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MILITARY SPECIFICATION

# PLASTIC SHEET, ACRYLIC, MODIFIED

This limited coordination military specification has been prepared by the Naval Air Systems Command based upon currently available technical conformation but it has not been approved for promulgation as a coordinated revision of MIL-P-8184. It is subject to modification. However, pending its promulgation as a coordinated military specification, it may be used in acquisition.

## 1. SCOPE

1.1 Scope. This specification covers optical quality transparent, cast acrylic sheet material which is superior to conventional acrylic material in craze and heat resistance.

* 1.2 Classification. The acrylic sheet shall be of the types, classes grades and thicknesses as specified (see 6.2.1).

* 1.2.1 Types

Type I - Suitable for use in stretching operations
Type II - Not suitable for stretching.

*1.2.2 Classes

Class 1 - Standard moisture craze resistance
Class 2 - Improved moisture craze resistance

1.2.3 Thickness. Thicknesses shall be as specified in Table I.

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Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Engineering Specifications and Standards Department (Code 93), Naval Air Engineering Center, Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. Unless otherwise specified, the following specifications, standards and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

| | | |
|---|---|---|
| NN-P-530 | - | Plywood, Flat Panel. |
| TT-I-735 | - | Isopropyl Alcohol. |
| TT-T-266 | - | Thinner, Dope and Lacquer (Cellulose-Nitrate). |
| TT-W-572 | - | Wood-Preservative, Water-Repellent. |
| PPP-B-585 | - | Box, Wood, Wirebound. |
| PPP-B-591 | - | Boxes, Shipping, Fiberboard, Wood-Cleated. |
| PPP-B-601 | - | Boxes, Wood, Cleated Plywood. |
| PPP-B-621 | - | Box, Wood, Nailed and Lock Corner. |

MILITARY

| | | |
|---|---|---|
| MIL-L-10547 | - | Liner, Case and Sheet, Overwrap, Water Vaporproof or Waterproof, Flexible. |

STANDARDS

MILITARY

| | | |
|---|---|---|
| MIL-STD-105 | - | Sampling Procedures and Tables for Inspection by Attributes. |
| MIL-STD-129 | - | Marking for Shipment and Storage. |

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the acquisition activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | | |
|---|---|---|
| ASTM D 542 | - | Index of Refraction of Transparent Organic Plastics. |
| ASTM D 570 | - | Water Absorption of Plastics. |
| ASTM D 635 | - | Rate of Burning and/or Extent of Time of Burning of Self-Supporting Plastics in a Horizontal Position. |
| ASTM D 637 | - | Surface Irregularities of Flat Transparent Plastic Sheets. |
| ASTM D 638 | - | Tensile Properties of Plastics. |
| ASTM D 648 | - | Deflection Temperature of Plastics Under Flexural Load. |
| ASTM D 696 | - | Coefficient of Linear Thermal Expansion of Plastics. |
| ASTM D 792 | - | Specific Gravity and Density of Plastics by Displacement. |
| ASTM D 1003 | - | Haze and Luminous Transmittance of Transparent Plastics. |
| ASTM G 26 | - | Operating Light-Exposure Apparatus (Xenon-Arc Type) with and without Water for Exposure of Non-metallic Materials |

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

UNIFORM CLASSIFICATION COMMITTEE, AGENT

Uniform Freight Classification Rules

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

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

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Qualification. The acrylic sheets furnished under this specification shall be products which are qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.3 and 6.3).

* 3.2 Materials. The plastic sheet shall be an acrylic type. The manufacturer is given a wide range in the selection of raw acrylic type material and in the process of manufacture, provided the sheet material furnished is a transparent plastic conforming to all requirements of this specification as applicable, and is suitable for the intended use.

3.3 Dimensions.

3.3.1 Length and width. Unless otherwise specified, dimensions of the sheets shall be as specified by applicable drawings or specifications. Unless otherwise specified, a tolerance of $\pm$ 0.063 inch shall be permitted on length and width dimensions for trimmed sheets at 23° $\pm$ 1°C (73.5° $\pm$ 2°F).

3.3.2 Thickness. Thickness shall be as specified in table I. The actual thickness, when examined as specified in 4.6.14, shall be within the tolerances in table I. Tolerances for those thicknesses not in table I shall not exceed the tolerance for the next larger thickness.

3.4 Color. Unless otherwise specified by the acquisition activity, the material shall contain no added dyes or pigments.

3.5 Specific gravity. The specific gravity of the conditioned material shall be 1.19 ± 0.01, when determined as specified in 4.6.1.

* 3.6 Water Absorption. When determined in accordance with 4.6.1, the water absorption of the conditioned material from each class shall not exceed the values given in table I.

3.7 Flammability. When tested as specified in 4.6.1, the rate of burning for a 0.500 inch width of material shall not exceed the values given in table I.

3.8 Thermal expansion. The coefficient of thermal expansion shall not exceed 0.00010 inch/inch/degree Centigrade (0.000055 inch/inch/degree Fahrenheit), when tested in accordance with 4.6.2.

3.9 Formability. Formability shall be determined as specified in 4.6.3. The material shall be suitable for forming into hemispheric shapes with an outside diameter of 10 inches and a draw of at least 4.5 inches.

3.10 Internal strain. The dimensional change after testing as specified in 4.6.4 shall not exceed 1 percent. Large values of dimensional change indicate the relief of high internal stress.

