

MIL-P-5431A(AS)

17 May 1967

SUPERSEDING

MIL-P-5431(Aer)

28 December 1954

MILITARY SPECIFICATION

PLASTIC-PHENOLIC, GRAPHITED, SHEETS, RODS, TUBES AND SHAPES

This specification has been approved by the Naval Air Systems Command, Department of the Navy.

1. SCOPE

1.1 Scope - This specification establishes the requirements for a laminated phenolic graphited material.

1.2 Classification - The laminated phenolic graphited material covered by this specification shall be furnished in the following forms, as specified:

Form S - Sheets
Form Rm - Rods, molded
Form Tm - Tubing, molded
Form U - Shapes

* 2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

Federal

MMM-A-132	Adhesives, Heat Resistant, Air Frame Structural; Metal to Metal
PPP-B-585	Box, Wood, Wirebound
PPP-B-591	Box, Fiberboard, Wood-Cleated

FSC 9330

MIL-P-5431A (AS)

Federal (Continued)

PPP-B-601	Box, Wood, Cleated - Plywood
PPP-B-621	Box, Wood, Nailed and Lock-Corner
PPP-B-636	Box, Fiberboard

Military

MIL-P-116	Preservation, Methods of
MIL-G-6711	Graphite, Lubricating
MIL-P-7936	Parts and Equipment, Aeronautical, Preparation for Delivery

STANDARDS

Federal

Fed. Test Method Std. No. 406	Plastics: Methods of Testing
----------------------------------	------------------------------

Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-831	Test Reports, Preparation of

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

2.2 Other publications - The following document forms 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.

CONSOLIDATED CLASSIFICATION COMMITTEE
Uniform Freight Classification Rules.

MIL-P-5431A (AS)

(Application for copies should be addressed to the Consolidated Classification Committee, 202 Chicago Union Station, Chicago 6, Ill.)

3. REQUIREMENTS

- * 3.1 Preproduction - The material furnished under this specification shall be a product which has been tested and passed the preproduction tests specified herein.
- * 3.2 Material - The material shall consist of a suitable fabric base reinforcement, properly impregnated and bonded with phenolic resin containing 6.4 to 6.6 percent by weight of inert free graphite. The material shall be of high quality, and processed to conform to the requirements of this specification. (see 4
- * 3.2.1 Construction -
 - 3.2.1.1 Form S (sheets) - Sheets shall be formed by subjecting layers of impregnated sheets to heat and pressure.
 - 3.2.1.2 Form Rm (rods) - Round rods shall be processed from laminations of impregnated sheet material molded in cylindrical molds under high temperature and pressure to rods.
 - 3.2.1.3 Form Tm (tubing) - Tubes shall be made by winding the impregnated sheet material on a mandrel and molding under heat and pressure.
 - 3.2.1.4 Form U (shapes) - Special shapes pressed in a mold and cured under heat and pressure shall show dimensions as specified by the procuring activity.
- 3.3 Machinability - The material shall be of such quality that it can be drilled, tapped, sawed, and machined in any direction without cracking or splitting.
- 3.4 Color - The molded material shall be natural in color. The natural color shall be the color of undyed ingredients used, and shall be substantially uniform in color, black or nearly black throughout. A grayish color on sawed, sanded, or machined surfaces is permissible.
- 3.5 Surface finish - The surface finish of sheet material shall be polished, semigloss, dull, or sanded as specified. Rods and tubing shall be finished ground, or ground and buffed as specified. Shapes shall have a semigloss or ground finish as specified.

MIL-P-5431A (AS)

3.6 Surface defects -

3.6.1 Sheets - Formed sheets shall be fabricated free from blisters, cracks, wrinkles, or other defects. Edges, drilled holes, machined, milled or ground faces of laminated material shall be smooth and shall exhibit a neat appearance.

3.6.2 Rods, tubing and shapes - Molded tubes shall be free from blisters, pronounced mandrel scores, and loose layers, and as free as possible from resin pockets, voids, and heat marks. Molded tubes shall be free from seam cracks. Rods and shapes shall be free from blisters and mold seam cracks and reasonably free from voids and resin pockets. Drilled holes, machined, milled or ground faces of rods and shapes, shall be smooth and shall present a neat appearance.

3.7 Warp or twist (Applicable only to sheets 36 inches and greater in length and in width) - The warp or twist of material, as delivered, shall not exceed that shown in Table I. Percentage of warp is given in terms of the lateral dimensions (length and width), of the material; percentage of twist is given in terms of dimensions from one corner to the opposite corner.

