Nominal Foil Thickness Inch	Nominal Foil Thickness Millimeters	Peel Strength Pounds Force Per Inch Width	Peel Strength N/m
1.00	0.3	0.0014	0.036	7	1226
2.00	0.6	0.0028	0.071	8	1401

3.2.10 Solder Bath Resistance: Sheet shall show no softening, splitting, blistering, or delamination after testing in accordance with 4.5.4.

3.2.11 Temperature Cycling Resistance: Sheet shall show no blistering after testing in accordance with 4.5.5.

3.2.12 Solvent Resistance: Sheet shall show no softening, blistering, or lifting of base laminate and residual surface adhesive after testing in accordance with 4.5.6.

3.2.13 Heat Resistance: Sheet shall show no blistering after testing in accordance with 4.5.7.

3.2.14 Copper Porosity: Sheet shall show no more than three resin spots 0.005 inch (0.13 mm) or greater in diameter spaced not less than 1 inch (25 mm) apart for each 18-inch (457-mm) square, and no resin spot with an included area larger than a 0.015 inch (0.38 mm) diameter circle, determined in accordance with 4.5.8.

3.2.15 Copper Surface Quality: Surface shall be free of defects that may affect serviceability. The total point count for pits and dents shall be less than 30 for any 12-inch (305-mm) square area. The point count value is shown in Table 3.

TABLE 3 - Point Values

Largest Dimension of Pits and Dents Inch	Largest Dimensions of Pits and Dents Millimeters	Point Value
0.005 - 0.010, incl	0.13 - 0.25, incl	1
Over 0.010 - 0.020, incl	Over 0.25 - 0.51, incl	2
Over 0.020 - 0.030, incl	Over 0.51 - 0.76, incl	4
Over 0.030 - 0.040, incl	Over 0.76 - 1.02, incl	7
Over 0.040	Over 1.02	30

3.2.16 Water Absorption: Weight gain in 24 hours shall not exceed the values shown in Table 4, determined in accordance with ASTM D 570.

TABLE 4 - Water Absorption

Nominal Thickness Inch	Nominal Thickness Millimeters	Weight Gain %
0.031	0.79	0.50
0.062	1.57	0.30
0.093	2.36	0.25
0.125	3.18	0.18
0.250	6.35	0.13

3.2.17 Flame Resistance: Maximum average values, when tested in accordance with 4.5.9, shall conform to the requirements shown in Table 5 (See 8.2).

TABLE 5 - Flame Resistance

Nominal Sheet Thickness Inch	Nominal Sheet Thickness Millimeter	Time of Burning Seconds	Extent of Burning Inches	Extent of Burning Millimeters
Up to 0.030, incl	Up to 0.76, incl	30	3	76
Over 0.030	Over 0.76	25	2	51

3.2.18 Fungus Resistance: Sheet shall show no fungus growth, determined in accordance with ASTM G 21.

3.2.19 Solderability: Metal clad surfaces of laminates, tested as in 4.5.10, shall exhibit no nonwetting and not greater than 5% dewetting.

3.3 Quality:

Sheet, as received by purchaser, shall be uniform in quality and condition and free from blisters, cracks, holes, wrinkles, delamination, unbonded areas, corrosion, excess bonding material, and other imperfections detrimental to usage of the sheet. Discoloration of the copper faces shall not be considered objectionable. The bonded copper faces shall be of such smoothness as to reveal no visible evidence of the underlying glass fabric weave.

3.4 Tolerances:

3.4.1 Length and Width: Shall not vary more than +1.0 inch (+25 mm), -0, from that ordered except where test specimens have been removed.

3.4.2 Thickness:

3.4.2.1 Copper face standard weight and thickness tolerances shall be as shown in Table 6.

TABLE 6A - Weight and Thickness Tolerances, Inch/Pound Units

Nominal Weight Ounces/Square Foot	Weight Tolerance Ounces/Square Foot plus or minus	Nominal Thickness Inch	Thickness Tolerance Inch plus	Thickness Tolerance Inch Minus
1.00	0.10	0.0014	0.0002	0.0001
2.00	0.20	0.0028	0.0004	0.0002

TABLE 6B - Weight and Thickness Tolerances, SI Units

Nominal Weight kg/m^2	Weight Tolerance kg/m^2 plus or minus	Nominal Thickness Millimeter	Thickness Tolerance Millimeter plus	Thickness Tolerance Millimeter Minus
0.305	0.030	0.036	0.005	0.003
0.610	0.061	0.071	0.010	0.005

3.4.2.2 Sheet Thickness: The nominal base laminate thickness of the finished sheet, excluding copper faces, shall be in accordance with Table 7. Sheet conforming to the normal thickness tolerances shall be furnished unless close tolerances are specified. Tolerance is applied over the base plus cladding with no additional tolerance for cladding allowed.