3.11 Flexural deformation temperature. The flexural deformation temperature of the acrylic sheet shall be within the range specified for thickness in table I when tested as specified in 4.6.5.

* 3.12 Mechanical properties.

3.12.1 Tensile strength. The tensile strength of materials as received shall be not less than 9,000 psi, when tested in accordance with 4.6.6.1 (see 4.6.6 for specimen preparation).

3.12.2 Elongation. The mean elongation immediately before fracture shall be not less than 2 percent as determined in 4.6.6.2.

3.12.3 Warpage after accelerated weathering. The warpage of the plastic after accelerated weathering shall not exceed the value given in table I as determined in 4.6.13.1. The specimen shall show no evidence of cracking, crazing or surface instability.

3.13 Instruction sheet. On direct purchases by the Government, an instruction sheet shall be furnished in each shipping container (see 5.2). Specific information or reference shall be made to the limitations of the material and the necessary precautions to be observed in handling, storing, cutting, drilling, machining, forming, bending, cementing, abrading, polishing and cleaning. The description of all compounds, materials and equipment mentioned therein shall be given in sufficient detail to permit nonproprietary acquisition, using Government specifications when available. Instruction sheets shall be approved by the acquisition activity (see 4.3.3).

* 3.14 Optical properties.

3.14.1 Property. Materials as received and after exposure to accelerated weathering shall conform to the requirements of table II.

3.14.2 Resistance to weathering. After exposure to accelerated weathering at the conditions specified in 4.6.13, specimens shall show no evidence of cracking, crazing or other indications of surface instability that could affect visability, except that scratches incident to exposure may be disregarded.

3.14.3 Optical uniformity.

3.14.3.1 Minor optical defects. The total number of minor optical defects in material which is 0.500 inch or less in thickness shall not exceed a limit determined by dividing the area of the sheet, measured in square feet, by 4. The total number of minor optical defects in material over 0.500 inch in thickness shall not exceed 1 per square foot. Minor defects include any imbedded particles, bubbles or scratches which reduce visibility through the plastic, and those localized imperfections which cause a variation in angular deviation of more than 5 minutes within a distance of not more than 20 inches on the screen when tested as specified in table III. It is not intended that the entire sheet be quantitatively surveyed for such variation in deviation but that localized imperfections which are suspected of being detrimental be evaluated by means of this test. Blemishes which do not individually reduce visibility through the plastic shall be disregarded unless they are grouped in an objectionable pattern. Minor defects within 1 inch from the nominal trimmed sheet edge shall be disregarded.

3.14.3.2 Angular deviation. The material shall contain no major defect. Major defects are defined as any variations in the material which cause angular deviations either side of the undeviated position in excess of the limits specified in table III

3.14.4 Thermal stability. The material shall show no evidence of blistering, crazing or other evidence of thermal instability when tested as specified in 4.6.10.

3.14.5 Properties of colored material. When colored material is furnished, the limits of spectral transmittance and haze before and after accelerated weathering shall be as specified by the acquiring activity.

3.14.6 Crazing. The material shall show no evidence of crazing, cracking or other chemical degradation in the area subjected to the action of lacquer thinner or isopropyl alcohol as described in 4.6.12. Edge crazing shall be disregarded.

3.15 Identification of product. The protective covering (see 5.1) of each individual sheet shall be marked with the specification number, Type, Class, nominal thickness, and the manufacturer's code for his approved product. The protective covering shall be distinctly marked at intervals of 1 foot (see 5.3.1).

3.16 Workmanship. Workmanship shall be in accordance with high-grade practice for this type of product. The finished sheet shall be free from such bubbles, striae and other defects as would render the material unfit for the purpose of viewing objects through it. Since this specification does not apply to formed, molded or fabricated parts, workmanship beyond the production of polished plane sheet materials is not included.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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

a. Qualification inspection (see 4.3).

b. Quality conformance inspection (see 4.4).

4.3 Qualification. Qualification inspection shall consist of all the tests specified in table IV.

4.3.1 Qualification test sample.

* 4.3.1.1 Sheet sample. To obtain qualification approval for all thicknesses, the sample shall consist of at least 10 square feet of trimmed sheets in each of 0.060 inch, 0.250 inch, 0.500 inch, 1.00 inch and 2.00 inch thicknesses. Individual sheet dimensions shall be at least 12 by 18 inches. If a manufacturer requests approval for a specific thickness, he shall submit 10 square feet of that thickness. A portion of the sheet sample shall be used by the manufacturer to prepare the specimens required in 4.3.1.2, with the remaining sheet material submitted to the qualifying laboratory (see 4.3.2).

* 4.3.1.2 Test specimen samples. A portion of the sheet sample (see 4.3.1.1) shall be used by the manufacturer to prepare sufficient test specimens to complete the tests specified for flammability (4.6.1), tensile properties (see 4.6.6), flexural deformation (see 4.6.5), thermal expansion (see 4.6.2), crazing (see 4.6.12), formability (see 4.6.3) and ultraviolet transmittance (see 4.6.7). Preparation of these specimens requires the sample to be machined and polished to specific thicknesses required by the applicable test.