TABLE I
WARP OR TWIST

Thickness (Inch)	Permissible variation, on basis of 36-inch dimension (Maximum percent)
1/32 to under 1/16	5.00
1/16 to under 1/8	2.50
1/8 to 1/4, inclusive	1.00
Over 1/4, up to and including 3/4	0.50
Over 3/4	0.25

3.7.1 The warp of material furnished in the rod or tube form, as delivered, shall not exceed the following:

Outside diameter (Inch)	Permissible warp, maximum (Percent) <u>1/</u>
1/8 to 1/4, inclusive	2.0
Over 1/4 to 3/4	1.0
Over 3/4	0.50

1/ Percentage of warp is specified in terms of a 36-inch length of the material.

MIL-P-5431A (AS)

- * 3.8 Physical properties - The material shall conform to the physical property values as shown in Table II.

TABLE II

PHYSICAL PROPERTIES

Physical test	Limits	Value
Tensile strength (sheets only), psi (see 4.6.4) Strongest direction 90° to strongest direction	Minimum Minimum	9,000 8,500
Compressive strength (sheets only) Flatwise, psi (see 4.6.5.1) Edgewise, psi Compressive strength axially (rods only) <u>1</u> / psi (see 4.6.5.2) Compressive strength axially (tubes only) <u>2</u> / psi (see 4.6.5.2)	Minimum Minimum Minimum Minimum	37,000 24,000 20,000 19,000
Flexural strength, flatwise (sheets of nominal thickness up to and including 2.0 inches) (see 4.6.6.1) Strongest direction, psi 90° to strongest direction, psi Flexural strength psi (rods only) <u>3</u> / (see 4.6.6.2)	Minimum Minimum Minimum	14,500 13,500 13,000
Moisture absorption (see 4.6.7) <u>Sheet</u> <u>Thickness (inches)</u> <u>4</u> / 1/32 1/16 3/32 1/8 3/16 1/4 1/2 3/4 1	Maximum Maximum Maximum Maximum Maximum Maximum Maximum Maximum Maximum	4.50% 2.20% 1.80% 1.60% 1.30% 1.10% 0.75% 0.75% 0.65%

MIL-P-5431A (AS)

TABLE II (Continued)

Physical test	Limits	Value
Moisture absorption (see 4.6.7) (Continued)		
<u>Rod</u>		
Diameter of 1/4 inch up to 1/2 inch	Maximum	1.7%
Diameter of 1/2 inch up to 1 inch	Maximum	1.3%
Diameter of 1 up to 2 inches	Maximum	1.2%
<u>Tube</u>		
Wall thickness from 1/16 up to 3/32 inch	Maximum	3.0%
Wall thickness from 3/32 up to 1/8 inch	Maximum	2.2%
Wall thickness from 1/8 up to 3/16 inch	Maximum	2.0%
Wall thickness from 3/16 up to 1/4 inch	Maximum	1.8%
Wall thickness from 1/4 up to 1/2 inch	Maximum	1.6%
Wall thickness from 1/2 up to 1 inch	Maximum	1.2%
Wall thickness = 1 inch	Maximum	1.1%
Hardness (Rockwell) sheets only (see 4.6.8)		
Flatwise	Minimum	103
Specific gravity (all forms) (see 4.6.9)	Minimum	1.34
Plastic flow (sheets only) (see 4.6.10)	Maximum	0.6%
Interlaminar bonding strength psi (see 4.6.11) sheets only	Minimum	2,500

1/ 1/4 to 2 inches in diameter

2/ ID 1/4 inch or greater; wall thickness 1/16 inch or greater

3/ 1/4 to 1 inch in diameter

4/ For intermediate thicknesses, the value for the next smaller thickness shall apply

3.9 Dimensions and tolerances -

3.9.1 Form S (sheets) - Sheets shall be furnished in standard sizes 36 inches square ± 1 inch. Manufacturers' standard sheet sizes 36 x 42 inches ± 1 inch and 36 x 59 inches ± 1 inch will be acceptable. Nonuniform standard sheet dimensions caused by cutting specimens for tests required by this specification shall not be cause for rejection, unless particular dimensions are specified in the contract or order. Where sheets are to be cut to size, the dimensions (length and width) shall be within the tolerances shown in Table III.

