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MILITARY SPECIFICATION

TANK, FUEL, CRASH-RESISTANT, AIRCRAFT

This specification is mandatory for use by all Departments and Agencies of Department of Defense.

1. SCOPE

1.1 This specification covers crash-resistant fuel tanks for use on aircraft.

1.2 Classification. - Crash-resistant fuel tanks shall be of the following types and classes:

Type I - Self-sealing

Protection level A - Tank is completely self-sealing against 50 caliber and 20 mm.

Protection level B - Part of tank is non-self-sealing and part is self-sealing against 50 caliber and 20 mm.

Type II - Non-self-sealing

NOTE: For type I tanks of protection level B, the portions of the tank to be self-sealing and non-self-sealing shall be as specified by the procuring activity. The non-self-sealing portions shall conform to the requirements for type II tanks.

Class A - Flexible cell construction

Class B - Semi-rigid or self-supporting cell construction

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

TT-S-735	Standard Test Fluids, Hydrocarbon

FSC 1560

PPP-B-601	Boxes, Wood, Cleated-Plywood
PPP-B-636	Box, Fiberboard
PPP-B-1055	Barrier Material, Waterproofed, Flexible
PPP-T-60	Tape, Pressure Sensitive Adhesive, Waterproof, for Packaging

Military

MIL-P-116	Preservation, Methods of
MIL-B-121	Barrier Material, Greaseproofed, Waterproofed, Flexible
MIL-C-5541	Chemical Films and Chemical Film Materials for Aluminum and Aluminum Alloys
MIL-G-5572	Gasoline, Aviation: Grades 80/87, 100/130, 115/145
MIL-F-5577	Fittings, Tank, Powerplant Fluid, Removable
MIL-T-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-C-6529	Corrosion-Preventive, Aircraft Engine
MIL-C-6800	Coating, Process for Application of Permanent Resin to Aircraft Engine Parts
MIL-P-8045	Plastic, Self-Sealing and Non-Self-Sealing Tank Backing Material
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-S-8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter; General Specification for
MIL-I-27686	Inhibitor, Fuel System Icing

STANDARDS

Federal

Fed. Test Method Std. No. 191	Textile Test Methods
Fed. Test Method Std. No. 601	Rubber: Sampling and Testing
Fed. Test Method Std. No. 791	Lubricants, Liquid Fuels, and Related Products; Methods of Testing

Military

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of US Military Property
MIL-STD-143	Standards and Specifications, Order of Precedence for the Selection of
MIL-STD-276	Impregnation of Porous Nonferrous Metal Castings
MIL-STD-831	Test Reports, Preparation of
MIL-STD-1186	Cushioning, Anchoring, Bracing, Blocking, and Waterproofing; with Appropriate Test Methods
MS20470	Rivet, Solid - Universal Head, Aluminum and Aluminum Alloy

PUBLICATIONS

Air Force-Navy Aeronautical Bulletins

No. 107	Inspection Standards for Stand and Dissection Tested Self Sealing Fuel and Oil Cells
No. 112	Acceptance Standards for Self-Sealing Fuel and Oil Cells
No. 434	Acceptance Standards for Non-Self-Sealing Type Cells
No. 435	Inspection Standards for Stand and Dissection Tested Non-Self-Sealing Type Cells

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

3. REQUIREMENTS

3.1 Preproduction. - This specification makes provisions for preproduction inspection.

3.2 Application. - The requirements of this specification apply only to fuel tanks which are installed within the aircraft. A tank shall consist of a cell or group of cells interconnected, and the components attached thereto.

3.3 Selection of specifications and standards. - Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143.

3.4 Materials. - Materials and processes used by the tank manufacturer shall be suitable for the purpose and shall conform to applicable Government specifications. Materials conforming to contractor's specifications may be used, provided the specifications are released by the Services and contain provision for adequate tests. The use of contractor's specifications shall not constitute waiver of Government inspection. The use of magnesium is prohibited. Cadmium plated parts shall not be used where the parts are normally exposed to fuel.

3.5 Design. - The tanks shall be suitable for use with fuels conforming to MIL-G-5572 and MIL-T-5624 and shall be designed in conjunction with the containing structure to avoid concentration of loads on splices, seams, fittings and to avoid concentrated flexure. The assembly consisting of the tank and aircraft structure in which it is mounted shall comprise the necessary strength to provide adequately for the stresses caused by the following:

(a) Flexing resulting from vibration
(b) Impact loads incident to takeoff, taxiing, and landing (including catapulting and arresting)
(c) Hydraulic surge of fuel incident to all dynamic conditions of flight
(d) Hydraulic surge of fuel incident to gunfire
(e) Pressure loads resulting from hydrostatic head of fuel during level flight or maneuvers, and resulting from neutral gases, if any, used to pressurize fuel cells
(f) Crash loads as required by the procuring activity

3.5.1 Dimensions. -

3.5.1.1 Class A tanks. - All outside dimensions of the cell (including attachment points) shall be no less than the corresponding dimensions of the cell cavity. The amount of oversize between attachment points and between any attachment point and the nearest edge shall not exceed 0.250 inch. Fitting alignment shall be accomplished by hand without the use of forcing tools. After installation there shall be no evidence of stress wrinkles.

3.5.1.2 Class B tanks. - The dimensions of class B tanks shall conform to the requirements specified by the procuring activity.

3.5.2 Capacity (class B tanks). - The head-versus-volume curve on production tanks shall conform within 1.5 percent to the average head-versus-volume curve prepared in accordance with 4.4.2.1.

3.6 Construction. -

3.6.1 Inner layer ply. - For type I tanks the inner layer ply and barrier, if used, shall limit diffusion of fuel sufficiently to prevent sealant activation and for either type I or type II tanks the diffusion rate shall be no greater than .025 fluid ounce per square foot, per 24 hours.

3.6.2 Fabric ply. - The edges of materials in fuel cell lap seams of any ply shall not be superimposed on parallel seams of an adjacent ply without specific approval by the procuring activity.

3.6.3 Sealant (type I tanks). - The fuel cells shall use a sealant which meets the performance requirements of this specification.

3.6.4 Fittings. - Fittings for tanks shall conform to class C of MIL-F-5577 and the "pull out" requirements specified herein. Single plane fittings shall be used wherever practicable. The use of through-bolts is prohibited where a bolt head seal is required.

3.6.5 Screw threads. - Screw threads shall be in accordance with MIL-S-8879. The use of pipe threads is prohibited.

3.7 Performance. -

3.7.1 Operating temperature. - The tank shall be suitable for operation throughout the temperature range of -40° to 160° F insofar as gunfire performance is concerned. For all other operating conditions, the cell shall be satisfactory throughout the temperature range of -65° to 160° F.

3.8 Weight. - The weight of production tanks shall be within 5 percent of the average weight of the first 10 production cells.

3.9 Finish. -

3.9.1 External surfaces. - The external surfaces of cells shall be protected against the action of ozone and hydrocarbon fuels.

3.9.2 Steel parts. - Steel parts shall be protected against corrosion.

3.9.3 Aluminum-alloy parts. - Aluminum-alloy parts shall be anodized in accordance with MIL-A-8625 or treated in accordance with MIL-C-5541, and then coated with a permanent resin in accordance with MIL-C-6800. If necessary to prevent porosity, parts shall be treated in accordance with MIL-STD-276. If required, to provide a path across the part for electrical current, the film may be removed locally.

3.10 Markings.

3.10.1 Access door covers. - The exterior surface of all access door covers shall be durably and legibly marked "outside".

3.10.2 Assembly torque. - The torque values required to assemble the fittings and accessories to the cell shall be durably and legibly marked on or adjacent to each fitting or accessory involved. In cases where the torque required to assemble all fittings and accessories is the same, the proper torque value need be stenciled in only one place provided it is visible when the access door is removed.

3.11 Identification of product. - Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130. The following special markings shall be added:

(a) Aircraft contractor
(b) Aircraft model(s) and cell location
(c) Specification MIL-T-27422B__ Type_____ Protection level____ Class_____
(d) Month and year of manufacture

The nameplate shall be readily visible after removal of aircraft access panels, deck doors, etc.

3.12 Workmanship. - Workmanship shall be in accordance with manufacturing practices covering this type of equipment. The acceptable quality level of workmanship shall be in accordance with ANA Bulletins No. 434 and 435. The vulcanized sealant shall be free of foreign matter and the thickness shall agree with the approved construction within the established manufacturing tolerance, as described in the manufacturer's specification.

3.12.1 Cleaning. - The tanks shall be thoroughly cleaned of rubber particles, dirt, sand, metal chips, welding flux, or other foreign material while being assembled and after final assembly.

3.13 Age. - Cells shall be not more than 2 years old from date of initial cure to date of installation in the aircraft or delivery of the cells to the procuring activity.

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 in the contract or order, the supplier 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 examination and testing of tanks shall be classified as:

(a) Preproduction inspection (4.3)
(b) Quality conformance inspection (4.4)

4.3 Preproduction inspection. - Preproduction inspection shall consist of phase I and phase II tests (see 4.3.1.2 and 4.3.2.2).

4.3.1 Phase I preproduction tests. - Phase I tests are those tests accomplished on samples of the materials and constructions to be used in the manufacture of tanks. Phase I tests of test cubes and materials shall be performed by the procuring activity or the tank manufacturer at a place named by the applicable procuring activity.

4.3.1.1 Phase I test samples. - Phase I test samples shall consist of the following:

(a) Four test cubes, to fit the metal container shown in figure 1, shall each contain a fitting centered on the top surface of the cube. The fitting shall be at least a 10-inch by 16-inch oval of sufficient strength to pass the drop test. If a non-crash resistant fitting is used for the drop test, it may be reinforced with a fabric collar extending 3 inches beyond the flange tip. For type I protection level B the top of the cubes and the top half of the sides shall be fabricated from a material meeting the requirements of this specification for type II tanks. The lower half and bottom of protection level B cubes shall be of self-sealing construction. For protection level B tanks the samples required by d, e, f, g, and h are to be from the self-sealing construction.

(b) Eight metal side panels in accordance with sheet 5 of figure 1.