* 4.3.2 Forwarding of qualification samples. The qualification samples from 4.3.1.1 and 4.3.1.2 shall be forwarded to the Commander, Naval Air Development Center, Warminster, PA 18974, Attention: Aircraft and Crew Systems Technical Directorate (Code 6063). The samples shall be segregated by thickness (machined samples shall be identified as to original thickness). The samples shall be plainly and durably marked with the following information:

Sample for qualification tests
PLASTIC SHEET, ACRYLIC, MODIFIED
Type and Class
Plant address (where manufactured)
Submitted by (name) (date) for qualification testing in accordance with the requirements of MIL-P-008184D under (reference authorizing letter) (see 6.3).

4.3.3 Manufacturer's data. Two copies of the manufacturer's test report shall be submitted with the samples of 4.3.1. The report shall contain numerical test data, where applicable, showing that the material submitted for the qualification inspection conforms to the requirements of this specification. In addition, two copies of the manufacturer's instruction sheet (see 3.13) shall be furnished at this time.

4.3.4 Retention of qualification. In order to retain qualification of a product approved for listing on the Qualified Products List (QPL), the manufacturer shall verify by certification to the qualifying activity that the manufacturer's product complies with the requirements of this specification. The time of periodic verification by certification shall be in two-year intervals from the date of original qualification. The Government reserves the right to re-examine the qualified product whenever deemed necessary to determine that the product continues to meet any or all of the specification requirements.

4.4 Quality conformance.

* 4.4.1 Lot formation. Unless otherwise specified, a lot shall consist of the total number of sheets of one type and class forming part of the contract or order, submitted for delivery at one time.

4.4.2 Sampling.

4.4.2.1 Visual inspection sampling. The samples for inspections of 4.4.3.1 and 4.4.3.2 shall be a quantity of plastic sheets randomly selected from each lot in accordance with the procedures of MIL-STD-105 and table V. The sample unit shall be one plastic sheet.

4.4.2.2 Packaging inspection sampling. A quantity of shipping containers fully prepared for shipment, just prior to closure, shall be selected in accordance with MIL-STD-105 and table V. The lot size, for purposes of this inspection, shall be the total number of shipping containers. The sample unit shall be one shipping container. Inspection shall be in accordance with 4.4.3.3.

4.4.2.3 Physical and mechanical testing.

4.4.2.3.1 Direct Government purchase. The sample shall be randomly selected from each lot in accordance with MIL-STD-105 and table V, except that no fewer than 3 sample units shall be taken. The sample unit shall be one sheet of at least 4 square feet with a minimum dimension of 12 inches. Each sample unit selected shall be inspected as specified in 4.4.3.4.

4.4.2.3.2 Indirect Government purchases. For those purchases which are not direct Government purchase, the sample size shall be ten sheets (sample units) randomly selected from each lot at the rate of one or two sheets per production day. When production levels are less than 1,000 sheets weekly, one sample unit shall be selected from each 100 sheets produced that week. Each sample unit shall be of sufficient size to prepare the specimens required in table IX. Testing of the sample shall be in accordance with 4.4.3.4.

4.4.3 Inspections.

4.4.3.1 Appearance and workmanship. Each sample unit selected in accordance with 4.4.2.1 shall be inspected to the characteristics in table VI. Minor optical imperfections and blemishes shall be evaluated as specified in 3.14.3.1 before being scored as defects.

4.4.3.2 Dimensional. Each sample unit selected in 4.4.2.1 shall be inspected for dimensional defects in accordance with table VII.

4.4.3.3 Packaging inspection. Samples selected as specified in 4.4.2.2 shall be examined for conformance to table VIII and Section 5 of this specification. In addition shipping containers fully prepared for delivery shall be examined for closure defects.

4.4.3.4 Physical and mechanical inspection. Samples selected as specified in 4.4.2.3.1 or 4.4.2.3.2 shall be tested to the requirements of table IX. The number of specimens for each sample unit and reporting of results shall be as specified therein. Failure of any requirement specified in table IX shall be cause to reject the indirect Government production lot represented by the sample.

4.5 Test conditions.

4.5.1 Standard conditions. Standard conditions shall be 25° ± 1°C (77° ± 2°F) and a relative humidity of 50 ± 5 percent. Unless otherwise specified, all tests and examinations shall be conducted at standard conditions.

4.5.2 Reporting of test results. Unless otherwise specified in the applicable test method, all results shall be reported as the average of the number of specimens being tested. Each individual value shall also be reported.

4.6 Test methods.

4.6.1 ASTM methods. Those requirements tested solely to ASTM methods are identified in table X. All other ASTM methods herein are included as part of a test method.

4.6.2 Thermal expansion. Two specimens, 0.250 inch thick, shall be tested in accordance with ASTM D 696.

4.6.3 Formability. Two specimens shall be formed to determine conformance to 3.9. Forming conditions shall be in accordance with the manufacturer's instructions. Material with a thickness up to 0.500 inch shall be tested in the as-cast form. Material of greater thickness shall be machined to 0.500 inch prior to testing.

