MIL-P-19904A(SHIPS)
2 October 1967
SUPERSEDING
MIL-P-19904(SHIPS)
15 July 1957
(See 6.6)

MILITARY SPECIFICATION

PLASTIC SHEETS, ACRYLONITRILE-BUTADIENE-

STYRENE TERPOLYMER, RIGID

1. SCOPE

1.1 Scope. This specification covers flat, rigid plastic sheets composed basically of acrylonitrile-butadiene-styrene terpolymer resin.

1.2 Classification. The material shall be of the following grades, as specified (see 6.2):

Grade FR - Flame resistant.
Grade SB - Slow burning.

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:

SPECIFICATION

MILITARY
MIL-E-15090 - Enamel, Equipment, Light-Gray (Formula No. 111).

STANDARD

FEDERAL
FED-STD-406 - Plastics: Methods of Testing.

(Copies of specifications, standards, drawings and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring agency 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.

UNIFORM CLASSIFICATION COMMITTEE
Uniform Freight Classification Rules.

(Application for copies should be addressed to the Uniform Classification Committee, 202 Union Station, 516 West Jackson Boulevard, Chicago, Illinois 60606.)

3. REQUIREMENTS

3.1 Material. The material used in the production of the sheets shall consist of an acrylonitrile-butadiene-styrene terpolymer resin with or without added compounding ingredients, such as rubber modifiers, dyes, pigments, fillers, and stabilizers. The grade FR and grade SB shall be so formulated and processed as to conform to all the applicable requirements of this specification.

3.2 Form. The material shall be in the form of flat sheets meeting the requirements specified herein.

3.3 Surface.

3.3.1 Surface defects. The sheets shall be free from tears, holes, blisters, wrinkles, creases or cracks, warpage, waviness, and free from other small defects such as scratches, dents, and heat marks.

3.3.2 Surface finish. The surface finish shall be smooth, polished, semigloss, or embossed, as specified (see 6.2).

3.4 Color. Unless otherwise specified (see 6.2 and 6.4); the sheets shall be gray in color conforming to class 2 (semigloss) of MIL-E-15090.

3.5 Dimensions and tolerances.

3.5.1 Length and width. Unless otherwise specified (see 6.2), the manufacturer's standard sizes between 30 and 52 inches in width and between 36 and 120 inches in length shall be acceptable. The length and width of sheets may vary 1 inch over or under the manufacturer's standard size. When particular sheet dimensions are specified, the permissible variations from the specified length or width shall be as shown in table I.

Table I - Permissible variations in length and width.

| Length or width | Permissible variation in length or width, inch, plus or minus |
|---|---|
| 6 inches and under | 1/32 |
| Over 6 to under 24 inches | 1/16 |
| 24 inches and over | 1/8 |

3.5.2 Thickness. Sheets shall be furnished in the nominal thicknesses shown in table II, as specified (see 6.2). Measurements taken at any point on the sheet shall be within the variation shown in table II.

Table II - Thicknesses.

| Nominal thickness | Permissible variation, inch, plus or minus |
|---|---|
| Inch | Grades FR and SB |
| 0.010 | 0.002 |
| .015 | .002 |
| .020 | .002 |
| .025 | .003 |
| 1/32 | .003 |
| 3/64 | .005 |
| 1/16 | .006 |
| 3/32 | .010 |
| 1/8 | .013 |
| 5/32 | .016 |
| 3/16 | .019 |
| 1/4 | .025 |

3.6 Machinability and fabrication. The sheet material shall be such that the standard machining operations necessary to the preparation of test specimens required for the specified tests and for the fabrication of finished parts, can be performed in accordance with the manufacturer's recommended technique without cracking, splitting, or otherwise impairing the material for general use. The sheets shall be suitable for welding or cementing in accordance with the recommended techniques.

3.7 Property values. When subjected to the tests specified in section 4, the sheet material shall conform to the property values specified in table III.