(c) Eight sheets of backing material 27 by 30 inches and two sheets of backing material 30 by 30 inches, conforming to MIL-P-8045. The weight of the backing material shall not exceed one-half pound per square foot.

(d) Two 12- by 12-inch samples of composite cell construction.

(e) Twenty samples of composite cell construction, dimensionally in accordance with figure 4. The samples shall be cut in such a manner that five have the seven-inch dimension parallel to the warp threads of the exterior ply, five have the seven-inch dimension at 90° to the right of the warp threads of the exterior ply, five have the seven-inch dimension at 45° to the left of the warp threads of the exterior ply, and five have the seven-inch dimension at 45° opposite to the previous five samples.

(f) Twenty samples of composite cell construction, in accordance with figure 5.

(g) Twenty samples of composite cell construction, dimensionally in accordance with figure 6. The figure 6 samples shall be cut in the same manner as those for figure 4.

(h) One sample of inner layer ply, without barrier, approximately 900 square inches in area with seam. This sample is required only for those constructions having inner layer ply seams.

(i) One sample of inner layer ply, with barrier, approximately 900 square inches in area without seam.

(j) One sample 6 by 6 by 0.075 to 0.125 inch inner layer ply, without barrier.

(k) Four samples of composite material to fit the clamping flange of figure 8 with a centrally mounted four-inch fitting. Samples shall not be preplasticized with fluid prior to submission.

(l) Six samples of composite construction as required to fit the clamping flange of figure 7.

4.3.1.2 Phase I tests. - Phase I tests shall consist of those tests listed in table I.

4.3.2 Phase II preproduction testing. - Phase II preproduction tests are those tests accomplished on complete full scale tanks or portions thereof.

4.3.2.1 Phase II test samples. - Phase II test samples shall consist of at least three of each tank or cell to be tested and the supporting structure, or jig, or both, equipped with all applicable fuel cell components. The cells shall be of the same materials and construction as used in the test cubes submitted for phase I tests and shall be designed to fit in a particular location in a specified aircraft. The cells to be tested shall be proposed by the airframe manufacturer and approved by the procuring activity prior to test.

4.3.2.2 Phase II tests. - Phase II preproduction tests shall consist of the tests listed in table II.

4.3.3 Reports of tests. -

4.3.3.1 Phase I.

4.3.3.1.1 Preproduction approval. - Phase I test reports shall be in accordance with MIL-STD-831. These reports shall be signed by a responsible representative of the manufacturer or the laboratory in which the tests are conducted.

TABLE I. Phase I tests

Test	Paragraph
Materials	
Non-volatile gum residue	4.6.4.1
Stoved gum residue	4.6.4.2
Inner liner strength	4.6.4.3 or 4.6.4.4
Permeability	4.6.4.5
Seam adhesion	4.6.4.6
Slit resistance	4.6.4.7
Inner liner adhesion	4.6.4.8 (Type I cells only)
Stress aging	4.6.4.9
Constant rate tear	4.6.5.1
Impact penetration	4.6.5.2
Impact tear	4.6.5.3
Panel strength calibration	4.6.5.4
Fitting strength	4.6.5.5
Test cubes	
Cube 1	
Fuel resistance of exterior surface	4.6.6.1
Slosh resistance (Phase I)	4.6.6.3
Stand test (Phase I)	4.6.6.6
Cube 2	
Crash impact (Phase I)	4.6.6.2
Cube 3	
Low temperature gunfire	4.6.6.4.2
Fuel aging	4.6.6.5
Cube 4	
Normal temperature gunfire	4.6.6.4.3
Fuel aging	4.6.6.5

NOTE: Material tests may be conducted in any order. Tests on each individual test cube shall be conducted in the order listed.

TABLE II. Phase II tests

Test Sample	Test 1/	Paragraph
I, II, and III	Inspection	4.6.1
I	Installation Capacity Pressure Slosh or slosh and vibration resistance Aging and low temperature leakage Dissection	4.6.7.1 4.6.7.2 (Class B only) 4.6.7.3 4.6.7.4 4.6.7.5 4.6.7.6
II	Accelerated load resistance 2/ Gunfire resistance on tank installation	4.6.7.7 4.6.7.8
III	Crash impact test on full size preproduction test cells	4.6.7.9

NOTE: 1/ Tests on each sample should be conducted in the order listed above.
2/ An additional sample may be used for this test.

4.3.3.1.2 Preemptive approval. - (See 6.4.2.1).

4.3.3.2 Phase II. - Phase II test reports shall be prepared in accordance with MIL-STD-831. At least 1 month prior to the initiation of phase II testing, a schedule shall be supplied to the procuring activity indicating the anticipated start and finish dates of all tests.

4.4 Quality conformance inspection. - Quality conformance inspection shall consist of:

(a) Individual inspection (4.4.1)
(b) Sampling plans and inspection (4.4.2)

4.4.1 Individual inspection. - Each fuel cell shall be subjected to the following tests as specified under 4.6.1.

(a) Examination (4.6.1.1)
(b) Dimensions (4.6.1.2)
(c) Weight (4.6.1.3)

4.4.2 Sampling plans and inspection.

4.4.2.1 Capacity check samples (class B checks only). - Each of the first 10 production cells shall be checked for capacity in accordance with 4.6.7.2. An average head-versus-volume curve shall be constructed from these tests.

4.4.2.2 Stand test samples. - Cells selected at random from part numbers specified by the contractor and the procuring activity, in accordance with the following schedule, shall be subjected to the stand test described in 4.6.2. In the event that more than one part number is selected for sampling, the tests shall be performed on an alternating basis.

Number of samples	Number of units produced
1	0-50
1	1 every 90 days or 1 out of each additional 500 cells, whichever occurs first

The samples specified above shall be selected from all cells produced at a particular plant for a specific aircraft and approved under the same preproduction test and identified with the manufacturer's same construction number. The random samples selected shall be representative of cells submitted by the manufacturer for acceptance with respect to quality of workmanship and the number and type of repairs.

4.4.2.3 Dissection test samples. - Cells selected at random from part numbers specified by the procuring activity, in accordance with the following schedule, shall be dissected as shown on figure 2, and subjected to the dissection test of 4.6.3.

Number of samples	Number of units produced
2	0-50
1	1 out of each additional 90 days' production or 1 out of each additional 50 units produced, whichever occurs latest. However, the maximum time between tests shall not exceed 180 days

The samples specified above shall be selected from cells produced at a particular plant for a specific aircraft and approved under the same preproduction test and identified with the manufacturer's same construction number. The random samples selected shall be representative of cells submitted by the manufacturer for acceptance with respect to quality of workmanship and the number and type of repairs.

4.4.2.4 Inspection standard. - When one item selected from production fails to meet this specification, action shall be taken in accordance with Bulletin No. 112 or 434, as applicable.

4.5 Test conditions. - In addition to the test conditions set forth in specific tests, the conditions specified herein shall apply.

4.5.1 Test fluid. - Test fluid shall be in accordance with TT-S-735.

4.5.1.1 Type I fluid shall be TT-S-735, type I.

4.5.1.2 Type III fluid shall be TT-S-735, type III.

4.5.2 Temperature tolerances. - Unless otherwise specified, the following temperature tolerances shall be maintained:

Specified temperature	Tolerance
Above 100° F	±10° F
Below 100° F	±5° F

4.5.3 Tank mounting structure. - The tank mounting structure shall correspond as closely as practicable with respect to shape, dimensions, and material to the tank supporting structure in the vehicle. The necessary stops, cushions, pads, and hangers identical with those used in the finished vehicle, for mounting and supporting the tank shall be provided. The test tank shall be mounted in the test structure in a manner which duplicates the actual installation. In addition, all lines attached to the tank in the actual installation shall be included. The length and configuration of these lines shall be the same as in the actual installation, from the tank to the first support.

4.5.4 Tank support jig. - The support jig shall be suitable for carrying the mounted sample tank and designed for bolting to the vibrator and rocker assembly. The jig framework shall be sufficiently rigid to prevent the possibility of unrealistic stresses being imposed on the mounted tank.

4.6 Inspection methods. -

4.6.1 Inspection. -

4.6.1.1 Examination. - The fuel cells shall be inspected to determine conformance to the acceptable standards listed in Bulletin No. 112 or 434, as applicable. Each fuel cell shall be carefully examined to determine conformance with all the requirements of this specification for which no specific tests are described and to determine conformance with the manufacturer's material and fabrication specifications.

4.6.1.2 Dimensions. - A check shall be made to insure that all dimensions conform to the tolerances of 3.5.1.

4.6.1.3 Weight. - Each cell shall be weighed to determine conformance with the tolerance on weight. (See 3.8).

4.6.2 Stand. - Class A cells shall be collapsed and held strapped for 30 minutes in a position comparable to that encountered prior to installation in its respective aircraft cavity, then released, and adequately supported. Both class A and class B cells shall be filled with type III fluid. During the filling process, the capacity test (4.6.7.2) shall be conducted on class B tanks to determine conformance with 3.5.2. Cells shall then be tested in accordance with the following time cycle:

(a)	First cell selected	90 days
(b)	Second cell	30 days
(c)	Third cell	30 days

This time cycle shall be repeated for additional cells chosen in accordance with 4.4.2.2 for the duration of the contract. Upon completion of the test and at the intermediate inspections, the cells shall be carefully examined for any evidence of failure. After the examination, if faulty performance is indicated, the cell shall be dissected as shown on figure 2 and inspected for evidence of failure. In the event of failure of this test, the procuring activity and the contractor shall be notified. Bulletin No. 107 or 435 shall apply.

4.6.3 Dissection. - The sectioned portion of each cell selected in 4.4.2.3 shall be examined for conditions outlined in Bulletin No. 107 or 435, as applicable. In the event of failure on this test, the procuring activity and contractor shall be notified immediately.

4.6.4 Inner layer ply. -

4.6.4.1 Nonvolatile gum residue. - A 5-gram sample of the inner layers, up to the barrier, shall be diced up into approximately 0.062 inch squares and placed in a flask containing 250 ml. of type III fluid and allowed to stand for 48 hours at 77° ±5° F. The contaminated test fluid shall be decanted off, and the nonvolatile gum residue determined by Method 3302 of Federal Test Method Standard No. 791 (ASTM D381-64) except that the total evaporation time shall be 45 minutes. The nonvolatile material shall not exceed 60 mg. per 100 ml. of contaminated fluid.