4.6.4 Internal strain. Two conditioned 12-by-18 inch sheets shall be tested. Each sheet shall be considered as a 12-by-12 inch specimen supported by the remainder of the sheet. Two fine lines shall be scribed at right angles crossing the center of the 12-by-12 inch area. Finely scribed gage marks shall then be placed 2 inches from the edge of the 12-by-12 inch area on each of these lines. The distance between each pair of gage marks shall be measured to the nearest 0.01 inch and the data recorded. Each sheet shall be hung by one short edge in a circulating air oven at 160° ± 10°C (320° ± 18°F) for the times indicated below:

| Nominal sheet thickness, inches | Minimum heating time, minutes |
|---|---|
| 0.250 and less | 16 |
| 0.375 | 25 |
| 0.500 | 33 |
| 0.750 | 55 |
| 1.000 | 79 |
| 1.500 | 136 |
| 2.000 | 203 |
| 2.250 | 240 |

After removal from the oven, the specimens shall be permitted to cool to standard testing conditions (see 4.5.1) while hanging vertically. The distance between each pair of gage marks shall be remeasured. The dimensional change shall then be computed as the percent change in distance between the gage marks based on the first measurement. The mean of the four values shall be reported.

4.6.5 Flexural deformation temperature. Two specimens shall be tested in accordance with ASTM D 648, except as follows: The thickness of the sample being tested shall become the width of the specimen. Those thicknesses not in the range specified in ASTM D 648 shall be plied or machined. The unmachined surface shall be on a side. The load shall be calculated to give a maximum fiber stress of 264 psi. Each value shall be reported.

4.6.6 Tensile properties. Tensile and elongation specimens shall be prepared from as received thicknesses up to and including 0.500 inch. All other thicknesses shall be machined to 0.500 inch using the as-cast surface as the face of the specimen. The machined surface shall be polished. The specimens shall be type II specimens as described in ASTM D 638. Prior to testing, machined specimens shall be annealed for 2 hours at 90°C (194°F) and slowly cooled (less than 15°C (27°F) per hour) to 23°C (74°F) to relieve stresses induced during machining.

4.6.6.1 Tensile strength. Five specimens shall be tested in accordance with ASTM D 638.

4.6.6.2 Elongation. Elongation shall be determined just before break. Procedures shall be in accordance with ASTM D 638.

4.6.7 Ultraviolet transmittance. The spectral transmittance shall be determined using a monochromator having a band width of 10 millimicrons or less, and a photometer having a reproducibility of ± 1 percent using a 0.250 inch thick specimen.

4.6.8 Index of refraction. Three specimens shall be tested in accordance with the refractometer procedure of ASTM D 542. Requirements are for clear, colorless material.

4.6.9 Luminous transmittance and haze. Three specimens, 2 by 3 inches, shall be examined as specified in ASTM D 1003, procedure A or B, for light transmission and haze. The same specimens shall be subjected to accelerated weathering (see 4.6.13) After weathering, immerse the specimens in distilled water for not longer than ten seconds, remove surface moisture by blotting, then examine.

4.6.10 Thermal stability. Two conditioned 12-by-18 inch sheets shall be tested. Each sheet shall be hung in a circulating air oven, at 180° ± 5°C (356° ± 9°F) for 2 hours. After removal from the oven, the specimens shall be permitted to cool to standard conditions (see 4.5.1) while hanging vertically, then visually examined for conformance to 3.14.4.

4.6.11 Optical uniformity.

4.6.11.1 Localized imperfections. Local areas which, upon visual examination, are suspected of containing localized optical imperfections exceeding the limits of 3.14.3.1 shall be tested in accordance with ASTM D 637.

* 4.6.11.2 Angular deviation. The angular deviation shall be determined in accordance with ASTM D 637 except that the displacement factor (angular deviation minutes) shall be determined by multiplying the maximum image movement in inches on the screen by 12. Each sheet shall be examined, then rotated 90°, and re-examined for conformance to 3.14.3.2.

* 4.6.12 Crazing

4.6.12.1 Conditioning for specimens. Ten specimens 1 by 7 by 0.250 inch, shall be conditioned for 2 hours at 120° ± 1°C (248° ± 2°F) followed by 48 hours at standard testing conditions (see 4.5.1). Each specimen shall be tested as specified in 4.6.12.3.

* 4.6.12.2 Test procedure. Each specimen shall be set up as a cantilever beam under the load specified in figure 1(2000 psi for class 1, 3000 psi class 2). After application of the load for 10 minutes and while still under load, lacquer thinner conforming to TT-T-266 shall be applied to 5 specimens and isopropyl alcohol conforming to TT-I-735 to the other 5 specimens. The solvents shall be applied to the tension side of the specimens and centered directly above the fulcrum by means of 1/2-inch square filter paper patches soaked with the liquid. The patches shall be kept wet using an eyedropper to apply the solvent. The patches shall be removed after 30 minutes and the specimens examined for evidence of crazing, cracking or other chemical degradation.

4.6.13 Accelerated weathering. Specimens from 4.6.9 shall be subjected to accelerated weathering in accordance with Method A of ASTM G 26 for 240 hours. Each test specimen shall be visually examined for conformance to 3.14.2, then subjected to examinations for luminous transmittance and haze, 4.6.9. Specimens shall also be subjected to the warpage examination below.

4.6.13.1 Warpage after accelerated weathering. The accelerated weathering specimens shall be conditioned on a plane surface. After conditioning, the specimen shall be measured for warpage by determining the greatest distance from a straight edge connecting diagonally opposite corners to the near surface of the plastic. This distance may be measured by means of dial micrometer, thickness gage or any other device having an accuracy of 0.001 inch. The warpage reported shall be the maximum value, not an average (see 3.12.3).