MIL-P-5431A (AS)

TABLE III

TOLERANCE ON LENGTH AND WIDTH OF SHEETS

Nominal thickness	Tolerance on length or width, plus or minus		
	6 inches or under	Over 6 to 24 inches	24 inches or over
Inches	Inch	Inch	Inch
1/32 to 1/4, inclusive	0.010	0.015	1/32
17/64 to 1/2, inclusive	0.012	0.017	1/32
33/64 to 1, inclusive	0.015	0.020	1/32
1-1/64 to 1-1/2, inclusive	0.018	0.030	1/16
1-33/64 to 2, inclusive	0.022	0.040	1/16

3.9.1.1 **Thickness** - Sheets shall be furnished in thickness as specified. Sheets or pieces cut or punched from sheets shall be within the tolerances specified in Table IV. At least 90 percent of the area of the sheet shall be within the tolerances specified, and at no point shall the thickness vary from the nominal by a value greater than 125 percent of this specified tolerance.

TABLE IV

TOLERANCES ON THICKNESS OF SHEETS

Nominal thickness (inch)	Tolerance (inch) plus or minus	Nominal thickness (inches)	Tolerance (inch) plus only	Nominal thickness (inches)	Tolerance (inch) plus only
1/32	0.0065	1	0.065	4	0.163
3/64	0.0075	1-1/8	0.069	4-1/2	0.179
1/16	0.0075	1-1/4	0.073	5	0.190
3/32	0.009	1-3/8	0.077	5-1/2	0.210
1/8	0.010	1-1/2	0.081	6	0.230
5/32	0.011	1-5/8	0.085	6-1/2	0.240
3/16	0.0125	1-3/4	0.089	7	0.260
7/32	0.014	1-7/8	0.093		
Plus Only					
1/4	0.030	2	0.097	7-1/2	0.280
5/16	0.035	2-1/4	0.105	8	0.290
3/8	0.040	2-1/2	0.113	8-1/2	0.310
7/16	0.044	2-3/4	0.121		

MIL-P-5431A (AS)

TABLE IV (Continued)

Nominal thickness (inch)	Tolerance (inch) plus or minus	Nominal thickness (inches)	Tolerance (inch) plus only	Nominal thickness (inches)	Tolerance (inch) plus only
<u>Plus Only</u>					
1/2	0.048	3	0.130	9	0.320
5/8	0.053	3-1/2	0.146	9-1/2	0.340
3/4	0.058			10	0.360
7/8	0.062				

- 1/ On sheets of nominal thickness not listed above, the tolerance shall be the same as specified for the next greater thickness.
- 2/ Where closer tolerances are required, the maximum and minimum thicknesses shall be as specified in the particular order.

3.9.2 Form Rm (rods) - Unless otherwise specified, rods shall be furnished in manufacturer's standard lengths of 24 to 36 inches with a tolerance of plus or minus 1 inch. Where rods are to be furnished cut to length, they shall be circular sawed within the tolerances shown in Table V.

TABLE V

TOLERANCES ON ROD LENGTHS

Rod length	Tolerances, plus or minus, for rods of the following diameter	
	1/4 to 1-5/16 inches	2 to 4 inches
Inches	Inch	Inch
0 to 3, inclusive	0.010	0.010
Over 3 to 6, inclusive	0.010	0.015
Over 6 to 12, inclusive	0.015	0.020
Over 12	0.030	0.030

3.9.2.1 Round rods shall be furnished in diameters as specified. The tolerances shown in Table VI shall apply.

MIL-P-5431A (AS)

TABLE VI

TOLERANCES ON ROD DIAMETERS

For nominal diameters		Tolerances plus or minus
From	Up to and including	
Inches	Inches	Inch
1/4	1-15/16	0.005
2	4	0.008

3.9.3 Form Tm (tubing) - Unless otherwise specified, tubing may be furnished in manufacturer's standard lengths with a tolerance of plus or minus 1 inch. Where so specified, the tubing shall be furnished cut to length, circular sawed, within the tolerances specified in Table VII.

TABLE VII

TOLERANCES ON LENGTH OF TUBING

Length	Tolerances, plus or minus, for tubing of following outside diameters		
	3/16 to 2 inches	2 to 4 inches	Over 4 inches
Inches	Inch	Inch	Inch
0 to 3, inclusive	0.010	0.010	0.030
Over 3 to 6 inclusive	0.010	0.015	0.030
Over 6 to 12, inclusive	0.015	0.020	0.030
Over 12 to 48, inclusive	0.030	0.030	0.050

3.9.3.1 Standard sizes - The following steps shown in Table VIII shall be considered standard for inside and outside diameter sizes of round tubing.