TABLE 7A - Sheet Thickness Tolerance, Inch/Pound Units

Base Laminate Thickness Inch	Normal Tolerance, (1) Plus or Minus Inch	Close Tolerance, (2) Plus or Minus Inch
0.0010 - 0.0045, incl	0.0010	0.0007
Over 0.0045 - 0.0065, incl	0.0015	0.0010
Over 0.0065 - 0.0120, incl	0.0020	0.0015
Over 0.0120 - 0.0200, incl	0.0025	0.0020
Over 0.0200 - 0.0310, incl	0.0030	0.0025
Over 0.0310 - 0.0410, incl	0.0065	0.0040
Over 0.0410 - 0.0660, incl	0.0075	0.0050
Over 0.0660 - 0.1010, incl	0.0090	0.0070
Over 0.1010 - 0.1410, incl	0.0120	0.0090
Over 0.1410 - 0.2500, incl	0.0220	0.0120

TABLE 7B - Sheet Thickness Tolerance, SI Units

Base Laminate Thickness Millimeters	Normal Tolerance, (1) Plus or Minus Millimeter	Close Tolerance, (2) Plus or Minus Millimeter
0.025 - 0.114, incl	0.025	0.018
Over 0.114 - 0.165, incl	0.038	0.025
Over 0.165 - 0.305, incl	0.051	0.038
Over 0.305 - 0.508, incl	0.064	0.051
Over 0.508 - 0.787, incl	0.076	0.064
Over 0.787 - 1.041, incl	0.165	0.102
Over 1.041 - 1.676, incl	0.190	0.127
Over 1.676 - 2.565, incl	0.229	0.178
Over 2.565 - 3.581, incl	0.305	0.229
Over 3.581 - 6.350, incl	0.559	0.305

(1) At least 90% of the sheet shall be within the tolerance given and at no point shall the thickness vary from the nominal thickness by a value greater than 125% of the specified tolerances.

(2) Specified tolerances shall be furnished over 100% of the area of the sheet.

3.4.3 Warp and Twist: Shall not exceed the values shown in Table 8 for either thickness of copper, based on 36 inches (914 mm) length, determined in accordance with ASTM D 229 or ASTM D 709.

TABLE 8 - Warp and Twist Tolerance

Nominal Sheet Thickness Inch	Nominal Sheet Thickness Millimeters	Maximum Deviation, % Copper on One Side Only	Maximum Deviation, % Copper on Both Sides
0.031 - 0.047, incl	0.79 - 1.19, incl	12	5
Over 0.047 - 0.062, incl	Over 1.19 - 1.57, incl	10	5
Over 0.062 - 0.124, incl	Over 1.57 - 3.15, incl	8	3
Over 0.124 - 0.250, incl	Over 3.15 - 6.35, incl	5	1.5

3.4.3.1 When it is desired to compare the actual deviation for any length, Equation 1 may be used:

$$D = C \times W \times L^2 \quad \text{(Eq.1)}$$

Where, D = Permissible deviation from the straight edge in inches (millimeters) for the given length

W= Maximum deviation in percent from Table 8

L = The given length in inches (millimeters)

C = 1/3600 for D in inches, 1/91,440 for D in millimeters

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of sheet shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the sheet conforms to requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for peel strength (3.2.9), solder bath resistance (3.2.10), solvent resistance (3.2.12), copper porosity (3.2.14), quality (3.3), and tolerances (3.4) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Test for arc resistance (3.2.5), temperature cycling resistance (3.2.11), water absorption (3.2.16), and solderability (3.2.19) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction TestsTests for all technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of sheet to a purchaser, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.3.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or request for procurement.

4.3 Sampling and Testing:

Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient sheet shall be taken at random from each lot to perform all required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three. A lot shall be all sheet produced in a single production run from the same batches of raw material under the same fixed conditions and presented for vendor's inspection at one time.

4.3.1.1 Not more than 4 square feet (0.37 m^2) shall be cut from each thickness in a shipment for testing. The size of the portion of sheet removed shall be stated on the outside of the package. The unit of product for determining sample size for testing (See ASTM D 3636) shall not exceed 150 pounds (68 kg) of sheet.