4.6.14 Thickness. The thickness shall be measured by means of a dial micrometer, thickness gage or any other device having an accuracy of 0.001 inch. Thickness shall conform to 3.3.2.

## 5. PACKAGING

5.1 Preservation - packaging. Preservation - packaging shall consist of a protective covering on both sides of the plastic sheet. The protective covering shall be a suitably adhered paper or film that can be readily removed without injury or damage to the plastic surface (see 3.15). The covering shall adequately protect the surfaces from scratches or damage during shipment.

5.2 Packing. Packing shall be level A, B or Commercial, as specified (see 6.2.1). Containers shall be suitable for maintaining the plastic in its original condition. All internal loads shall be supported to avoid damage to surfaces by cleats, etc. An instruction sheet shall be included in each individual exterior container (see 3.14). All plastic sheets shall be packed as far as practicable by size and thickness.

5.2.1 Level A. Plastic sheets, packaged as specified in 5.1, shall be packed for shipment in overseas type containers conforming to PPP-B-585 (class 3), PPP-B-591, PPP-B-601 or PPP-B-621 (class 2, style 2). Plywood shall conform to NN-P-530, type I or II, grade 4 of group A. Plywood shall be treated in accordance with TT-W-572. Containers conforming to PPP-B-591 or PPP-B-601 shall be modified to the extent that solid wood ends and sides, in lieu of the cleated type, shall be used. Wirebound boxes conforming to PPP-B-585 shall be provided with fiberboard liners having a minimum Mullen test of not less than 275 pounds. All cleats shall be flush and containers shall be designed in a manner which will insure even weight distribution over the entire bearing surface when the sheets are stored. Containers shall be closed and strapped in accordance with the applicable container specification and appendix thereto. Containers conforming to PPP-B-585, PPP-B-591 or PPP-B-621 shall be provided with a case liner fabricated and sealed in accordance with MIL-L-10547. The gross weight of the shipping container, when packed for shipment, shall not exceed approximately 200 pounds, except when the weight of a single packed sheet exceeds this limitation.

5.2.2 Level B. Plastic sheets, packaged as specified in 5.1, shall be packed for shipment in domestic type containers conforming to PPP-B-585, PPP-B-591, PPP-B-601 or PPP-B-621 (class 1, style 2). Containers conforming to PPP-B-591 or PPP-B-601 shall be modified to the extent that solid wood ends and sides in lieu of cleated type shall be used. Wirebound boxes conforming to PPP-B-585 shall be provided with fiberboard liners having a minimum Mullen test of not less than 275 pounds. All cleats shall be flush and containers shall be designed in a manner which will insure even weight distribution over the entire bearing surface when the sheets are stored. Containers shall be closed and strapped in accordance with the applicable container specification and appendix thereto. The gross weight of the shipping container, when packed for shipment, shall not exceed 500 pounds, except when the weight of a single packed sheet exceeds this limitation.

5.2.3 Commercial. Packages which require over-packing for acceptance by the carrier shall be packed in exterior type shipping containers in a manner that will insure safe transportation at the lowest rate to the point of delivery. Containers shall meet Uniform Classification Rules or regulations of other common carriers as applicable to the mode of transportation.

5.3 Marking of shipment.

5.3.1 Marking of individual sheets. The protective covering (see 5.1) of each plastic sheet shall be distinctly marked, at intervals of 1 foot, with the following:

* a. Specification number (including Type and Class).

b. Nominal thickness.

c. Manufacturer's designation or code for the product.

In addition, the national stock number (NSN) shall be marked a minimum of one time on each protective covering.

5.3.2 Shipping containers. Each shipping container shall be marked to indicate method of packing and, in addition, shall be marked in accordance with the requirements applicable to the individual Services, as specified in MIL-STD-129. The identification shall be composed of the following information listed in the order shown:

* Stock number or other identification number as specified in the purchase order or contract.
PLASTIC SHEET, ACRYLIC, MODIFIED
MIL-P-008184D
Type, Class
Quantity.
Size and thickness.
Color of plastic sheet (when required).
Date of manufacture (month and year).
Stored items shall be issued by their date of manufacture (i.e., older items shall be issued first).
Contract or order no.
Name of manufacturer.
Name of contractor (if different from manufacturer).

NOTE: The contractor shall enter the NSN specified in the purchase document or as furnished by the acquiring activity. When the NSN is not provided or available from the acquiring activity, leave space therefor and enter the number or other identification as provided by the acquiring activity.

5.3.3 Additional marking. In addition to all other required markings, the top of each shipping container shall be marked with the following:

6. NOTES

* 6.1 Intended use. This modified acrylic plastic sheet is primarily intended for transparent areas on aircraft where a material with good optical, formability, crazing resistance, outdoor weathering and heat resistance properties is required. Type II materials shall not be used in stretching operations to produce sheets and forms conforming to MIL-P-25690.

6.1.3 Drawing references. Reference of this specification on drawings or in product specifications may be made in order to specify the flat material to be used in the fabrication of a part. It must be clearly understood that the requirements herein apply to the flat material prior to forming or fabrication and not necessarily to the material in its final form. The thickness of the material (see 1.2) must be specified on the drawings or product specification.

* 6.2 Ordering data.