Table III - Property values.

| Property | Thickness, inch | Value required | | Number of determinations required | Test reference |
|---|---|---|---|---|---|
| | | Grade FR | Grade SB | | |
| Tensile break strength, psi, minimum | | | | | |
| Lengthwise | All | 3500 | 3500 | 5 | 4.4.3 |
| Crosswise | All | 3500 | 2500 | 5 | 4.4.3 |
| Tensile modulus, psi, minimum | | | | | |
| Lengthwise | 1/16 to 1/4 | $1.5 \times 10^5$ | $2.0 \times 10^5$ | 5 | 4.4.3 |
| Crosswise | 1/16 to 1/4 | $1.5 \times 10^5$ | $1.5 \times 10^5$ | 5 | 4.4.3 |

Table III - Property values. (Continued)

| Property | Thickness, inch | Value required | | Number of determinations required | Test reference |
|---|---|---|---|---|---|
| | | Grade FR | Grade SB | | |
| Elongation at yield point, percent, minimum | | | | | |
| Lengthwise | 1/16 to 1/4 | 2.5 | 2.0 | 5 | 4.4.3 |
| Crosswise | 1/16 to 1/4 | 2.5 | 1.5 | 5 | 4.4.3 |
| Flexural strength, psi, minimum | | | | | |
| Lengthwise | 1/16 to 1/4 | 6000 | 6000 | 5 | 4.4.4 |
| Crosswise | 1/16 to 1/4 | 6000 | 5000 | 5 | 4.4.4 |
| Flexural modulus, psi, minimum | | | | | |
| Lengthwise | 1/8 to 1/4 | $4.0 \times 10^5$ | $5.0 \times 10^5$ | 5 | 4.4.4 |
| Crosswise | 1/8 to 1/4 | $4.0 \times 10^5$ | $4.0 \times 10^5$ | 5 | 4.4.4 |
| Heat resistance, percent of original Flexural strength, minimum | 1/8 to 1/4 | 50 | 50 | 5 | 4.4.5 |
| Penetration impact strength, pounds, minimum | 0.010 | 0.10 | 0.10 | 5 | 4.4.6 |
| | .015 | .12 | .12 | 5 | |
| | .020 | .15 | .15 | 5 | |
| | .025 | .18 | .18 | 5 | |
| | 1/32 | .20 | .20 | 5 | |
| | 3/64 | .25 | .25 | 5 | |
| | 1/16 | .38 | .38 | 5 | |
| | 3/32 | .50 | .50 | 5 | |
| | 1/8 | .63 | .71 | 5 | |
| | 5/32 | .88 | .97 | 5 | |
| | 3/16 | 1.08 | 1.18 | 5 | |
| | 1/4 | 1.68 | 2.30 | 5 | |
| Hardness, Rockwell R scale, minimum | 1/8 to 1/4 | 75 | 75 | 5 | 4.4.7 |
| Flammability (burning rate), inches per minute, maximum | 1/16 to 1/4 | self extinguishing | 1.2 | 10 | 4.4.8 |
| Water absorption, percent, maximum | 1/16 to 1/4 | 0.5 | 0.5 | 5 | 4.4.9 |
| Specific gravity, maximum | All | 1.4 | 1.4 | 5 | 4.4.10 |

3.8 Instructions for use. When requested by the procuring activity, the manufacturer shall provide instructions for thermoforming, welding, and cementing of the sheets.

3.9 Workmanship. Workmanship shall be of the quality necessary to insure uniform properties of the sheet material.

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 Sampling for quality conformance inspection.

4.2.1 Lot. For purposes of sampling, examinations, and tests, a lot shall consist of all the sheets of the same grade and thickness produced in one plant under essentially the same conditions, and offered for delivery at one time.

4.2.2 Sampling for examination. Representative samples shall be taken at random from each lot in accordance with the sampling plan given in table IV for the examination specified in 4.3.1.