4.3.1.2 When a statistical sampling plan has been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6 shall state that such plan was used.

4.3.2 For Periodic and Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample sheet shall be approved by purchaser before sheet for production use is supplied, unless such approval be waived by purchaser. Results of tests on production sheet shall be essentially equivalent to those on the approved sample.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production sheet which are essentially the same as those used on the approved sample sheet. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in ingredients and/or processing and, when requested, sample sheet. Production sheet made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Test Specimen Preparation: Specimens for dielectric strength (both directions), dielectric constant, and flexural strength shall have the copper facing removed in accordance with ASTM D 1825.

4.5.2 Insulation Resistance:

4.5.2.1 Circuit Test Specimens: Test specimens, 2.00 x 2.50 inch (50.8 x 63.5 mm) x thickness of the sheet, shall be made as shown in Figure 1 or be the equivalent thereof.

4.5.2.2 Specimen Preparation: Apply suitable resist to each test panel and develop Figure 1 wiring pattern in accordance with best commercial practice. Remove unwanted copper in accordance with ASTM D 1825 except that the final rinse shall be for 15 to 20 minutes. Immediately remove iron salts by immersing the wet panel in 10% oxalic acid at room temperature for 5 to 10 minutes with occasional agitation. Rinse panel for at least one hour in running water at 15 to 30 °C (59 to 86 °F) and 15 to 20 minutes in running water at 75 to 90 °C (167 to 194 °F). Dry for 2 to 2 1/2 hours in a forced circulating-air oven maintained at 65 to 80 °C (149 to 176 °F) and cool in a desiccator to room temperature at approximately 50% relative humidity. Drill necessary holes and solder lead wires into the holes using a pencil-type soldering iron or gun and water-white, unactivated rosin flux, filling the hole with a plug of solder. Remove excess flux and other contaminants by rinsing in a clean mixture of 90% by volume ethanol and 10% by volume distilled water. Air dry. Care should be exercised to avoid touching critical areas of the clean specimen with bare hands.

4.5.2.3 Insulation Resistance Measurement: Mount test specimens in a circulating-air humidity chamber, provided with suitable specimen lead wire insulators on the chamber wall, maintained at a relative humidity of 92% ± 2 at 65 °C ± 2 (149 °F ± 4) and expose for 18 hours ± 1. Lower the relative humidity to 87% ± 2 while holding the temperature constant and stabilize the specimens at this condition for 2 to 2 1/4 hours. Apply 500 volts direct current between terminal leads and maintain electrification time for at least one minute. Immediately thereafter, measure insulation resistance using a suitable megohm bridge. Measurements shall be performed while the relative humidity is 87% ± 2.

4.5.3 Peel Strength:

4.5.3.1 Specimens conforming to Figure 2 shall be cut from each sample sheet. The specimens shall be etched in accordance with ASTM D 1825 so that the strips on one specimen are length-wise and the strips on the second specimen for the same clad side are crosswise. The specimens shall be bonded to a 0.063-inch (1.60-mm) thick aluminum alloy plate or any suitable rigid substrate if necessary to prevent bending of the base materials during testing. The base material for Figure 2 may extend 1 inch (25 mm) in a lengthwise direction to provide space for a hanghole. The metal foil shall be peeled back approximately 1 inch (25 mm) starting from the wider end of each strip, so that the line of peel is perpendicular to the edge of the specimen. Each specimen shall be clamped or held on a horizontal surface with the peeled metal strip projecting upward 1 inch (25 mm). The end of the strip shall be gripped between two knurled jaws of a clamp with a chain attached to a force-indicator dial, or a tensile tester which has been adjusted to compensate for the weight of the chain and clamp.

4.5.3.2 Test Procedure: The load-recording device shall be capable of a direct reading with a precision not less than 0.1 pound force inch (17.5 N/m) of width. For nominal 1/32 inch (0.8 mm) lines, this value is 0.00325 pound force (0.01 N). The jaws shall cover the full width of the strip and shall be clamped parallel to the line of peel. The force shall be exerted in a vertical plane and shall not deviate from the perpendicular by more than five degrees. The metal foil shall be pulled from the base material at a speed of 2 inches ± 0.1 (51 mm ± 3) per minute; the minimum load shall then be observed, converted to pounds force per inch (N/m) of width and shall be considered the peel strength for the strip. If the full width of the strip does not peel, the results for that strip shall be discarded and another strip tested. The actual line widths shall be measured and recorded so that they may be used to calculate the peel strength. The peel strength for any specimen is the average of four strips on one side of the specimen; however, any strip more than 1.5 pounds force per inch (263 N/m) less than the specified minimum shall constitute a failure.