6.2.1 Acquisition documents. Acquisition documents should specify the following:

a. Title, number and date of this specification.

b. Type and class.

c. Quantity.

d. Dimensions.

e. Color, spectral transmittance and haze, when required.

f. Selection of applicable levels of packing.

* 6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in Qualified Products List (QPL 8184) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Air Systems Command, Washington, DC 20361; however, information pertaining to qualification of products and letter of authorization for submittal of sample may be obtained from the Commander, Naval Air Development Center, Warminster, PA 18974, Attn: Aircraft and Crew Systems Technical Directorate (Code 6061).

6.4 Solubility. These acrylic plastic products may be attacked or undergo swelling in ketones, esters, aromatic hydrocarbons and chlorinated hydrocarbons.

6.5 Additional optical requirements. In the event material conforming to this specification is used for specialized optical purposes, more rigid optical requirements may be specified in the detail product specification. In this event, the requirements of the detailed specification prevail.

6.6 Variation of physical properties with temperature. Many physical properties of this material vary with temperature. This fact should be considered by designers, engineers, draftsmen and prospective users of the material.

6.7 Supersedure data. Supersedure data is as follows:

| MIL-A-8184B | MIL-A-8184C | MIL-A-008184D |
|---|---|---|
| Finish A | Finish A | Type I, Class 1 |
| Finish B | — | — |
| | | Type I, Class 2 (New) |
| | | Type II, Class 1 (New) |
| | | Type II, Class 2 (New) |

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

Preparing activity:
Navy - AS
(Project No. 9330-NB14)

TABLE I. Requirements which vary with thickness.

| Nominal thickness, inch | Tolerances | | | Heat deflection temperature | | Water absorption percent (max) | | Flammability inches per minute (max) | Warpage after accelerated weathering inch (max) |
|---|---|---|---|---|---|---|---|---|---|
| | Sheet up to 36 inches by 60 inches | Sheet sizes larger than 36 inches by 60 inches up to 60 inches by 80 inches | Sheet sizes larger than 60 inches by 80 inches up to 72 inches by 100 inches | degree centigrade (max) | degree centigrade (min) | Class 1 | Class 2 | | |
| 0.060 | ±0.012 | - | - | 112 | 87 | 1.00 | 0.50 | 1.60 | 0.030 |
| 0.080 | ±0.012 | ±0.020 | - | 114 | 89 | 0.80 | 0.40 | 1.55 | 0.020 |
| 0.100 | ±0.012 | ±0.020 | - | 116 | 91 | 0.70 | 0.35 | 1.45 | 0.020 |
| 0.125 | ±0.015 | ±0.020 | ±0.030 | 118 | 93 | 0.65 | 0.25 | 1.40 | 0.015 |
| 0.150 | ±0.017 | ±0.020 | ±0.030 | 119 | 94 | 0.60 | 0.25 | 1.37 | 0.015 |
| 0.187 | ±0.020 | ±0.023 | ±0.030 | 121 | 96 | 0.50 | 0.23 | 1.35 | 0.015 |
| 0.220 | ±0.023 | ±0.025 | ±0.030 | 122 | 97 | 0.45 | 0.20 | 1.35 | 0.015 |
| 0.250 | ±0.025 | ±0.030 | ±0.035 | 123 | 98 | 0.40 | 0.17 | 1.35 | 0.015 |
| 0.312 | ±0.30 | ±0.035 | ±0.040 | 124 | 99 | 0.36 | 0.17 | 1.35 | 0.015 |
| 0.375 | ±0.035 | ±0.040 | ±0.045 | 125 | 100 | 0.30 | 0.17 | 1.30 | 0.015 |
| 0.417 | ±0.040 | ±0.045 | ±0.045 | 125 | 100 | 0.28 | 0.15 | 1.30 | 0.015 |
| 0.500 | ±0.040 | ±0.045 | ±0.050 | 126 | 101 | 0.25 | 0.10 | 1.30 | 0.015 |
| 0.625 | ±0.050 | ±0.050 | ±0.055 | 126 | 101 | 0.23 | 0.10 | 1.20 | 0.015 |
| 0.750 | ±0.050 | ±0.050 | ±0.060 | 126 | 101 | 0.20 | 0.09 | 1.10 | 0.015 |
| 0.875 | ±0.050 | ±0.050 | ±0.070 | 126 | 101 | 0.20 | 0.09 | 1.10 | 0.015 |
| 1.000 | ±0.050 | ±0.050 | ±0.075 | 127 | 102 | 0.20 | 0.09 | 1.00 | 0.015 |
| 1.250 | ±0.063 | ±0.063 | ±0.094 | 127 | 102 | 0.20 | 0.09 | 1.00 | 0.015 |
| 1.500 | ±0.075 | ±0.075 | ±0.112 | 127 | 102 | 0.20 | 0.09 | 1.00 | 0.015 |
| 1.750 | ±0.088 | ±0.088 | ±0.131 | 127 | 102 | 0.20 | 0.09 | 1.00 | 0.015 |
| 2.000 | ±0.100 | ±0.100 | ±0.150 | 127 | 102 | 0.20 | 0.09 | 1.00 | 0.015 |
| 2.250 | ±0.113 | ±0.113 | ±0.168 | 127 | 102 | 0.20 | 0.09 | 1.00 | 0.015 |

TABLE II. Special physical properties.