Table IV - Sampling for examination.

| Number of Sheets in Lot | Number of Sheets to be Sampled | Number of Defective Sheets | |
|---|---|---|---|
| | | Major Defects | Total Defects |
| | | Acceptance Number | Acceptance Number |
| up to 8 | All | 0 | 1 |
| 9 to 15 | 2 | 0 | 2 |
| 16 to 50 | 3 | 1 | 3 |
| 51 to 150 | 8 | 2 | 5 |
| 151 to 500 | 20 | 5 | 15 |
| 501 to 1200 | 32 | 7 | 21 |
| over 1200 | 50 | 10 | 30 |

4.2.3 Sampling for tests. Representative samples shall be taken at random from each lot which passes the requirements of 4.3.1 in sufficient quantity to conduct the production check tests and quality conformance tests specified in 4.3.2 and 4.3.3. If the sheets are of such thickness that test specimens can not be prepared from them, substitute samples shall be provided having the appropriate thickness. Thickness tolerances of the substitute samples shall be as specified in 3.5.2. The substitute samples shall be certified by the manufacturer to be of the same material and representative of the sheet material offered for delivery.

4.3 Quality conformance inspection.

4.3.1 Examination. Each of the samples taken in accordance with 4.2.2 shall be examined visually and dimensionally, as applicable, for compliance with the requirements specified in 3.2, 3.3, 3.4, 3.5, 3.8, and Section 5 of this specification. Each sample and the packaging, packing, and marking shall be examined for the applicable defects listed in table V. If the number of defects exceeds the applicable acceptance number specified in table IV, the lot represented by the sample shall be rejected.

4.3.1.1 Definition of defects. A major defect is likely to prevent or to reduce materially the usability of the unit of product for its intended purpose. A minor defect is not likely to reduce materially the usability of the unit of product for its intended purpose.

Table V - List of defects.

| Examine | Defect |
|---|---|
| | Major |
| Surface | Not free of tears, holes, blisters, wrinkles, creases or cracks, waviness, and warpage; not free of defects which affect utility and appearance of the sheet; color not grey or other specified color. |
| Surface finish | Not smooth, polished, semigloss, or embossed; embossment not as specified. |
| Dimensions | Length and width not as specified; variations in length and width exceeding those of table I; thickness not as specified; exceeding tolerances specified in table II. |
| Workmanship | Not uniform. |
| Packaging | Sheets not individually wrapped; not interleaved between each sheet; wrapping not kraft paper; paper less than 25 pound basis weight. |
| Packing | Shipping containers not as specified; not all of same type, or damaged; cushioning missing or inadequate to prevent damage to edges and corners of sheets. Caseliners, when specified, missing or nonconforming; box closures not as specified. Gross weight of shipping containers exceeding specified limits. |
| Marking | Not conforming to MIL-STD-129, special markings missing, or incorrect or illegible; not conforming to carrier regulations. |

Table V - List of defects. (Continued)

| Examine | Defect |
|---|---|
| | Minor |
| Surface | Not Clean. |
| Packaging | Not in accordance with generally accepted commercial practice (Level C only). |
| Packing | Not in accordance with generally accepted commercial practice (Level C only). |
| Marking | Incomplete. |

4.3.2 Production check tests. Production check tests shall be conducted on samples from or representing the first lot of material and from every fifth lot thereafter. All the tests specified in 4.4 shall be performed.

4.3.3 Quality conformance tests. Quality conformance tests shall be conducted on samples from or representing all intermediate lots on which production check tests were not performed. The tests specified in 4.4.3, lengthwise only, 4.4.4, flexural strength only, lengthwise only, and 4.4.5 through 4.4.8 shall be performed.

4.3.4 Action in case on nonconformance. If any of the samples in the production check tests or quality conformance tests is found not to be in conformance with the requirements of this specification, the lot which it represents shall be rejected. Furthermore, additional samples shall be taken or provided from each subsequent lot and shall be subjected to the test or tests wherein the failure occurred. Each lot shall then be accepted only after satisfactory results are obtained on the test or tests by all the samples taken or provided to represent the lot. This additional testing shall be discontinued after four successive lots have passed the test or tests.