MIL-P-5431A(AS)

TABLE VIII

NOMINAL TUBING SIZES

Nominal inside and outside diameters in inches	By steps of
1/4 to 1, inclusive	1/32
Over 1 to 3, inclusive	1/16
Over 3 to 6, inclusive	1/8
Over 6 to 8, inclusive	1/4

3.9.3.2 Tolerance, inside and outside - Round tubing shall conform to the specified dimensions for nominal inside and outside diameters, within the tolerances specified in Table IX.

TABLE IX

TOLERANCES ON TUBING DIAMETERS

Tube sizes	Tolerance (plus or minus)	
	Inside diameter	Outside diameter
Inches	Inch	Inch
1/4 to 23/32, inclusive	0.003	0.005
3/4 to 1-15/16, inclusive	0.004	0.005
2 to 4, inclusive	0.008	0.008
4-1/8 to 12, inclusive	0.010	0.025

3.9.3.3 Tolerances, wall thickness - Tubing shall conform to the wall thickness tolerances specified in Table X.

3.9.4 Form U (shapes) -

3.9.4.1 General - The dimensions of laminated graphited phenolic material in the form of special shapes shall be as specified in the particular order or as shown on drawings.

MIL-P-5431A(AS)

TABLE X

TOLERANCES ON TUBING WALL THICKNESS

Wall thickness	Thickness tolerances, plus or minus
Inch	Inch
1/16 and less than 1/8	0.015
1/8 and less than 1/4	0.020
1/4 to 1/2, inclusive	0.020

3.9.4.2 Tolerances - Where shapes are in the form of angles, channels, or rectangular tubes, the dimensions specified in the contract or order shall be maintained within the tolerances shown in Table XI. Permissible warp shall be as specified in the order or as shown on drawings.

TABLE XI

TOLERANCES ON SHAPES

Maximum cross-sectional dimensions	Tolerances, plus or minus
Inches	Inch
Less than 2	0.015
2 to 4	0.020
Over 4 to 12	0.025
Over 12	0.030

3.10 Marking - Each sheet, rod, tube or shape shall be marked with the manufacturer's name or trademark, lot number, and the specification number. The method of marking or the material used shall not be deleterious to the phenolic material, and shall not affect its use. The method of marking shall be approved by the procuring activity.

3.11 Workmanship - Workmanship shall be in accordance with high-grade commercial practice for this type of fabrication.

MIL-P-5431A (AS)

4. QUALITY ASSURANCE PROVISIONS

- * 4.1 Responsibility for inspection - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.
- * 4.2 Classification of tests - The inspection and testing of phenolic graphited laminated material shall be classified as follows:
 - (a) Preproduction tests (4.3)
 - (b) Quality conformance tests (4.4)
- * 4.3 Preproduction tests - Preproduction tests shall consist of all the tests of this specification. The responsibility for the performance of the preproduction tests shall be as specified in the contract or order (see 6.2).
 - 4.3.1 Preproduction test samples -
 - * 4.3.1.1 Sampling - Preproduction test samples shall consist of one sheet of the material 24 by 30 inches by 1/2 inch thick, one sheet 12 by 12 inches by 1/2 inch thick and one sheet of material 21 inches long by 1-3/4 inches wide by one inch in thickness (Laminations perpendicular to the one inch dimension) selected at random from a lot. Samples shall be individually identified as required and forwarded to a laboratory designated in the contract, purchase order, or invitation for bids (see 6.2). Each sample shall be accompanied by the contractor's test report, prepared in accordance with MIL-STD-831, and the manufacturer's instructions.
 - * 4.4 Quality conformance tests - Quality conformance tests shall consist of Examination of product and sampling tests, and shall be performed on each lot of material.
 - * 4.4.1 Sampling - Sampling tests shall be conducted on material selected from production lots under one contract or order. The samples shall represent as nearly as possible all thicknesses or sizes contained in the lot, and sampling tests shall be conducted in accordance with MIL-STD-105, Inspection Level S-1, AQL 1.0 percent.
 - * 4.4.1.1 Lot - A lot shall consist of all material of a particular form processed from a coating operation in which the basic resin, filler and treating conditions are the same.