4.6.4.2 Stoved gum residue. - The beakers containing the nonvolatile material shall be placed in an appropriate bath maintained constantly at a temperature of 572° ±9° F for 30 minutes. After cooling in a closed container, the beakers shall be weighed. The stoved gum residue shall not exceed 20 mg. per 100 ml. of the contaminated fluid, after necessary corrections have been made for preformed gums originally present in the test fluid.

4.6.4.3 Gum inner liner strength. - The tensile strength of the gum inner layer ply, without barrier, shall be determined in accordance with Federal Test Method Standard No. 601, Method 4111, before and after immersion in type III fluid for 72 hours at a temperature of 135° ±3° F. The tensile strength shall also be determined before and after immersion in a solution of 25 percent MIL-I-27686 inhibitor and 75 percent water, by volume, for 72 hours at a temperature of 135° ±3° F. The tensile strength reduction shall be reported to the procuring activity. The tensile strength shall not be reduced more than 50 percent for fuel immersion and 20 percent for water immersion calculated on the basis of the original cross-sectional area.

4.6.4.4 Fabric inner liner strength. - The tensile strength of the fabric inner layer ply, without barrier, shall be determined in accordance with Federal Test Method Standard No. 191, Method 5100 before and after immersion in type III fluid for 72 hours at a temperature of 135° ±3° F. The tensile strength shall also be determined before and after immersion in a solution of 25 percent MIL-I-27686 inhibitor and 75 percent water, by volume, for 72 hours at a temperature of 135° ±3°F. The tensile strength reduction shall be reported to the procuring activity. The tensile strength shall not be reduced more than 20 percent for fuel immersion and 50 percent for water immersion calculated on the basis of the original cross-sectional area.

4.6.4.5 Permeability. -

4.6.4.5.1 Preparation of test specimens. - For cells employing vulcanized inner liners, the uncured inner liner shall be applied to a 10- by 10-inch piece of corrugated fiberboard coated on one side with a suitable water-soluble breakaway agent. The exposed surface of the inner liner shall be coated with prime cement and barrier resin (if required) that conform to manufacturer's specifications. The assembly shall then be wrapped with cellophane and covered with a suitable waterproof bag. The assembly shall be vulcanized by the method used in regular production. After vulcanization, the waterproof bag and cellophane shall be removed. The inner liner shall then be removed from the fiberboard, using water if necessary. The free moisture shall then be wiped from the assembly, and the assembly shall be conditioned for 24 hours at a temperature of 77° F and a relative humidity of 40 percent ±5 percent. For cells using unvulcanized, continuous inner liners, the inner liner shall be applied by production methods on a 10- by 10-inch piece of corrugated fiberboard coated on one side with a suitable release agent. The exposed surface of the inner liner shall be coated with barrier material that conforms to manufacturer's specifications. The assembly shall then be cured or otherwise processed by the method used in regular production. The inner liner shall then be removed from the fiberboard. The assembly shall be conditioned for 24 hours at a temperature of 77° F and a relative humidity of 40 percent ±5 percent. After the conditioning, two discs 2.5 inches in diameter shall be cut from the panel prepared above. One hundred ml. of type III fluid shall be placed in a cup conforming to figure 3. A suitable nylon solution shall be applied to the face of the cup flange covering the area inside the bolt circle. When the nylon solution is almost dry, the test disc shall be applied to the cup with the barrier, if any, facing outward. Other sealing materials may be used only after approval by the procuring activity. The assembly shall be completed by attaching the bolting ring shown on figure 3 and tightening the bolts in accordance with the following:

Inner liner type	Bolt torque in pound inches
Gum stocks	5 to 10
Coated fabrics	15 to 20
Unsupported plastic films	20 to 25

4.6.4.5.2 Conduct of test. - The cups, prepared as specified in 4.6.4.5.1, shall be placed in a suitable rack and maintained at a temperature of 77° F and a relative humidity of 40 percent ±5 percent for a 1 hour equilibration period. The cup shall be weighed to the nearest 0.005 gram and placed in the rack with the face of the cup facing upward. The cup shall be maintained at a temperature of 77° ±5° F and a relative humidity of 40 percent ±5 percent for a 24 hour period. The cup shall then be weighed to check for the integrity of the seal. The bolts shall be retorqued if necessary. The cup shall be inverted (test disc down) in a rack that permits free access of air to the test disc. The cups shall be weighed at the end of the third, fifth, and eighth day after inverting. Defective films or leaks resulting from faulty assembly will usually be found when weighing on the third day. The diffusion rate calculation shall be made on the fifth to the eighth day period and expressed as fluid ounces per square foot per 24 hours. The permeability shall be less than 0.025 fluid ounce per square foot per 24 hours.

NOTE: Diffusion expressed in fluid ounces per square foot per 24 hours equals the gram loss of the test specimen per 24 hours multiplied by a factor K which is defined as follow:

$$K = \frac{144}{(\text{Sp. gr.})\ (29.573)\ (3.142)\ (R)^2}$$

Where: Sp. gr. = specific gravity of test fluid at 77° F

R = inside radius of the test cup in inches

4.6.4.6 Seam adhesion. - The seam adhesion of the inner layer ply to itself shall be tested before and within 4 hours after immersion in type III fluid for 72 hours at a temperature of 135° F. The test shall be made along the length of the seam by the stripback method, using a jaw separation rate of 2 inches per minute in accordance with Federal Test Method Standard No. 601, Method 8011. In cases where the adhesion of the seam is less than the strength of the material, the adhesion shall be a minimum of 6 pounds per inch. This test is not required for cell constructions which do not employ seams in the inner layer ply.

4.6.4.7 Slit resistance. - A section of the composite cell construction sample shall be selected. A slit of the inner layer ply, 1 inch long to the depth of the sealant, shall be cut parallel to the calender grain, if present, or to the direction of minimum tear resistance. The test section shall be 5 inches long with width sufficient to clamp in a vise, with the jaws of vise 1 inch from the slit when the test section is bent 180 degrees. The slit shall be parallel to vise jaws and on the outside of the bend. The sample shall be held in this folded condition for 1 hour and the increase in length of the slit noted. The slit shall not increase more than 0.25 inch.

4.6.4.8 Inner liner adhesion (type I cells). - The adhesion of the inner layer ply, with barrier, when used, to the sealant shall be tested by the strip back method, using a jaw separation rate of 2 inches per minute in accordance with Federal Test Method Standard No. 601, Method 8011. The adhesion shall be a minimum of six pounds per inch. For cell constructions which do not employ an inner layer ply adhered directly to the sealant, the inner layer ply adhesion shall be determined between the inner layer ply and the next adjacent layer.

4.6.4.9 Stress aging. - Ten samples of the inner layer ply 4 inches square shall be double folded with the point of double fold located in the center of the sample. The material shall be held in the folded position by means of a spring clip, or equivalent, located 0.5 inch from the double folded edge. Folded samples shall be soaked in type III fluid, for 7 days at 160° F, and air dried for 7 days at 160° F. There shall be no evidence of blistering, cracking, separation, or other material failure.

4.6.5 Composite construction tests. -

4.6.5.1 Constant rate tear. - Twenty of the composite cell construction samples in accordance with figure 4 shall be conditioned at 77° ±5° F, and a relative humidity of 40 percent ±5 percent for 24 hours. At the end of the conditioning period, the samples shall be tested at a jaw separation rate of 20 inches per minute, until complete separation occurs. Clips as shown in figure 4 may be used. A plot of force versus jaw separation shall be made. The minimum energy for complete separation shall be 400-foot-pounds as determined by the area under the force versus jaw separation curve.

4.6.5.2 Impact penetration. - Twenty of the composite cell construction samples in accordance with figure 5 shall be conditioned at 77° ±5° F, and a relative humidity of 40 percent ±5 percent for 24 hours. At the end of the conditioning period, five of the samples shall be impacted from a height of 15 feet with the 5-pound chisel (75-foot-pounds) parallel to the warp direction of the exterior ply, 5 with the chisel at 90° to the warp direction on the exterior play, 5 with the chisel at 45° to the right of the warp direction of the exterior ply, and 5 with the chisel at 45° to the left of the warp direction of the exterior ply. All samples shall be impacted on the exterior of the construction. After impact, the interior side of the sample shall be pressurized to 5 psi air. There shall be no evidence of leakage when checked with a soap solution on 18 of the 20 samples tested.

4.6.5.3 Impact tear. - Twenty of the composite cell construction samples in accordance with figure 6 shall be conditioned at 77° ±5° F, and a relative humidity of 40 percent ±5 percent for 24 hours. At the end of the conditioning period, the samples shall be impacted from a height of 10 feet, with 5-pound chisel. The length of tear shall not exceed 0.5 inch on 18 of the 20 samples tested.

4.6.5.4 Panel strength calibration. - Six samples of the composite construction shall be evaluated. Each sample shall be held firmly in a clamping flange as shown on figure 7, three oriented with the inner liner up and three with the inner liner down. The 4-inch diameter plunger shall be forced into the center of the panel at a rate of 20 inches per minute until failure occurs. The average ultimate load of the three highest samples shall be recorded and reported in the phase I test report.

4.6.5.5 Fitting strength. - Four test samples, each containing 4-inch outside diameter fittings shall be fabricated of the composite construction using the same fitting material and attaching methods that will be used on full size production cells. A 200 pound weight shall be attached to the fitting as shown on figure 8. A force transducer shall be located between the fitting and the weight and located as close to the fitting as possible. The test sample shall be attached to a rigid drop cage and dropped from a height of 20 feet and decelerated in a distance of 9 inches or less. Two samples shall be oriented with the inner liner up and two with the inner liner down. The lowest recorded load of the samples tested shall be in excess of 80 percent of the average of the three highest failure loads attained in the panel strength test of 4.6.5.4, but need not exceed 30,000 pounds, whichever is lower.