4.4 Test methods.

4.4.1 General. Unless otherwise specified in the contract or order, the atmospheric conditions surrounding the specimen prior to and during test shall be 73.4° plus or minus 3.6°F (23.1° plus or minus 2.0°C) and 50 plus or minus 5 percent relative humidity. The conditioning period prior to test shall be at least 48 hours for specimens of 1/8 inch or less in thickness and at least 96 hours for thicker specimens. In conducting tests, the term "lengthwise" shall be interpreted to mean the sheet direction which is found to be stronger in tension. "Crosswise" shall be the sheet direction perpendicular thereto.

4.4.2 Methods for measurement of dimensions.

4.4.2.1 Sheet size. The sheet size shall be determined by the use of a steel scale graduated to read within 1/32 inch. The sheet shall be held flat on a smooth surface at the time of measurement. At least two measurements in both length and width directions shall be made at representative points on the sheet, and the average values shall be recorded.

4.4.2.2 Thickness. The thickness shall be determined by the use of a suitable instrument accurate to 0.001 inch. Five measurements shall be made at random points on the sheet.

4.4.3 Tensile properties. Tests for tensile strength, tensile modulus, and elongation at the yield point shall be performed in accordance with method 1011 of FED-STD-406 employing the type I specimen described therein. The elongation at the yield point shall be determined on a 2 inch gage length, as defined in method 1011.

4.4.4 Flexural strength and modulus (tested flatwise). Specimens of sheets in thicknesses of 1/16 to 1/4-inch inclusive shall be tested flatwise in accordance with method 1031 of FED-STD-406 except that the dimensions and speed of test specified in table VI shall be used. Specimens shall be tested in both lengthwise and crosswise directions.

Table VI - Dimensions of specimens and speeds of testing for flexural strength tests.

| | Specimen thickness, inch | | | | | |
|---|---|---|---|---|---|---|
| | 1/16 | 3/32 | 1/8 | 5/32 | 3/16 | 1/4 |
| Width of specimen, inches | 1 | 1 | 1 | 1 | 1/2 | 1/2 |
| Length of specimen, inches | 3 | 3-1/2 | 4 | 4-1/2 | 5 | 6 |
| Span, inches | 1 | 1-1/2 | 2 | 2-1/2 | 3 | 4 |
| Speed of test, inches per minute | 0.03 | 0.04 | 0.05 | 0.07 | 0.08 | 0.11 |

4.4.5 Heat resistance. The flexural strength test method as specified in 4.4.4 shall be used. Specimens shall be aged in a circulating air oven at 150° minus 0°F plus 5°F for 24 hours. While at the oven temperature, the specimens shall be tested lengthwise for flexural strength. The heat resistance is expressed as the average percent retention of lengthwise flexural strength at room temperature.

4.4.6 Penetration impact strength.

4.4.6.1 Specimens. Specimens shall be 4 inches in diameter by the thickness of the material.

4.4.6.2 Apparatus. The specimen shall be supported in a steel frame fitted with a bezel and a hardened steel penetrator as shown in figure 1. The frame shall be mounted rigidly on a heavy steel bed-plate. A steel ball of the diameter and weight specified for the particular specimen thickness in table VII shall be used to deliver the impact.