MIL-P-5431 A(AS)

- * 4.4.2 Examination of product - Each sheet, rod, tube, or shape shall be examined to determine conformance with the requirements of this specification with respect to material, color, surface finish, surface defects, dimensions and tolerances, marking and workmanship.
- * 4.5 Test conditions - Unless otherwise specified, all specimens shall be conditioned in accordance with Fed. Test Method Std. No. 406.
- 4.6 Tests -
 - * 4.6.1 Graphitic content in phenolic resin - The manufacturer shall certify that the phenolic resin used for bonding the fabric reinforcement (see 3.2) shall contain 6.4 to 6.6 percent by weight of graphite conforming to MIL-G-6711.
 - 4.6.2 Machineability - The tests for machineability of laminated phenolic material shall be performed on test samples by a skilled mechanic who shall employ the same technique on all materials in the "as received" condition in order to obtain an idea as to the relative ease or the difficulty of machining in each case. In addition, the machining properties in the preparation of specimens for the physical tests specified hereinafter shall be noted.
 - 4.6.3 Warp and twist -
 - * 4.6.3.1 Sheets - The warp and twist of a 24 by 30 by 1/2 inch sheet shall be determined in accordance with Method 6051 of Fed. Test Method Std. No. 406.
 - 4.6.3.2 Warp (rods and tubing) -
 - 4.6.3.2.1 Apparatus - A horizontal flat surface and a rigid bar with a vertically plane surface firmly fixed at right angles to the flat surface, both at least as long as the specimen, shall be used. The height of the bar shall exceed half the outside diameter of the tube or rod. Feeler gages of suitable thicknesses will also be required.
 - 4.6.3.2.2 Procedure - The specimen shall be placed on the horizontal flat surface and rotated against the vertically plane surface of rigid bar. The bar shall be firmly fastened to the horizontal flat surface. With the aid of feeler gages, the maximum distance between the tube or rod and the vertically plane surface shall be measured to the nearest 0.001 inch.
 - 4.6.3.2.3 Report and calculation - Warp or lack of straightness shall be reported as the maximum distance of any part of the tube or rod from a straight edge which connects the ends of the specimen. The minimum length tested for warpage shall be 24 inches. The warpage shall then be calculated as follows:

$$W_{36} = \frac{36D \times 100}{L^2}$$

MIL-P-5431A(AS)

Where: W_{36} = Percentage of warp, calculated to a 36-inch length.
 D = Maximum deviation of tube or rod from straight edge in inches.
 L = Length of tube or rod in inches.

4.6.4 Tensile strength - Any standard testing machine may be used provided it is accurate to within one percent of the lowest load to be applied. Jaws which tighten over load, such as wedge-grip jaws, shall be used, with the specimen properly aligned. The specimen holders shall be attached to the heads of the machine by links held so that the pull is central to avoid any transverse strain. The speed of the head of the testing machine shall be in the range of 0.15 to 0.25 inch per minute while under load. The test specimens shall conform to the Type I specimens of Method 1011 of Fed. Test Method Std. No. 406. At least five specimens cut in each of the directions specified in Table II shall be broken for this test, and the results averaged for each direction.

4.6.5 Compressive strength -

4.6.5.1 Sheet - Any standard testing machine may be used, provided it is accurate to within one percent of the lowest load for which it is used. One end of the specimen shall bear upon an accurately centered spherical bearing block, located, whenever practicable, at the top, and the metal bearing plates shall be directly in contact with the ends of the test specimen. The pressure heads used for standard compressive tests of cement are satisfactory for this test. The load shall be applied on the ends of the specimen and the speed of the testing machine shall be such that the machine can be kept balanced. The rate of loading shall not exceed 0.050 inch per minute. Specimens shall be machined cubes 1/2 inch square and 1/2 inch in thickness. At least five specimens taken in the flatwise direction of the sheet and at least ten specimens taken in the edgewise direction of the sheet shall be tested, and the results averaged for each direction. Five of the edgewise specimens shall be tested in the strongest direction of the sheet and five shall be tested in the 90 degrees to the strongest direction of the sheet.

* 4.6.5.2 Axially for rods and tubes - The axial compressive strength shall be determined by Method 1021 of Fed. Test Method Std. No. 406, except that the specimen length shall be as shown in Table XII. Five specimens from each sample shall be tested and the results averaged.