| Characteristics | Condition of specimen as received | Condition of specimen After accelerated weathering | Test paragraph |
|---|---|---|---|
| Ultraviolet transmittance, 290 to 330 mu, percent, maximum: | 5.0 | - | 4.6.7 |
| Index of refraction | 1.49 ± 0.01 | - | 4.6.8 |
| Luminous transmittance of colorless sheet, percent, minimum: | | | 4.6.9 |
| Thickness, inch: | | | |
| 0.060 through 0.187 | 91 | 90 | |
| Over 0.187 through 0.312 | 90 | 89 | |
| Over 0.312 through 0.417 | 89 | 87 | |
| Over 0.417 through 1.250 | 88 | 86 | |
| Over 1.250 through 2.250 | 88 | 85 | |
| Colorless sheet, haze, percent, max. | 3.0 | 4.0 | 4.6.9 |

TABLE III. Angular deviation requirement.

| Sheet thickness | Limits of permissible deviation 1/ |
|---|---|
| 0.060 inch through 0.220 inch | 7 minutes at any location more than 1 inch from the edge of the sheet |
| Over 0.220 inch through 0.250 inch | 7 minutes at any location more than 3 inches from the edge of the sheet and 9 minutes between 3 inches and 1 inch of the edge |
| Over 0.250 inch through 0.375 inch | 7 minutes at any location more than 3 inches from the edge and 12 minutes between 3 inches and 1 inch of the edge |
| Over 0.375 inch through 0.500 inch | 7 minutes at any location more than 3 inches from the edge and 14 minutes between 3 inches and 1 inch of the edge |
| Over 0.500 inch through 1.00 inch | 12 minutes at any location more than 3 inches from the edge and 20 minutes between 3 inches and 1 inch of the edge |
| Over 1.000 inch through 2.250 inch | 20 minutes at any location more than 3 inches from the edge and 25 minutes between 3 inches and 1 inch of the edge |

1/ Major defects within 1 inch from the edge shall be disregarded.

TABLE IV. Qualification tests and inspections.

| Characteristics | Paragraph Requirement | Paragraph Test |
|---|---|---|
| Specific gravity | 3.5 | 4.6.1 |
| Water absorption | 3.6 | 4.6.1 |
| Flammability | 3.7 | 4.6.1 |
| Thermal expansion | 3.8 | 4.6.2 |
| Formability | 3.9 | 4.6.3 |
| Internal strain | 3.10 | 4.6.4 |
| Flexural deformation | 3.11 | 4.6.5 |
| Tensile strength | 3.12.1 | 4.6.6 |
| Elongation | 3.12.2 | 4.6.6 |
| Ultraviolet transmittance | 3.14.1 | 4.6.7 |
| Index of refraction | 3.14.1 | 4.6.8 |
| Luminous transmittance and haze | 3.14.1 | 4.6.9 |
| Thermal stability | 3.14.4 | 4.6.10 |
| Optical uniformity | 3.14.3 | 4.6.11 |
| Crazing | 3.14.6 | 4.6.12 |
| Resistance to weathering | 3.14.2 | 4.6.13 |
| Warpage | 3.12.3 | 4.16.13.1 |
| Workmanship | 3.16 | All |

TABLE V. Inspection levels and acceptable quality levels (AQL).

| Sampling | Inspection | Inspection level | Paragraph AQL 1/ |
|---|---|---|---|
| 4.4.2.1 | 4.4.3.1 | II | 1.0 major, 4.0 minor |
| 4.4.2.1 | 4.4.3.2 2/ | II | 1.0 |
| 4.4.2.2 | 4.4.3.3 | S-2 | 4.0 |
| 4.4.2.3.1 | 4.4.3.4 | S-3 | 4.0 |

1/ Percent defective.

2/ Sample units selected for 4.4.3.1 may be used in 4.4.3.2.

TABLE VI. Quality conformance appearance inspection.

| Examine | Defect | Classification of defect |
|---|---|---|
| Appearance | Any visible haze. | Minor |
| | Not free of dyes or pigments. | Minor |
| | Scratches, cut, cracked or otherwise damaged. | Major |
| | Protective sheets mark surfaces when removed, not easily peeled. | Minor |
| | Imbedded dirt, foreign material. | Major |
| Workmanship | Rough, uneven edges. | Minor |
| | Optical defects such as striae, bubbles, blisters, "fish-eyes" and other blemishes, except as described as minor defects. | See 3.14.3.1 |

TABLE VII. Quality conformance dimensional inspection.

| Examine | Defect |
|---|---|
| Length and width | Not as specified by the applicable drawings or specifications for stock size sheets. (Unless otherwise specified, a tolerance of $\pm$ 1/4 inch shall apply). Trimmed sheets varies by more than $\pm$ 0.06 inch from dimension specified. |
| Thickness | Varies by more than tolerances indicated in table I for applicable size sheet. |

TABLE VIII. Quality conformance packaging inspection.

| Examine | Defect |
|---|---|
| Packaging | Individual sheets not packaged as specified. |
| Packing | Packing material not as specified.<br>Not in accordance with contract requirements. |
| | Container not as specified, closure not accomplished by specified or required methods or materials. |
| | Inadequate application of components, such as incomplete closures of case liners, container flaps, loose or inadequate strappings, bulged or distorted containers. |
| Instruction sheet | Missing or not as specified (see 3.13). |
| Count | Less than specified or indicated quantity. |
| Weight | Gross or net weight exceeds specified requirements. |
| Markings | Interior or exterior markings (as applicable) omitted, illegible, incorrect, incomplete, or not in accordance with contract requirements (see 5.3). |