4.6.6 Cells. - The sample phase I cells shall be subjected to the tests described in the following paragraphs.

4.6.6.1 Fuel resistance of exterior surface. - The No. 1 test cube shall be placed in a container sufficiently large to permit immersion of the bottom half of the cell in type III fluid. The cube shall be immersed for 24 hours at the ambient temperature. The cube shall then be removed and examined for swelling, separation, blisters, pinholes, dissolution, or other evidence of deterioration. The exterior surface of the cell construction shall show no unsatisfactory swelling, separation, blistering, dissolution, or other deterioration.

4.6.6.2 Crash impact (phase I). - The No. 2 test cube with cover plate attached to the fitting and filled with 770 pounds of water (no air in the cube) and held loosely with a sling made of webbing in accordance with figure 9 shall be lifted to a height of 65 feet, measured from the bottom of the cube. With the bottom of the cube in a horizontal position, the release mechanism shall be actuated and the cube allowed to drop freely on a nondeforming surface. Any rupture resulting in spillage shall constitute failure.

4.6.6.3 Slosh resistance (phase I). - The No. 1 test cube shall be tested for slosh resistance by mounting on a suitable rocker assembly and rocking the cell through an angle of 15 degrees on each side of the level position (total 30 degrees) at a rate of 18 ±2 cycles per minute for a period of 25 hours with the cell two-thirds full of type III fluid. Class A cells shall be installed in a test structure in accordance with figure 1. The fluid shall be maintained at a temperature of 110° F throughout the test for type I cells and 135° F for type II cells. Brown paper or another leakage detection method approved by the procuring activity shall be used for type II cells. There shall be no evidence of leakage or failure of any kind during or as a result of this test.

4.6.6.4 Gunfire resistance on phase I cubes. - Test setup. Class A cells shall be installed in the metal structure shown on figure 1. Class B cells shall be tested without auxiliary support. The temperature shall be measured by a thermometer or thermocouple immersed in the fluid. Test cubes shall be mounted 75 feet from the gun. All ammunition shall be fired into the cell space occupied by the fluid. A nonmetallic yaw plate shall be used to impart tumbling when required by table III.

4.6.6.4.1 Firing schedule. - The firing schedule as shown in table III shall be conducted at low temperature on test cube No. 3. It shall then be repeated at normal temperature on test cube No. 4.

4.6.6.4.2 Low temperature gunfire. - The No. 3 test cube shall be conditioned for gunfire testing by filling three-quarters full of type I fluid for a period of 24 hours. The fluid used in the conditioning shall remain in the cube during the gunfire test. The conditioning shall be at a temperature of 50° to 100° F. The cell shall then be cooled, and at the time of firing, the temperature of the fluid and cell shall have been maintained at -40° F for a minimum of 4 days.

4.6.6.4.3 Normal temperature gunfire. - The No. 4 test cube shall be filled three-quarters full of type I fluid. The temperature of the fluid at the time of the test shall be 50° to 100° F.

4.6.6.4.4 Evaluation. - The following points shall be considered in determining the acceptable performance of the type I fuel cell:

(a) Quantity of fuel leakage

(b) Time required to effect a damp seal. In general, wounds shall seal within 2 minutes at ambient temperature and within 4 minutes at -40° F.

(c) Integrity of inner layer ply, seams, and joints. (Cracking of the inner liner will be permitted under the low temperature test of 4.6.6.4.2.)

(d) Integrity of fittings

(e) Deformation

(f) Support for sealant throughout the test

(g) Healing, knitting, or breaching over the gunfire wound

(h) Resistance of non-self-sealing materials to tearing and integrity of transition seam (protection level B)

Shots striking as noted below, shall not be considered in evaluating the tank.

(a) Slicing shots wherein a projectile slices parallel to the cell wall instead of piercing
(b) Striking of cell fittings by the projectile
(c) Shots where the wounds overlap or run together
(d) Shots which strike within 3 inches of corners
(e) Shots where the projectile remains imbedded in the construction
(f) Shots where metallic fingers project into wounds (flowering) and in a mechanical manner prevent the sealant from functioning
(g) Shots where coring is present

Type II cells

(a) Low temperature gunfire. This test shall produce no larger than a 4-inch diameter tear for each entry and exit
(b) Normal temperature gunfire. This test shall produce no larger than a 3-inch diameter tear for each entry and exit
(c) There shall be no tears which do not radiate from the bullet hole which cannot be accounted for by shrapnel or structure

4.6.6.5 Aging following gunfire resistance. - After the gunfire resistance test the cubes shall be emptied and inspected, and any wounds which failed to seal (but did not disqualify the cell) shall be plugged and the cell refilled with type III fluid. After 24 hours the cell shall be emptied, and the wounds shall be carefully examined. There shall be no evidence of deterioration of the inner-layer ply or sealant for type II cells

4.6.6.6 Stand test (phase I test cubes). - Following the slosh test (4.6.6.3) the No. 1 test cube shall be completely filled with type III fluid and allowed to stand for 90 days. The cell shall be carefully examined every 30 days for any evidence of failure. For this test, the cube shall be supported in the same manner as for the slosh test. Brown paper or another leakage detection method approved by the procuring activity shall be used for type II cells.

4.6.7 Phase II tests. -

4.6.7.1 Installation. - For this test, the aircraft or a section thereof shall be used. The installation test shall be performed prior to the pressure test described in 4.6.7.3. The installation test shall consist of removing and installing the tank in the test structure three times. Applicable service procedure shall be followed in tank installation and removal. All tank fittings shall be fastened to corresponding structure fittings and interconnect fittings of each installation. The tank shall be in a satisfactory condition on the completion of this test.

TABLE III. Phase I gunfire schedules

Round number	Type I, protection level A and type II cells	Type I, protection level B
1	One .50 caliber projectile 90° to the cell surface and with exit	One .50 caliber projectile 90° to the cell surface into the self-sealing portion of the cell with entrance within 1 inch of transition seam and with exit wherever it occurs
2 and 3	One .50 caliber projectile 90° to the cell surface 3/4 to full tumbled entrance	One .50 caliber projectile 90° to the cell surface into the self-sealing portion of the cell with 3/4 to full tumbled entrance
4	One .50 caliber projectile 45° to the cell surface and with exit	One .50 caliber projectile 45° to the cell surface into self-sealing portion of the cell with exit wherever it occurs
5	One 20 MM AP (M55A1) projectile 90° to the cell surface	One 20 MM AP (M55A1) projectile 90° to the cell surface into the self-sealing portion of cell within 3 inches of the transition seam
6		One 20 MM AP (M55A1) projectile 90° to the cell surface into non-self-sealing portion of cell within 3 inches of the transition seam

NOTE: 20 MM exits to be described in test report for information only.

4.6.7.2 Capacity (class B tanks only). - The cell, supported in the same manner as in the aircraft, shall be slowly filled to capacity with type III fluid. The volume in gallons and the head in inches shall be recorded at a sufficient number of points during the filling to construct a head-versus-volume curve.

4.6.7.3 Pressure. - For this test, the tank shall be mounted in the preproduction slosh test structure. All openings in the tank shall be sealed during the pressure test. All parts necessary to effect a satisfactory seal at the openings shall be furnished by the aircraft contractor. Tanks shall be subjected to a pressure equivalent to the normal head measured at the bottom of the tank multiplied by a factor of 1.5. Pressures shall be measured by means of a manometer using type III fluid and shall be applied in such a manner that the testing pressure is stabilized. No change in pressure shall occur in the following 15 minutes.

4.6.7.4 Slosh or slosh and vibration resistance. - For this test, an actual section of the aircraft structure shall be used. All fitting and non-self-sealing areas in the interior of each fuel cell compartment shall be lined with brown paper, held in place with a suitable adhesive. The test specimen shall be slosh or slosh and vibration tested (see 4.6.7.4.1 and 4.6.7.4.2) with the tank two-thirds full of type III fluid containing a staining agent at a temperature of 110° F for type I cells and 135° F for type II cells. All slosh or slosh and vibration resistance tests shall be conducted with the tank subjected to a pressure equivalent to the maximum stabilized vapor pressure encountered in any prescribed stabilized level flight conditions. The tank shall be mounted in such a manner as to simulate pitching in the actual aircraft. Special fixtures, such as baffles, shall also be tested if applicable by mounting the aircraft structure on the rocker in another position for a portion of the test time. The pressure test (4.6.7.3) shall be repeated. There shall be no evidence of leakage or failure of the fuel tank or the attachment of its components during this test.

4.6.7.4.1 Fighter, attack, and interceptor aircraft. - Test of fighter, attack, and interceptor aircraft preproduction tanks shall be conducted on a vibrator and rocker assembly of a design acceptable to the procuring activity, and shall conform to the following requirements:

(a) Class A tanks or portions thereof, except those with cells containing suspension or supporting arrangements which may be subject to failure due to vibration, shall be slosh tested.

Test conditions:
Time: 25 hours
Rock: Total of 30°, approximately 15° on either side of the horizontal position
Cycles per minute: 16 to 20

(b) Class A tanks or portions thereof, with cells containing suspension or supporting arrangements which may be subject to failure due to vibration, and class B tanks shall be simultaneously slosh and vibration tested.

Test conditions:
Time: 25 hours
Rock: Total of 30°, approximately 15° on either side of the horizontal position
Cycles per minute: 16 to 20
Displacement: The throw of the two eccentric weights on the vibration machine shall be in the same direction and shall be adjusted to produce a total displacement of 0.032 inch, +0.010 inch, -0.000 inch, measured at points of inherent rigidity on the tank
Speed:
Tanks for piston powered aircraft - 90 percent of normal rated crankshaft speed
Tanks for turbine powered aircraft - 2,000 ±100 rpm

(c) Remove cell from structure and examine for evidence of damage or failure.

4.6.7.4.2 Types of aircraft other than fighter, attack, and interceptor. - Tests of all types of aircraft preproduction tanks other than fighter, attack, and interceptor type, shall be conducted on a vibration and rocker assembly design acceptable to the procuring activity and shall conform to the following requirements:

(a) Class A tanks or portions thereof, except those with cells containing suspension or supporting arrangements which may be subject to failure due to vibration shall be slosh tested.