4.6.6 Flexural strength -

* 4.6.6.1 Sheets - Five specimens from each sample cut in the strongest direction of the sheet, and five samples cut at 90 degrees to the strongest direction shall be tested flatwise in accordance with Method 1031 of Fed. Test Method Std. No. 406, except that the dimensions and speed of test shown in Table XIII shall be used and that specimens over 1 inch in nominal thickness shall be machined on both surfaces to a specimen thickness of 1 inch. The results for each direction shall be averaged.

MIL-P-5431A(AS)

TABLE XII
SPECIMEN LENGTHS

Outside diameter of the tube or rod (inches)	Length of specimen (inches)
Rods: 1/8 to 1/4, inclusive	1/2
Above 1/4 to 1/2, inclusive	1
Above 1/2 to 1, inclusive	2
Above 1 to 2, inclusive	4
Tubes: Up to 2, inclusive	1

TABLE XIII
DIMENSIONS OF SPECIMEN AND SPEED OF TEST

Nominal specimen thickness	Width of specimen	Length of specimen	Span	Speed of test per minute
Inch	Inch	Inches	Inches	Inch
1/32	1	2-1/2	5/8 ¹ / ₁	0.025
1/16	1	3	1	0.026
3/32	1	3-1/2	1-1/2	0.040
1/8	1	4	2	0.053
3/16	1/2	5	3	0.080
1/4	1/2	6	4	0.106
3/8	1/2	8	6	0.160
1/2	1/2	10	8	0.213
3/4	3/4	14	12	0.320
1	1	18	16	0.426

¹/₁ This span depth ratio is greater than 16 to 1 in order to give clearance between moving head and specimen supports.

4.6.6.1.1 Procedure - The breadth and depth of the specimens shall be measured to the nearest 0.001 inch. The span length shall be measured to the nearest 0.01 inch. No modulus data need be taken. Care shall be taken that the specimens are centered properly in the jig prior to being tested.

MIL-P-5431 A(AS)

4.6.6.1.2 Calculations - The maximum fiber stress shall be calculated as follows:

$$\text{Maximum fiber stress} = \frac{3 PL}{2bd^2}$$

Where: P = breaking load in pounds.
L = the span in inches.
b = breadth of specimen in inches.
d = depth of specimen in inches.

4.6.6.2 Rods -

4.6.6.2.1 Specimens - The test specimen shall have a diameter equal to the diameter of the rod and a span - depth ratio of eight to one shall be used. For rods over one-half inch in diameter, specimens shall be machined to a diameter of one-half inch and specimens 5 inches long shall be cut. Specimens shall be limited to 1/4 to 1 inch in diameter. Five specimens from each sample shall be tested and the results averaged.

4.6.6.2.2 Procedure - The procedure shall be as specified in 4.6.6.1.1 except that the maximum permissible rate of head travel shall be 0.05 inch per minute and the specimens shall be prepared as stated above. The maximum flexural, or fiber stress in psi shall be calculated from the following formula:

$$\text{Flexural strength, } S = \frac{8 PL}{\pi d^3}$$

Where: P = The breaking load applied in pounds.
L = The span or distance between supports.
d = the machined diameter in inches.

4.6.7 Moisture absorption - The test for water absorption shall be conducted in accordance with the procedure described in Method 7031 of Fed. Test Method Std. No. 406, except that the oven conditioning shall be $105 \pm 2^\circ \text{C}$ for one hour (-0, +6 minutes), and no correction shall be made for water-soluble matter. The average of the results on five specimens from each sample shall be taken to determine the percent water absorbed.

4.6.8 Hardness - Hardness shall be determined in accordance with Method 1080 of Fed. Test Method Std. No. 406, using the Rockwell -M scale. The average of 10 readings shall be taken as the hardness of the sample.

4.6.9 Specific gravity - The specific gravity shall be determined at 25°C (77°F) with respect to water at 4°C (39°F). The average of the results on five specimens from each sample shall be taken as the specific gravity.

MIL-P-5431A(AS)

4.6.10 Plastic flow - The test specimens shall be machined cubes 1/2 inch square and 1/2 inch in thickness. The same apparatus as used for the "Compressive strength" test shall be used, and in addition, provision shall be made for maintaining the specimen at 120° F for 24 hours at a 4,000 psi load. The specimen shall be so placed between the testing heads that the load is applied perpendicular to the laminations. The specified load shall then be applied to the specimen and maintained at this value, within ± 20 pounds, for the specified time. The amount of flow shall be determined by means of a dial gauge suitably arranged to measure the relative movement between the fixed and movable heads in line with the axis of the specimen, over the compression period. The amount of plastic flow shall be calculated in percent, using the original thickness of the specimen as 100 percent. Five specimens shall be tested and the results averaged.