TABLE IX. Quality conformance - physical and mechanical inspection.

| Characteristic 1/ | Paragraph Requirement | Paragraph Test | No. of determinations per sample unit | Results reported as Pass or fail | Results reported as Average numerically to the nearest 2/ |
|---|---|---|---|---|---|
| Formability | 3.9 | 4.6.3 | 2 | X | |
| Internal strain | 3.10 | 4.6.4 | 2 | X | |
| Flexural deformation temperature | 3.12 | 4.6.6 | 2 | - | 0.1°C |
| Angular deviation | 3.15.3.2 | 4.6.12.2 | 2 | - | 1 minute |

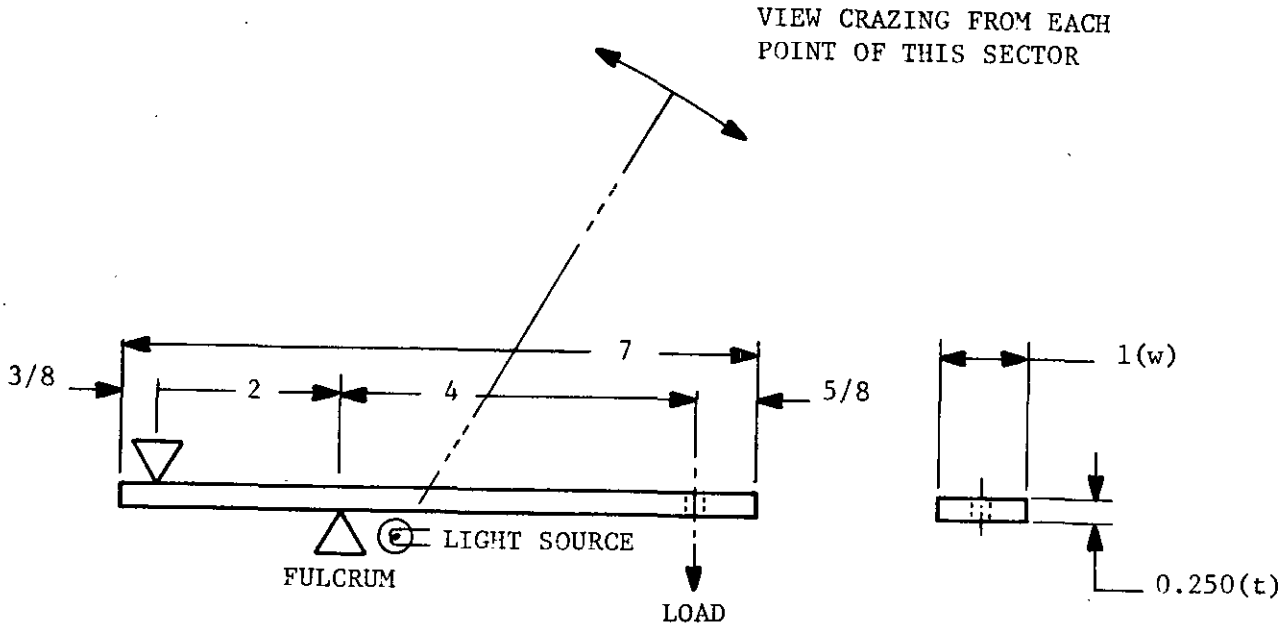
1/ Angular deviation shall be completed prior to internal strain and flexural deformation.

2/ Averages and test results shall be reported as specified in 4.3.2.

* TABLE X. ASTM methods.

| Property | Requirement | ASTM method |
|---|---|---|
| Specific gravity | 3.5 | D 792 |
| Water absorption | 3.6 | D 570 1/ |
| Flammability | 3.7 | D 635 |

1/ 24 hours at room temperature.




LOAD - OUTER FIBER STRESS OF 2,000 PSI FOR CLASS 1, 3000 PSI FOR CLASS 2

FORMULA: LOAD (POUNDS) = $\frac{w \times t^2 \times 2{,}000}{24}$ or 3000

w = Width of panel (measured to nearest 0.001 inch)
t = Thickness of panel (measured to nearest 0.001 inch)

Dimensions in inches. Tolerances on all dimensions ± 0.030 inch, except thickness dimension which shall be ± 0.025 inch.

FIGURE 1. Loading condition for cantilever beam.

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# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

*(See Instructions – Reverse Side)*

| 1. DOCUMENT NUMBER | 2. DOCUMENT TITLE |
|---|---|
| MIL-P-008184D | Plastic Sheet, Acrylic, Modified |

**3a. NAME OF SUBMITTING ORGANIZATION**

**b. ADDRESS** *(Street, City, State, ZIP Code)*

**4. TYPE OF ORGANIZATION** *(Mark one)*

- ☐ VENDOR
- ☐ USER
- ☐ MANUFACTURER
- ☐ OTHER *(Specify)*: _____

**5. PROBLEM AREAS**

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

**6. REMARKS**

| 7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional | b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional |
|---|---|
| c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional | 8. DATE OF SUBMISSION *(YYMMDD)* |

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