Test conditions:
Time: 40 hours
Rock: Total of 30°, approximately 15° on either side of the horizontal position
Cycles per minute: 10 to 16

(b) Class A tanks or portions thereof, with cells containing supporting or suspension arrangements which may be subject to failure due to vibration and class B tanks shall be slosh and vibration tested.

Test conditions:
Time: 25 hours simultaneous slosh and vibration and 15 hours additional slosh
Rock: Total of 30°, approximately 15° on either side of the horizontal position
Cycles per minute: 10 to 16

Displacement: The throw of the two eccentric weights on the vibration machine shall be in the same direction and shall be adjusted to produce a total displacement of 0.032 inch, +0.010 inch, -0.000 inch measured at point of inherent rigidity on the tank

Speed:

Tanks for piston powered aircraft - 90 percent of normal rated crankshaft speed

Tanks for turbine powered aircraft - 2,000 ±100 rpm

(c) Remove cell from structure and examine for evidence of damage or failure.

4.6.7.4.3 Alternate vibration frequency and displacement. - Where the above frequencies and displacements are not applicable, the tank shall be vibrated at a frequency and displacement agreed upon by the contractor and the procuring activity.

4.6.7.5 Aging and low temperature leakage. - The tank shall be mounted in a structure for which it is designed, or a simulated test sample incorporating identical tank fitting installations may be used. The interior of the test structure around fitting areas shall be lined with brown paper, held in place with a suitable adhesive. The tank with fittings assembled shall be subjected to a 7-day soak with type III fluid, at a fluid temperature of 135° F. Following the hot fuel soak, the tank shall be emptied and air dried for a period of 7 days at a temperature of 160° F. On completion of the 7-day period of air drying, the tank shall be filled with type I fluid, containing a staining agent, and placed in a cold box for a period of 3 days. The cold box shall be maintained at a temperature of -65° F for the 3 day period. At the end of this 3 day period, the tank shall be removed from the cold box, drained, and examined for any indications of leakage. The tank shall then be filled with type III fluid, containing a staining agent and allowed to stand at ambient temperature for a period of 80 days, at which time the fluid shall be drained and the tank examined for any unsatisfactory condition or indication of fuel leakage as shown by any indication of stain on the brown paper or activation of the tank sealant (type I tanks). Sealant activation or any leakage of the tank, or at the attachment of its component(s), shall be considered as a tank failure. In the event of failure at the attachment of the component, retesting for this condition may be simulated in other than a full scale tank.

4.6.7.6 Dissection. - After completion of the above test, the cell shall be dissected as shown on figure 2. The sectioned portion of each cell shall be examined for conditions outlined in Bulletin No. 107 or Bulletin No. 435.

4.6.7.7 Accelerated load. - The tank assembly shall be mounted in a test jig that provides support equivalent to the aircraft structure for which it is designed and subjected to a load test as mutually agreed upon between the contractor and the procuring activity to determine the suitability of the tank installation under aircraft design accelerations, including the appropriate dynamic magnification factors. Tanks of pressurized systems shall be subjected to normal operating pressures during this test, except where unpressurized conditions are considered to be more critical. There shall be no structural failure of any components of the tank during these tests. Deflection of the tank shall be measured and shall be such that there will be no interference with the functional operation of the aircraft components. All tanks shall be tested dynamically.

4.6.7.7.1 Carrier-based aircraft. - Tanks shall be tested in the directions of dynamic loadings associated with catapult, flight, and arrested landing conditions to a total acceleration in gravitational units equal to the maximum applied acceleration for which the aircraft is designed. The suitability of the tank installation shall be tested for catapult and arrested landings with various fuel loads from full to the minimum fuel load specified for a safe landing. For these tests, the tank shall be oriented in the normal position for catapult or arrested landings.

4.6.7.8 Gunfire resistance on tank installation (type I and II). - For this test, the tank shall be mounted in an actual section of the aircraft structure containing the backing board that will be used in the specific application. The tank for this test need not include accessories. Purging capabilities may be provided to help prevent fires during gunfire test. The tank shall be filled two-thirds full with type I fluid. All gunfire testing shall be conducted with the tank subjected to an internal pressure equivalent to the maximum stabilized vapor pressure encountered during any prescribed stabilized level flight conditions. The tank shall be subjected to the gunfire test in accordance with the capacity of each tank. The number of rounds of .50 caliber AP ammunition to be fired shall be determined on the basis of one round for each 1[illegible] gallons of tank capacity up to a maximum of 10 rounds. For cells intended for type I protection level B at least two rounds of .50 caliber shall be fired into the non-self-sealing portion of the cell. In addition to the .50 caliber gunfire, one round of 20 millimeter AP ammunition (M55A1) shall be fired. For type protection level B, the round of 20 millimeters shall be placed in the self-sealing portion of the cell. All shots shall be so placed as to be compatible with the aircraft installation and the combat utility of the aircraft. Tumbled .50 caliber AP rounds shall be utilized to simulate shrapnel. No bursts shall be fired, and the test shall be conducted at ambient temperature. The same conditions that are cause for rejection of the phase I test cell shall apply to this test.

4.6.7.9 Crash impact test on full size preproduction test cells. - Each cell configuration shall be tested using a platform in accordance with figure 10.

4.6.7.9.1 Rotary wing type aircraft. - The cell with all openings suitably closed shall be filled to normal capacity with water and the air removed. The cell shall be placed upon the platform and raised to a height of 65 feet. The platform shall be released and allowed to drop freely onto a nondeforming surface so that the cell shall impact in a horizontal position ±10°. After the drop test there shall be no leakage. A light weight cord may be used to support the cell in its proper attitude.

4.6.7.9.2 Fixed wing aircraft. - The cell with all openings suitably closed shall be filled to normal capacity with water and the air removed. The cell shall be placed upon the platform and raised to a predetermined height of 65 feet. The platform shall be released and allowed to drop freely onto a non-deforming surface so that the surface normally facing forward as mounted in the aircraft impacts at an angle of 20° ±10° to the horizontal. After the drop test there shall be no leakage.

5. PREPARATION FOR DELIVERY

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

5.1.1 Level A. - Unless otherwise specified, tapped holes on fuel cell fittings or attachments shall be protected from corrosion by the application of a corrosion-preventive compound conforming to MIL-C-6529, type II. Care shall be taken to prevent an excessive amount of compound from being applied to the fuel cell proper. Paper conforming to MIL-B-121, grade A, shall be placed over all exposed tapped holes, and sealed with a moisture-resistant tape conforming to PPP-T-60, type I, class 1. In those instances where cover plates are bolted into their positions, it will not be necessary to use tape or grade A paper. Unless otherwise specified, all openings, fittings, etc., shall be covered with waterproof paper conforming to PPP-B-1055, class C-1, and sealed with a moisture-resistant tape conforming to PPP-T-60, type I, class 1. The cells shall be closed in such a manner as to prevent dust or other foreign material from entering the cells. One vent hole may be left open, at the option of the manufacturer, but protected to prevent dust or other foreign material from collecting in the cells.

5.1.2 Level C. - Cells shall be preserved and packaged in a manner to prevent damage or deterioration during shipment from the supply source to the first receiving activity for immediate use.

5.2 Packing. - Packing shall be level A, level B, or level C, as specified (see 6.2).

5.2.1 Level A. - Cells preserved and packaged to meet 5.1 shall be packed in overseas-type exterior shipping containers conforming to PPP-B-601. Boxes conforming to PPP-B-601 shall be surface-treated in accordance with the requirements of that specification. As far as practicable, exterior shipping containers shall be of uniform shape and size, be of minimum cube and tare consistent with the protection required, and contain identical quantities. The gross weight of each pack shall be limited to 200 pounds. Containers shall be closed and strapped in accordance with the applicable container specification or appendix thereto.

5.2.2 Level B. - Cells preserved and packaged to meet 5.1 shall be packed in weather-resistant (overseas) type or class of PPP-B-636. Exterior shipping containers shall be of minimum cube and tare consistent with the protection required. As far as practicable, exterior shipping containers shall be of uniform shape and size and contain identical quantities. The gross weight of each pack shall be limited to 200 pounds. Containers shall be closed and strapped in accordance with the applicable container specification or appendix thereto. The fiberboard shall meet the special requirements table of PPP-B-636, as applicable.

5.2.3 Level C. - Cells preserved and packaged to meet 5.1 shall be packed in fiberboard boxes conforming to domestic class of PPP-B-636.

5.3 Physical protection. - Cushioning, blocking, bracing, and bolting as required shall be in accordance with MIL-STD-1186, except that for domestic shipment, waterproofing requirements for cushioning materials and containers shall be waived. Drop tests of MIL-STD-1186 will be waived when preservation, packaging, and packing of the item is for immediate use or when drop tests of MIL-P-116 are applicable.

5.4 Marking of shipments. - Each shipping container shall be marked to indicate presence of preservation and method of packing. The container shall be marked to indicate presence of preservation and method of packing. The container shall be marked in accordance with MIL-STD-129. The following additional information shall be applied to the container:

TANK, FUEL AIRCRAFT, CRASH RESISTANT
TYPE ____________, CLASS ____________,
PROTECTION LEVEL ________________
Model of aircraft for which cell is intended and location in the aircraft.
Construction number of the cell.

6. NOTES

6.1 Intended use. - Self-sealing and non-self-sealing fuel tanks manufactured under this specification are intended for use in aircraft as a means for carrying aircraft fuel including aromatic constituents under all prescribed operating conditions and as a means of preventing, under the gunfire conditions specified herein, an excessive loss of fuel, and to provide a significant reduction in post crash fires.

6.2 Ordering data. - Data generated by this document is not deliverable unless specified on the Contract Data List (DD Form 1423) referencing the appropriate data item description in the Military Department's Authorized Data List (ADL). The data required by this specification is as follows:

(a) Title, number, and date of this specification.
(b) Model designation of the aircraft.
(c) Name of the cell manufacturer.
(d) Part number, type, class, and protection level of cell desired (see 1.2).
(e) Selection of applicable levels of preservation and packaging and packing (see section 5).