* 4.6.11 Interlaminar bonding strength - Test specimens prepared as shown in Figure 1 shall be subjected to tension loading in the manner shown by Figure 2. The cement used for attaching the plastic specimen to the aluminum alloy cylinders shall conform to MMM-A-132. Five specimens shall be prepared and tested to failure in tension, and the results averaged. The rate of loading shall not exceed 0.050 inch per minute.

* 4.6.12 Rejection criteria - Failure of any specimen to meet the test requirements specified herein shall be cause for rejection of the lot represented.

5. PREPARATION FOR DELIVERY

* 5.1 Preservation and packaging - Preservation and packaging shall be Level A or C as specified (see 6.2).

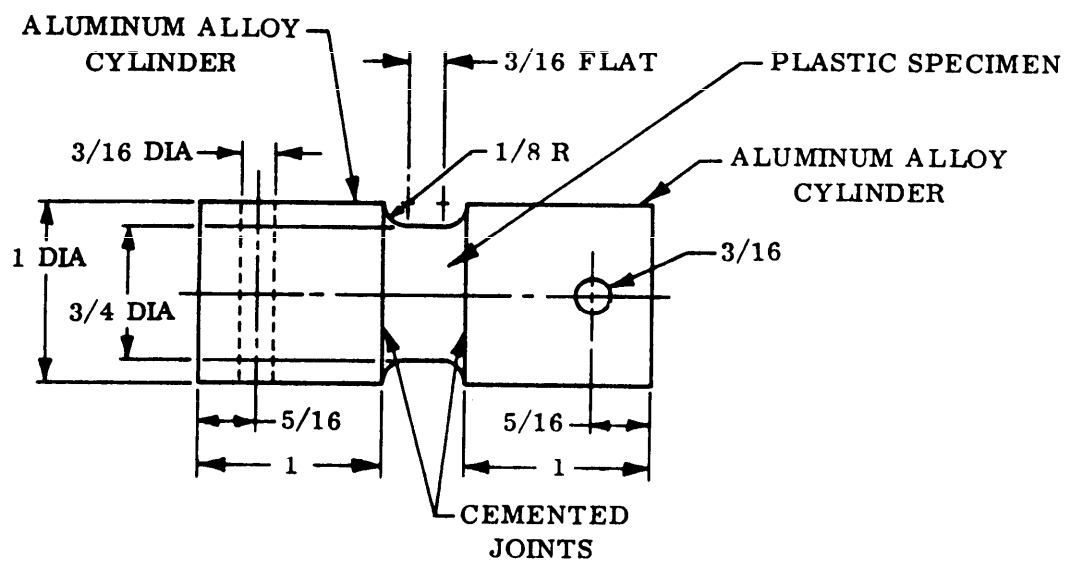
* 5.1.1 Level A - Method III of MIL-P-116 shall be used for Level A packaging in accordance with the requirements of MIL-P-7936. Sheets shall be wrapped individually, or interleaved, using not less than 25-pound basis weight kraft paper.

* 5.1.2 Level C - Sheets, rods, tubes and shapes shall be packaged in accordance with the manufacturer's commercial practice.

* 5.2 Packing - Packing shall be Level A or C as specified (see 6.2).

5.2.1 Level A - Sheets, rods, tubes, and shapes shall be packed in overseas-type wirebound wood, wood-cleated fiberboard, wood-cleated plywood, nailed wood or fiberboard boxes, (Class Weather Resistant) conforming to PPP-B-585, PPP-B-591, PPP-B-601, PPP-B-621, and PPP-B-636, respectively, at the option of the manufacturer. Box closure shall be as specified in the applicable box specification or appendix thereto. The gross weight of wood boxes shall not exceed 200 pounds; fiberboard boxes shall not exceed the weight limitations of the applicable box specification.

MIL-P-5431A(AS)



DIMENSIONS IN INCHES.