Table VII - Diameters and weights of steel balls for penetration impact tests.

| Specimen thickness, inches, | Grade FR | | | Grade SB | | |
|---|---|---|---|---|---|---|
| | Diameter of ball, inches | Weigth of ball, pounds | Weight tolerance, pounds, (+ or -) | Diameter of ball, inches | Weight of ball, pounds | Weigth tolerance, pounds, (+ or -) |
| 0.010 | 29/32 | 0.109 | 0.0005 | 29/32 | 0.109 | 0.0005 |
| .015 | 15/16 | .121 | .0005 | 15/16 | .121 | .0005 |
| .020 | 1 | .147 | .001 | 1 | .147 | .001 |
| .025 | 1- 1/16 | .176 | .001 | 1- 1/16 | .176 | .001 |
| 1/32 | 1- 1/8 | .209 | .002 | 1- 1/8 | .209 | .002 |
| 3/64 | 1- 1/4 | .246 | .004 | 1- 1/4 | .246 | .004 |
| 1/16 | 1- 3/8 | .38 | .005 | 1- 3/8 | .38 | .005 |
| 3/32 | 1- 1/2 | .50 | .01 | 1- 1/2 | .50 | .01 |
| 1/8 | 1- 5/8 | .63 | .02 | 1-11/16 | .71 | .02 |
| 5/32 | 1-13/16 | .88 | .03 | 1- 7/8 | .97 | .03 |
| 3/16 | 1-15/16 | 1.08 | .04 | 2 | 1.18 | .05 |
| 1/4 | 2- 1/4 | 1.68 | .05 | 2- 1/2 | 2.30 | .06 |

4.4.6.3 Procedure. The impact blow shall be delivered by allowing the steel ball to fall on the center of the penetrator head from a height of 10 feet measured to the top surface of the penetrator. A single blow shall be delivered to each specimen. The damage caused to each specimen tested be reported. The following types of damage shall represent failure of the specimen to withstand the impact.

Puncture.
Fracture.
Crack in the surface.

4.4.7 Hardness. Hardness shall be tested in accordance with method 1081 of FED-STD-406, using Rockwell "R" scale.

4.4.8 Flammability. The test shall be performed in accordance with method 2021 of FED-STD-406.

4.4.9 Water absorption. The test shall be performed in accordance with method 7031, procedure A, of FED-STD-406.

4.4.10 Specific gravity. The specific gravity shall be determined in accordance with method 5011 of FED-STD-406.

4.5 Inspection of preparation for delivery. The packaging, packing, and marking shall be examined for compliance with section 5 of this document.

5. PREPARATION FOR DELIVERY

(Preparation for delivery requirements specified herein apply only to direct Government procurement. Preparation for delivery requirements between contractors and sub-contractors shall be as specified in the individual order.)

5.1 Domestic shipment and early material use.

5.1.1 Packaging. Packaging shall be sufficient to afford adequate protection against deterioration and physical damage during shipment from the supply source to the using activity and until early material use and may conform to the supplier's commercial practice when such meets these requirements.

5.1.2 Packing. Packing shall be accomplished in a manner which will insure acceptance by common carrier at the lowest rate, and will afford protection against physical or mechanical damage during direct shipment from the supply source to the using activity for early material use. The shipping containers or method of packing shall conform to the Uniform Freight Classification Rules, Ratings, and Regulations or other carrier regulations as applicable to the mode of transportation and may conform to the supplier's commercial practice when such meets these requirements.

5.1.3 Marking. Shipment marking information shall be provided on interior packages and exterior shipping containers in accordance with the contractor's commercial practice. The information shall include nomenclature, Federal stock number or manufacturer's part number, lot number, date (month and year) of manufacture, size, contract or order number, contractor's name, and destination. The following precautionary marking shall appear on the sides of exterior containers. "DO NOT DROP. HANDLE WITH CARE."

5.2 Domestic shipment and storage or overseas shipment. The requirements and levels of packaging, packing, and marking for shipment shall be specified by the procuring activity (see 6.2).

5.2.1 The following provides various levels of protection during domestic shipment and storage or overseas shipment, which may be required when procurement is made (see 6.2).

5.2.1.1 Packaging.

5.2.1.1.1 Level A. Plastic sheets shall be individually wrapped or interleaved between each sheet with not less than 25 pound basis weight kraft paper in order to protect the sheets from abrasion.