6.3 Definitions. -

6.3.1 Manufacturer. - For purposes of this specification, the term manufacturer refers to the manufacturer of the tank.

6.3.2 Contractor. - The term contractor refers to the airframe manufacturer.

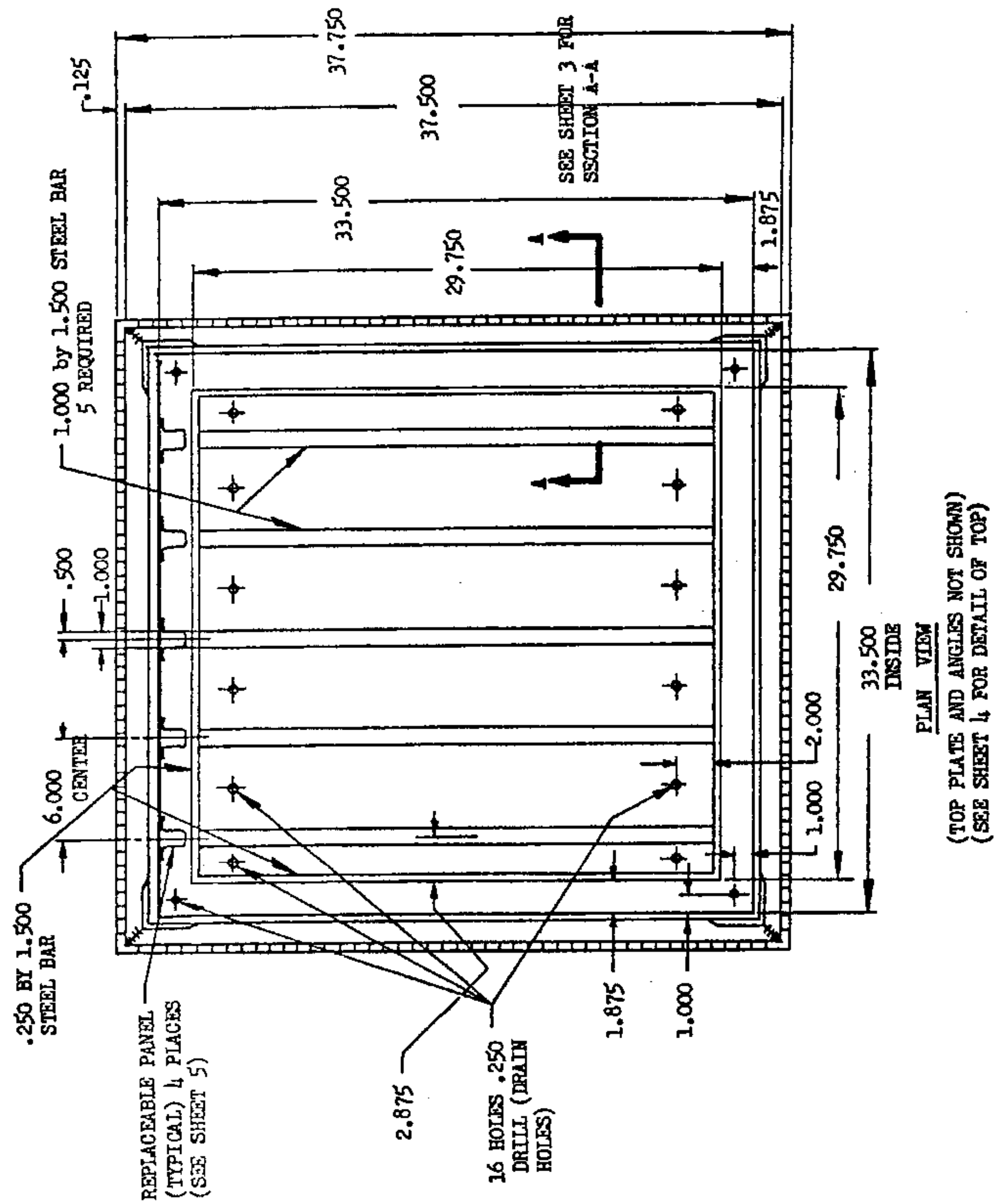
6.3.3 Supplier. - The term supplier as used in 4.1 herein, refers to both the manufacturer and the contractor.

6.4 Preproduction testing. -

6.4.1 Notification of approval or disapproval. -

6.4.1.1 Phase I preproduction tests. - In the case of phase I preproduction tests, written notification of approval or disapproval will be given by the applicable procuring activity to the fuel cell manufacturer.

6.4.1.2 Phase II preproduction tests. - In the case of phase II preproduction tests, notification of approval or disapproval will be given by the applicable procuring activity to the aircraft manufacturer. A copy of such notification will be supplied to the fuel cell manufacturer.



DIMENSIONS IN INCHES. TOLERANCES, DECIMALS ±.016.