FIGURE 1. SPECIMEN FOR INTERLAMINAR BONDING STRENGTH TEST

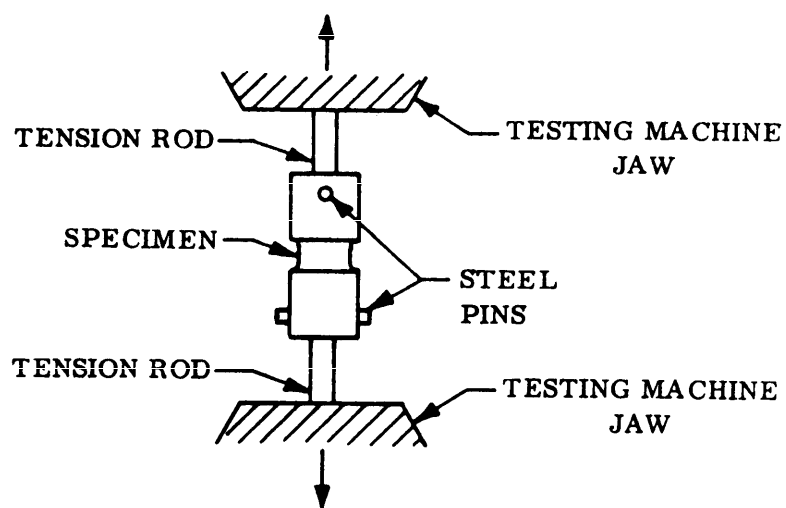


FIGURE 2. INTERLAMINAR BONDING STRENGTH TEST SET-UP

MIL-P-5431A(AS)

- * 5.2.2 Level C - Sheets, rods, tubes and shapes packaged as specified in 5.1 shall be packed in a manner to insure carrier acceptance and safe delivery at destination. Containers shall be in accordance with Uniform Freight Classification Rules or regulations of other carriers applicable to the mode of transportation. This may be the supplier's commercial practice when such meets the requirements of this level.

5.3 Marking - In addition to any special marking required by the contract or order, unit packages, and shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use - The graphited, laminated phenolic material covered by this specification is intended for use in making bearings, spacers and catapult parts. The material is especially suitable for parts which may be subjected to a combination of high pressures and high surface speeds acting over short periods of time. It may be used with water as a coolant, or with oil or grease as a lubricant. Metal surfaces in rubbing contact with this material should be finished smooth, preferably by surface grinding.

- * 6.2 Ordering data - Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Form required (see 1.2).
- (c) Particular dimensions, if required (see 3.9).
- (d) Thickness of sheet required (see 3.9.1.1).
- (e) Special tolerances on tubes, if required (see 3.9.3).
- (f) Finish required (see 3.5).
- (g) Selection of applicable levels of preservation, packaging and packing (see 5.1 and 5.2).

- * 6.3 Changes from previous issue - The outside margins of this document have been marked "*" to indicate where changes (deletions, additions, etc.) from the previous issue have been made. This has been 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 as written irrespective of the marginal notations and relationship to the last previous issue.

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE NAVY
Commanding Officer
Naval Air Engineering Center
Systems Engineering Standardization Department
(SESD), Code 93
Lakehurst, NJ 08733

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

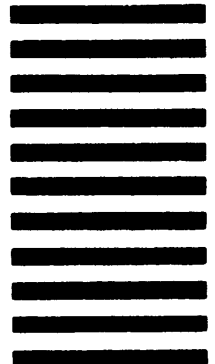
BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 12503 WASHINGTON D C

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE NAVY

Commanding Officer
Naval Air Engineering Center
Systems Engineering Standardization Department
(SESD). Code 93
Lakehurst, NJ 08733

ATTN: TJM (9322)



STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL*(See Instructions - Reverse Side)***1. DOCUMENT NUMBER****2. DOCUMENT TITLE****3a. NAME OF SUBMITTING ORGANIZATION****4. TYPE OF ORGANIZATION (Mark one)**☐**VENDOR**☐**USER**☐**MANUFACTURER**☐**OTHER (Specify):** _____**b. ADDRESS (Street, City, State, ZIP Code)****5. PROBLEM AREAS****a. Paragraph Number and Wording:****b. Recommended Wording:****c. Reason/Rationale for Recommendation:****6. REMARKS****7a. NAME OF SUBMITTER (Last, First, MI) - Optional****b. WORK TELEPHONE NUMBER (Include Area Code) - Optional****c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional****8. DATE OF SUBMISSION (YYMMDD)**

TO DETACH THIS FORM, CUT ALONG THIS LINE.)