5.2.1.1.2 Level C. Packaging shall be sufficient to afford adequate protection against deterioration and physical damage. This level may conform to the Supplier's commercial practice.

5.2.1.2 Packing.

5.2.1.2.1 Level A. Plastics sheets packaged as specified (see 6.2), shall be packed in any of the following containers at the option of the contractor:

| Specification | Box | Classification |
|---|---|---|
| PPP-B-591 | Fiberboard, Wood-Cleated | Overseas type |
| PPP-B-576 | Wood-Cleated, Veneer (paper overlaid) | Class 2 |
| PPP-B-601 | Wood, Cleated-Plywood | Overseas type |

The sheets shall be cushioned and wood boxes lined with fiberboard, as necessary, to prevent damage to edges and corners of sheets. Shipping containers shall have caseliners conforming to Specification MIL-L-10547. Caseliners shall be closed and sealed in accordance with the appendix to MIL-L-10547. Containers shall be closed and sealed in accordance with the applicable box specification or appendix thereto. The gross weight of wood boxes shall not exceed 200 pounds.

5.2.1.2.2 Level B. Plastic sheets packaged as specified (See 6.2) shall be packed in containers conforming to any one of the following specifications at the option of the contractor:

| Specification | Box | Classification |
|---|---|---|
| PPP-B-591 | Fiberboard, Wood-Cleated | Overseas type |
| PPP-B-576 | Wood-Cleated, Veneer (paper overlaid) | Class 2 |
| PPP-B-601 | Wood, Cleated-Plywood | Overseas type |

The sheets shall be cushioned and wood boxes lined with fiberboard, as necessary, to prevent damage to edges and corners of sheets. Box closures shall be as specified in the applicable box specifications or appendix thereto. The gross weight of wood boxes shall not exceed 200 pounds.

5.2.1.2.3 Level C. Plastic sheet packaged as specified (see 6.2), shall be packed in a manner which will insure acceptance by common carrier at lowest rate and afford protection against physical or mechanical damage during direct shipment from supply source to the first receiving activity for early installation. The shipping containers or method of packing shall conform to the Uniform Freight Classification Rules and Regulations or other carrier regulations as applicable to the mode of transportation and may be the Supplier's commercial practice.

5.2.1.3 Marking. In addition to any special marking specified in the contract or order (see 6.2) each shipping container shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Acrylonitrile-butadiene-styrene terpolymer sheet is intended primarily for fabrication by thermoforming techniques of large plastic items such as carrying cases, housings, and liners where a tough, rigid, and impact and abrasion resistant plastic is required which performs dependably over a wide range of service conditions.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Grade, sheet size and thickness required (see 1.2 and 3.5).
(c) Number of sheets required.
(d) Surface finish required (see 3.3.2).
(e) Color, if other than gray (see 3.4).
(f) Level of packaging and packing required (see 5.1 and 5.2).
(g) Special markings, if required (see 5.3).

6.3 Fabricated parts or equipment. Requirements applicable to fabricated parts or equipment incorporating this material shall be specified in a separate specification or as part of contracts or orders.

6.4 Color cards. Color cards may be obtained upon application to the Commander, Norfolk Naval Shipyard (Chemical Laboratory, Code 3205) Portsmouth, Virginia, 23709. The purpose for which the color cards are desired should be specified.

6.5 Additional grades. Additional grades, in sheet form, reinforced with various amounts of glass fibers, are available commercially. The fiber filled terpolymers exhibit a higher strength to weight ratio, higher stiffness, and greater resistance to temperature and creep. Sheets of expanded terpolymer combining strength with light weight are also available. These grades are at present not covered by Government specifications.

6.6 CHANGES FROM PREVIOUS ISSUE. THE EXTENT OF CHANGES (DELETIONS, ADDITIONS, ETC.) PRECLUDE THE ANNOTATION OF THE INDIVIDUAL CHANGES FROM THE PREVIOUS ISSUE OF THIS DOCUMENT.