FIGURE 1 (Sheet 1 of 5). Mounting structure for phase I preproduction testing

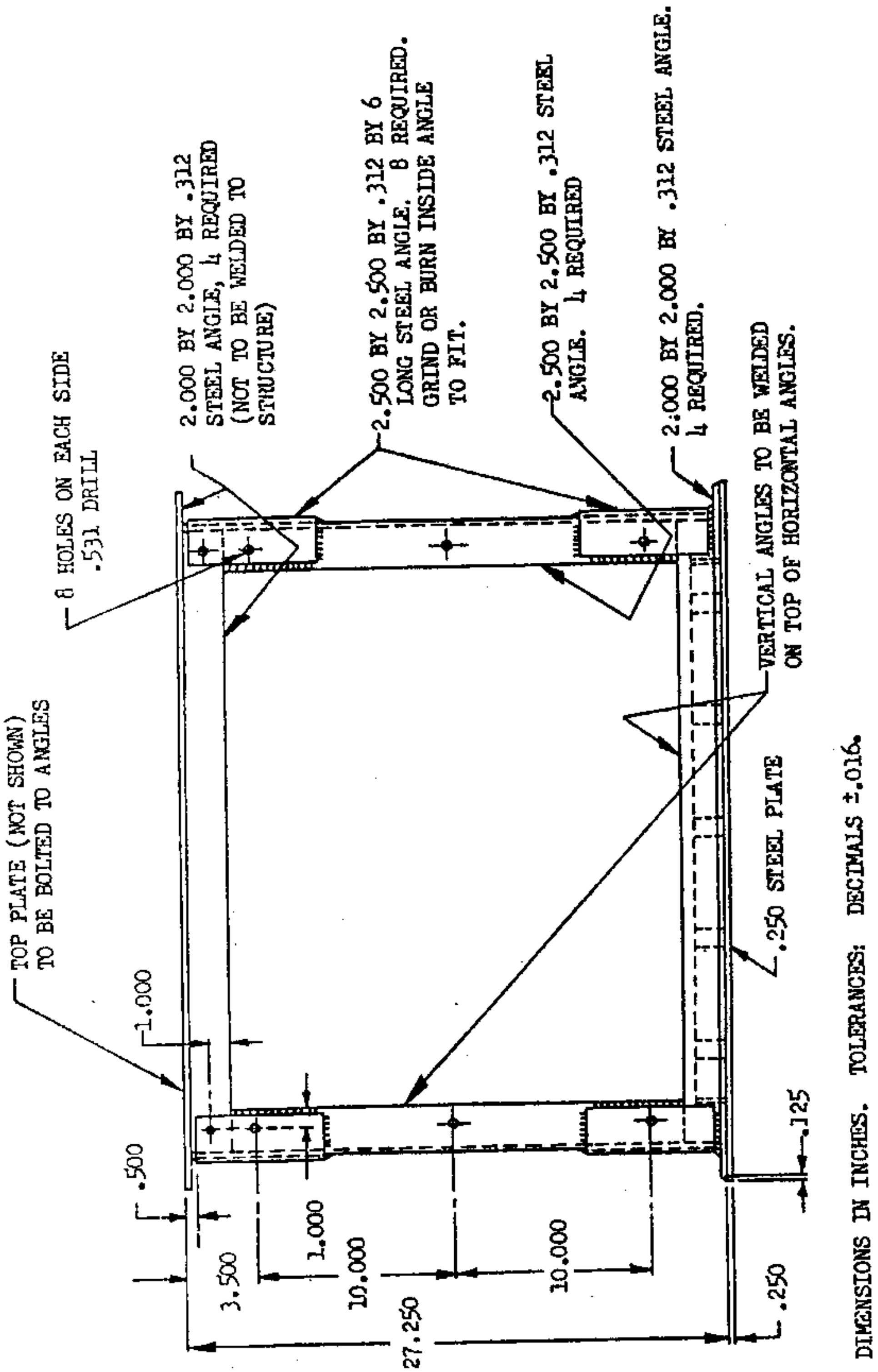


FIGURE 1 (Sheet 2 of 5). Mounting structure for phase I preproduction testing

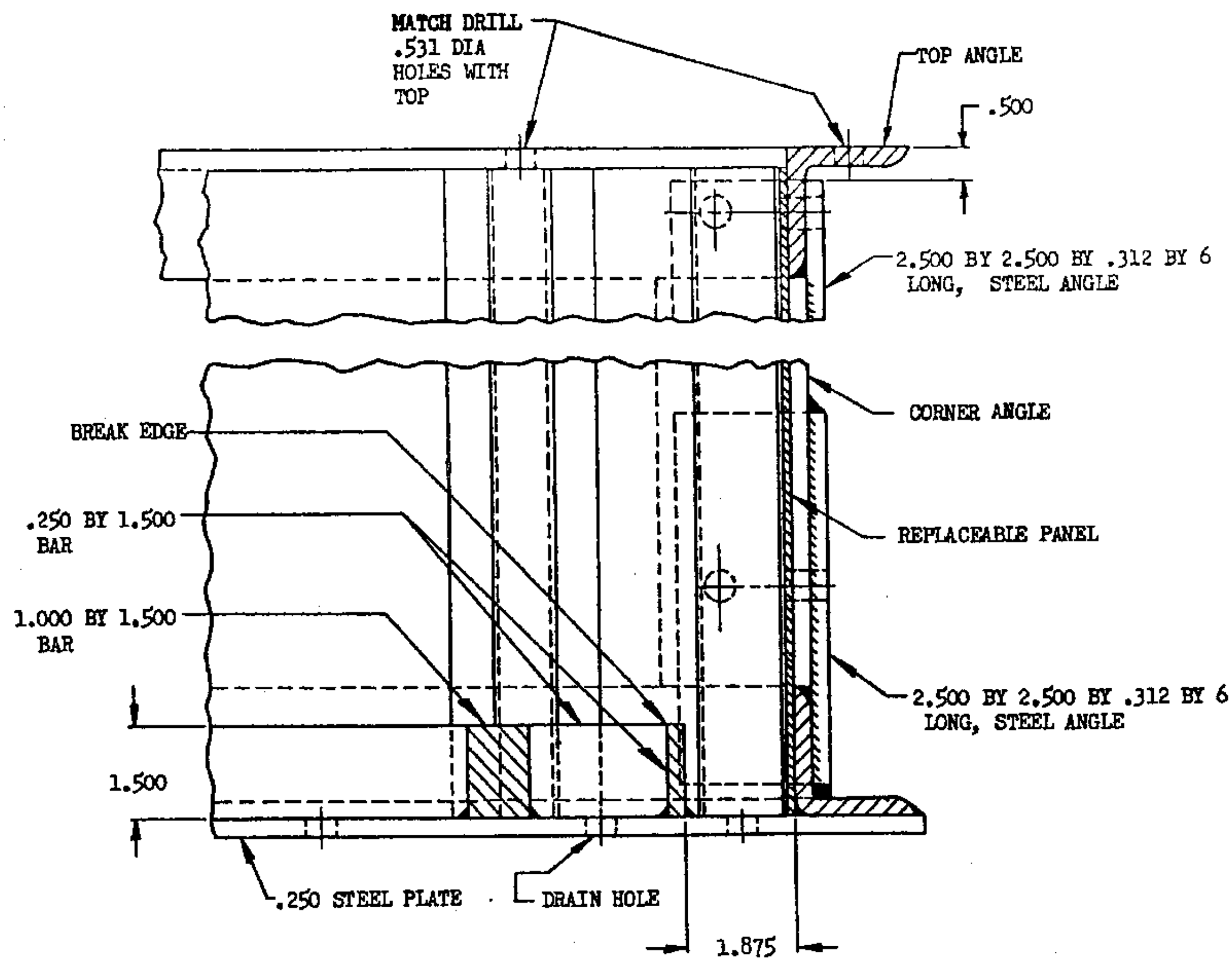


FIGURE 1 (Sheet 3 of 5). Mounting structure for phase I preproduction testing

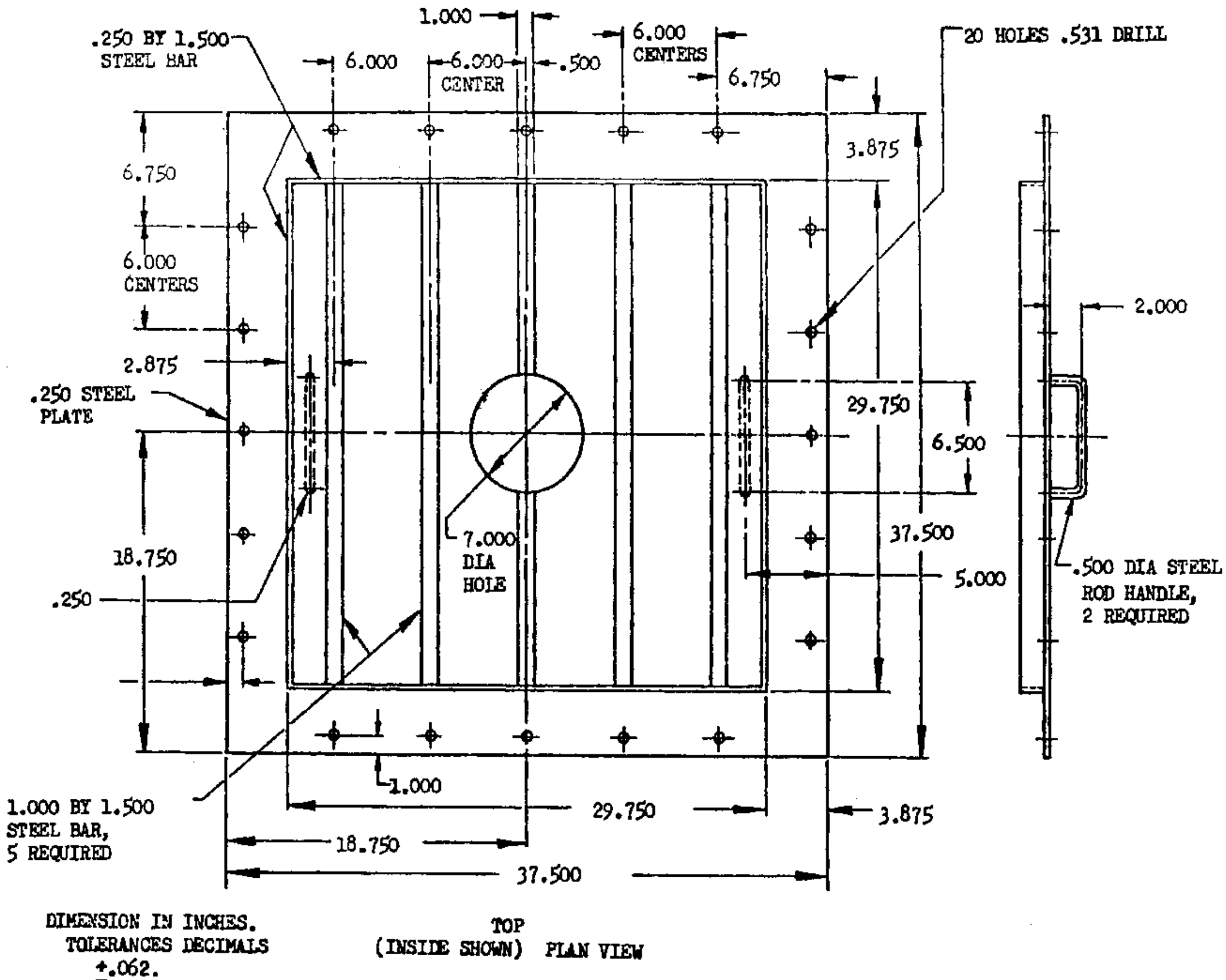
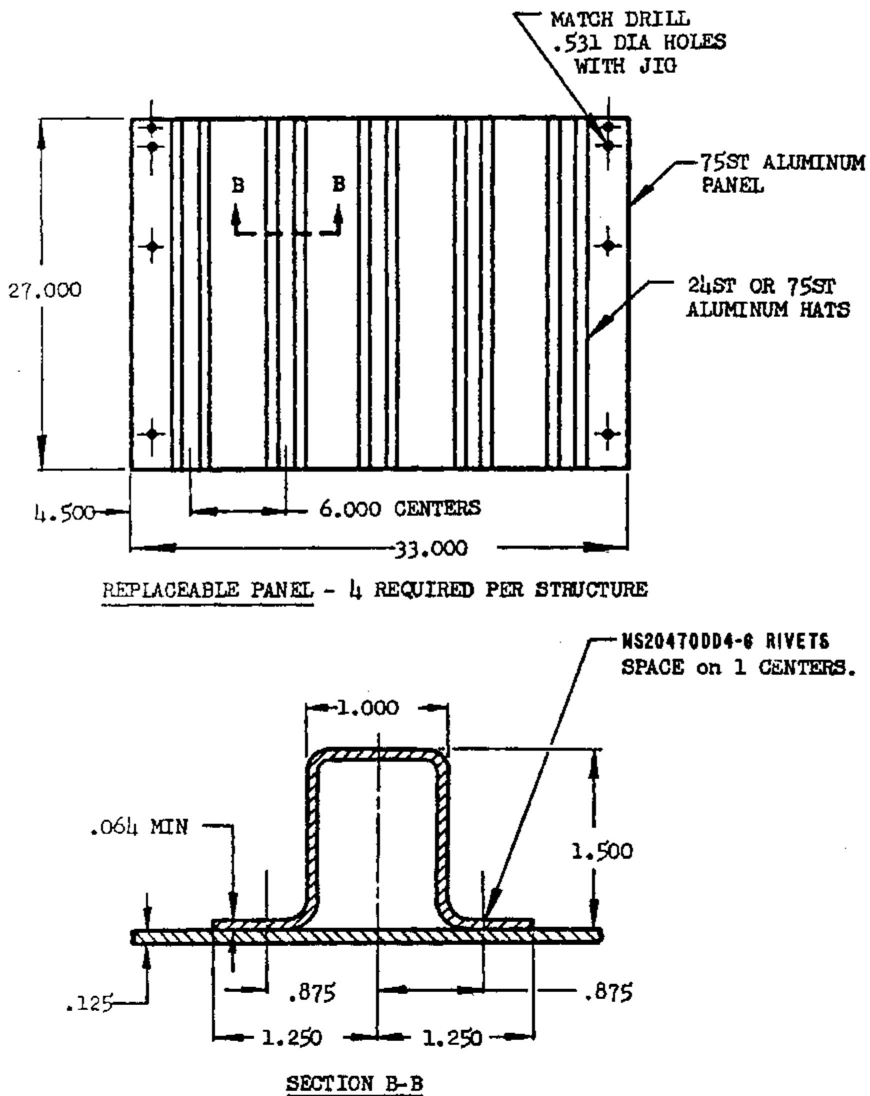


FIGURE 1 (Sheet 4 of 5). Mounting structure for phase I preproduction testing



DIMENSIONS IN INCHES. TOLERANCES: DECIMALS ±.062.