4.5.4 Solder Bath Resistance: Specimens as in 4.5.3.1 shall be dipped in liquid flux (rosin in alcohol) and then floated on the surface of molten solder with the copper face to be tested down. The solder shall be maintained at 255 °C ± 5 (491 °F ± 9). After 20 seconds exposure to the molten solder, the specimen shall be removed, visually examined, and tested as in 4.5.3.2.

4.5.5 Temperature Cycling Resistance: Specimens as in 4.5.3.1 shall be visually examined for evidence of blistering or delamination on the metal foil, or blistering of the base material, after exposure to five complete temperature cycles. Each cycle shall consist of 30 minutes ± 1 at 125 °C ± 3 (257 °F ± 5), 15 minutes ± 1 at 25 °C ± 1 (77 °F ± 2), 30 minutes ± 1 at -65 °C ± 3 (-85 °F ± 5), and 15 minutes ± 1 at 25 °C ± 1 (77 °F ± 2). Any specimen failing this cycling test shall be rejected and further testing discontinued. Specimens passing the visual examination after temperature cycling shall be peel tested in accordance with 4.5.3.

4.5.6 Solvent Resistance: A 1 x 6 inch (25 x 152 mm) specimen, etched in accordance with ASTM D 1825, rinsed, and dried, shall be vapor degreased for at least 30 seconds, sprayed with recirculated degreaser solvent for at least 90 seconds, and examined. The degreaser solvent shall be 1,1,2-trichloro-1,2,2-trifluoroethane.

4.5.7 Heat Resistance: A 6 inch (152 mm) square test specimen shall be supported vertically, on a non-metallic rack in a horizontal-flow, air-circulating oven at 177 °C ± 5 (351 °F ± 9) for at least 30 minutes. The plane of the test specimen shall be parallel to the air flow. At the end of this period, remove the specimen from the oven and examine immediately.

4.5.8 Copper Porosity: One-half of a standard size sheet shall be vapor degreased and air dried. Lightly scrub the copper surfaces with a slurry of pumice and water, rinse thoroughly, and air dry. Handle board so that the copper surfaces are free of fingerprints, dust, and other contaminants. Examine in a dark room, using ultraviolet light, for fluorescent resin spots.

4.5.9 Flame Resistance (See 8.2):

4.5.9.1 Laminates 0.030 inch (0.76 mm) and Under in Nominal Thickness: The flammability test shall be conducted in accordance with ASTM D 568 except that a 5-second ignition time shall be used. The total burning time shall be recorded starting from the time the bottom of the flame reaches the lower gage mark until the flame either extinguishes or the bottom of the flame reaches the upper gage mark. A hole approximately 0.12 inch (3.0 mm) in diameter shall be drilled in the approximate center of the narrow dimension of the specimen at a point approximately 0.75 inch (19.0 mm) from the edge. A thin wire shall be fastened to the hole and a 100-gram weight attached to the wire so that the weight hangs approximately 5 inches (127 mm) below the sample.

4.5.9.2 Laminates Over 0.030 Inch (0.76 mm) in Nominal Thickness: Flammability shall be tested in accordance with UL 94. The preconditioning procedure shall be changed to 24 hours at 125 °C ± 3 (257 °F ± 5).

4.5.10 Solderability: Specimens, 3 inches (76 mm) square by thickness of sheet, shall be wiped with isopropyl alcohol, immersed in a 20% by volume solution of 22 degree Baume, technical grade hydrochloric acid at 21 °C ± 6 (70 °F ± 11) for 15 seconds, immediately rinsed with a cold water spray for five seconds, blown dry with filtered, oil-free compressed air, and tested in accordance with IPC-S-804.

4.6 Reports:

The vendor of sheet shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the sheet conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS 3601E , manufacturer's identification, size, and quantity.

4.7 Resampling and Retesting:

If any specimen used in the above tests fails to meet the specified requirements, disposition of the sheet may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the sheet represented. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

A lot of sheet may be packaged in small quantities and delivered under the basic lot approval provided lot identification is maintained.

5.1.1 Packaging of sheet shall be accomplished to ensure that the sheet, during shipment and storage, will not be permanently distorted and will be protected against damage from exposure to weather or any other normal hazard.