Preparing activity:
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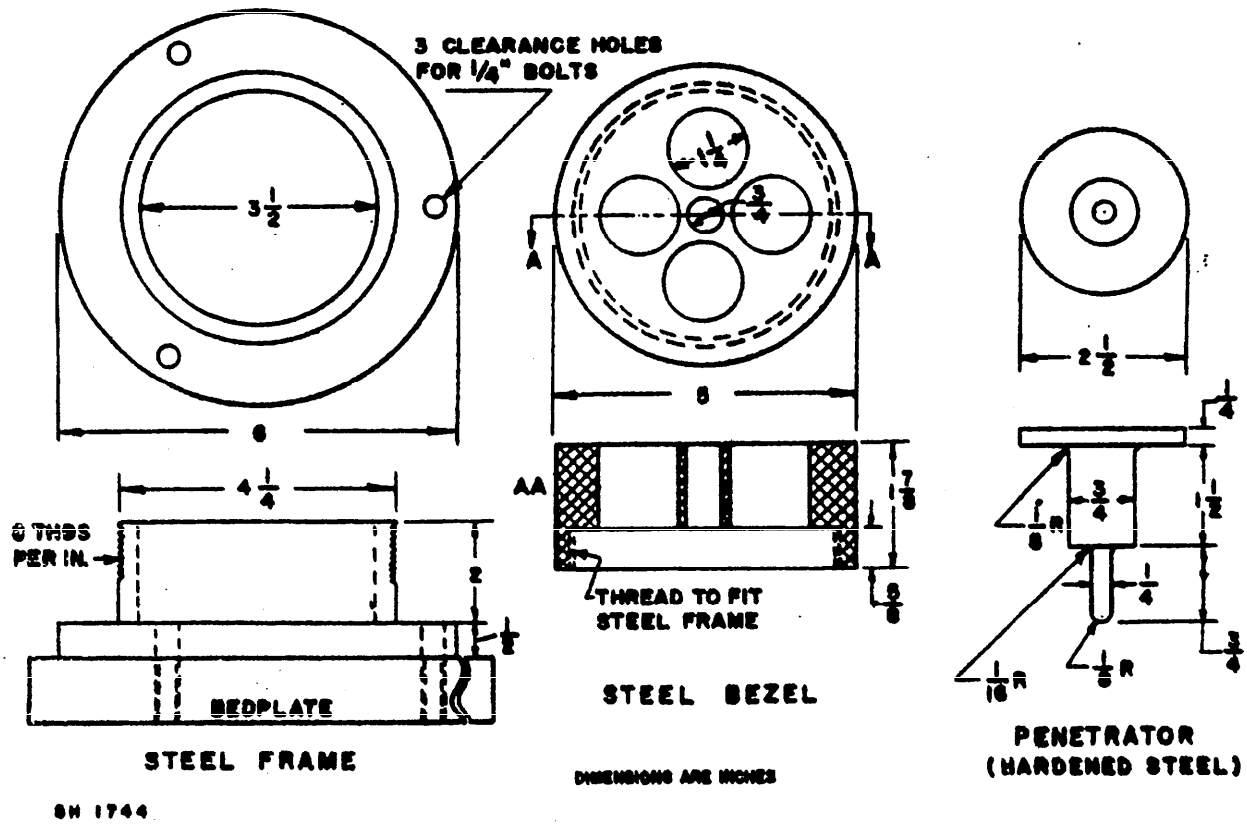


Figure 1 - Penetration impact strength test apparatus.

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| 1. DOCUMENT NUMBER | 2. DOCUMENT TITLE |
|---|---|

| 3a. NAME OF SUBMITTING ORGANIZATION – | 4. TYPE OF ORGANIZATION *(Mark one)* |
|---|---|
| b. ADDRESS *(Street, City, State, ZIP Code)* | ☐ VENDOR<br>☐ USER<br>☐ MANUFACTURER<br>☐ 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 |
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