FIGURE 1 (Sheet 5 of 5). Mounting structure for phase I preproduction testing

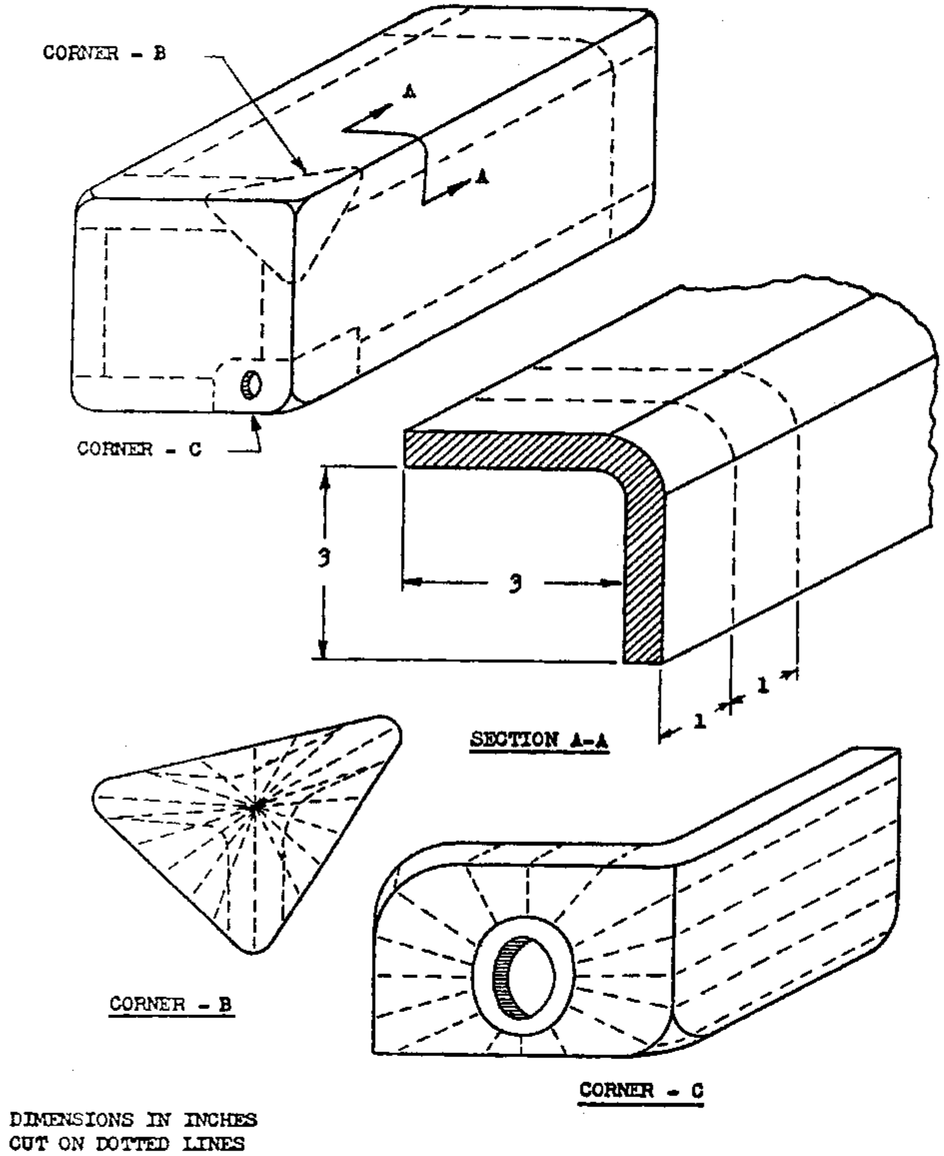
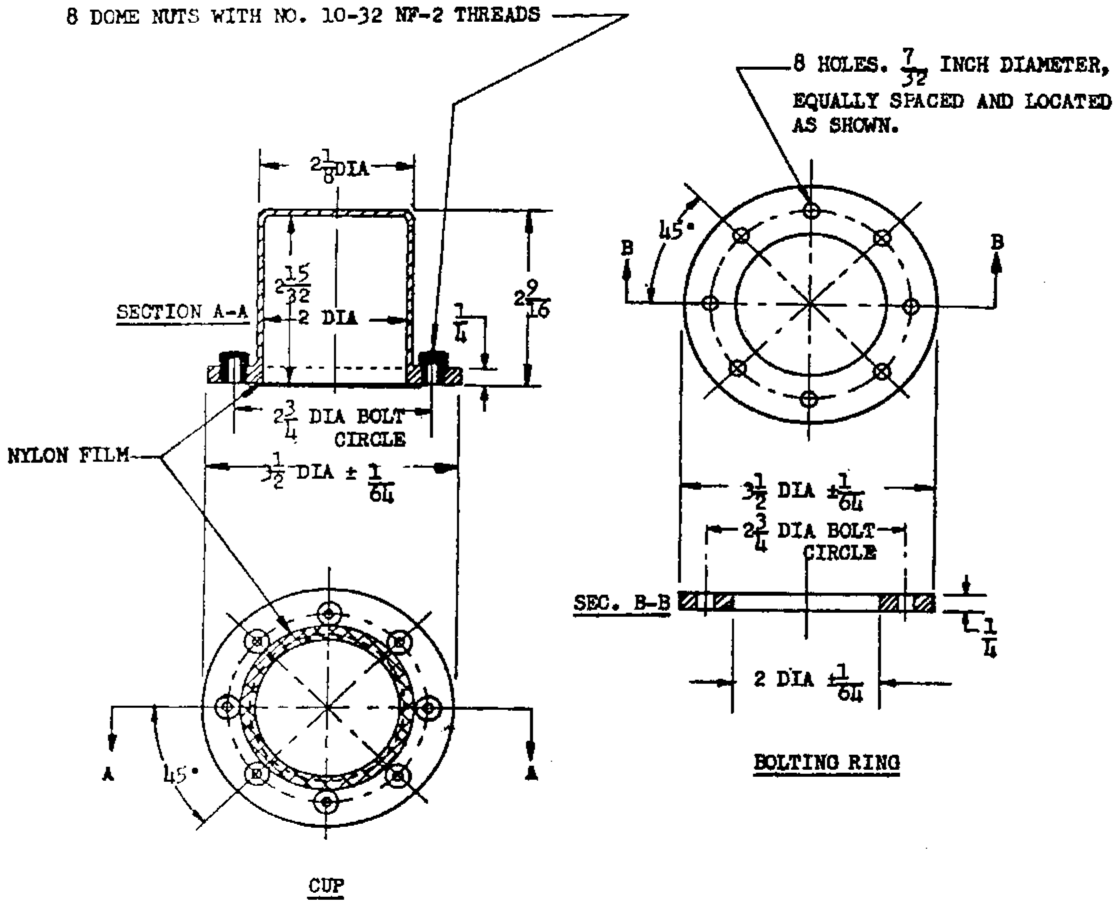


FIGURE 2. Location of cuts for dissection sample

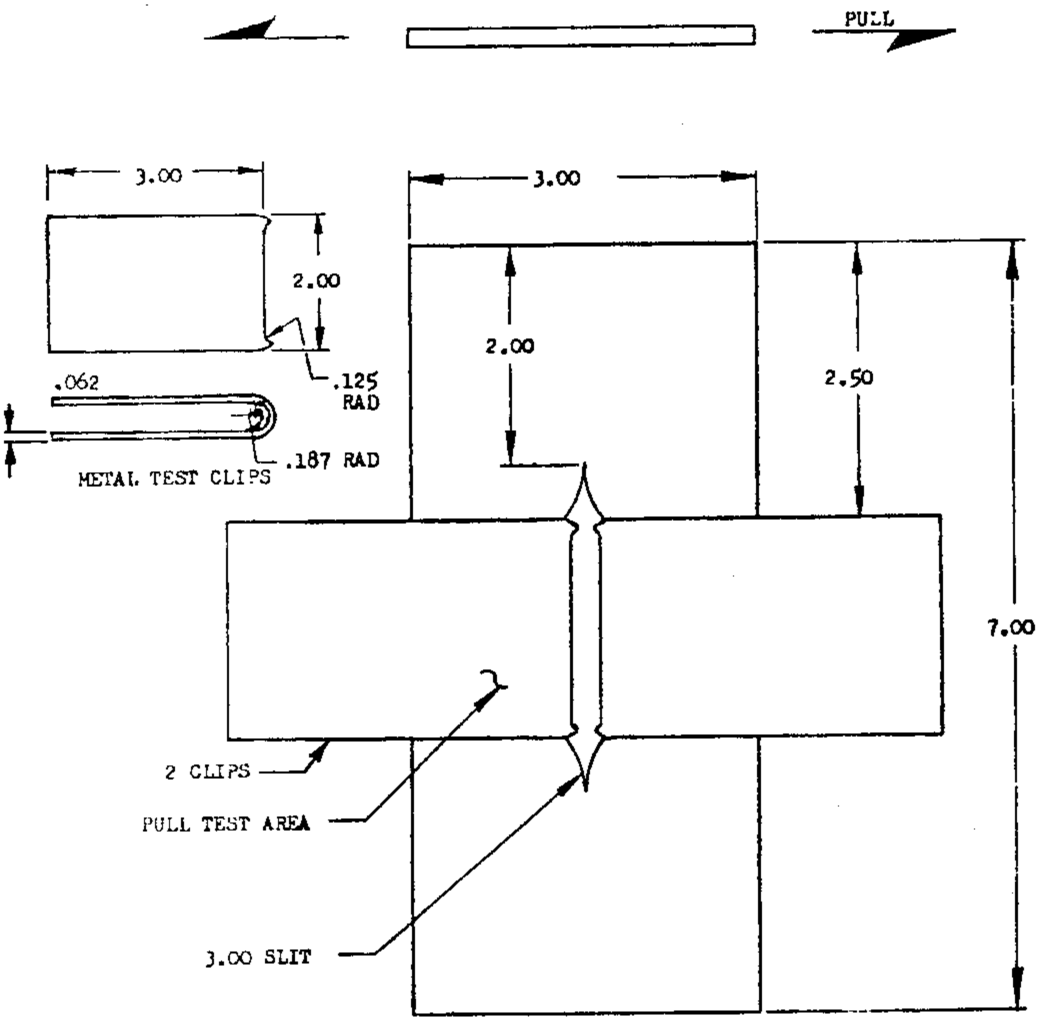


BREAK ALL EDGES 1/32 RAD, MAX
ALL FILLETS 1/32 RAD, MAX

MATERIAL: 17ST ALUMINUM ALLOY BAR STOCK OR EQUAL

DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: ±.010

FIGURE 3. Cup for permeability test



SAMPLES SHALL BE CUT IN ACCORDANCE WITH 4.3.1.1 (a)

DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: ± .032

FIGURE 4. Constant rate tear test sample

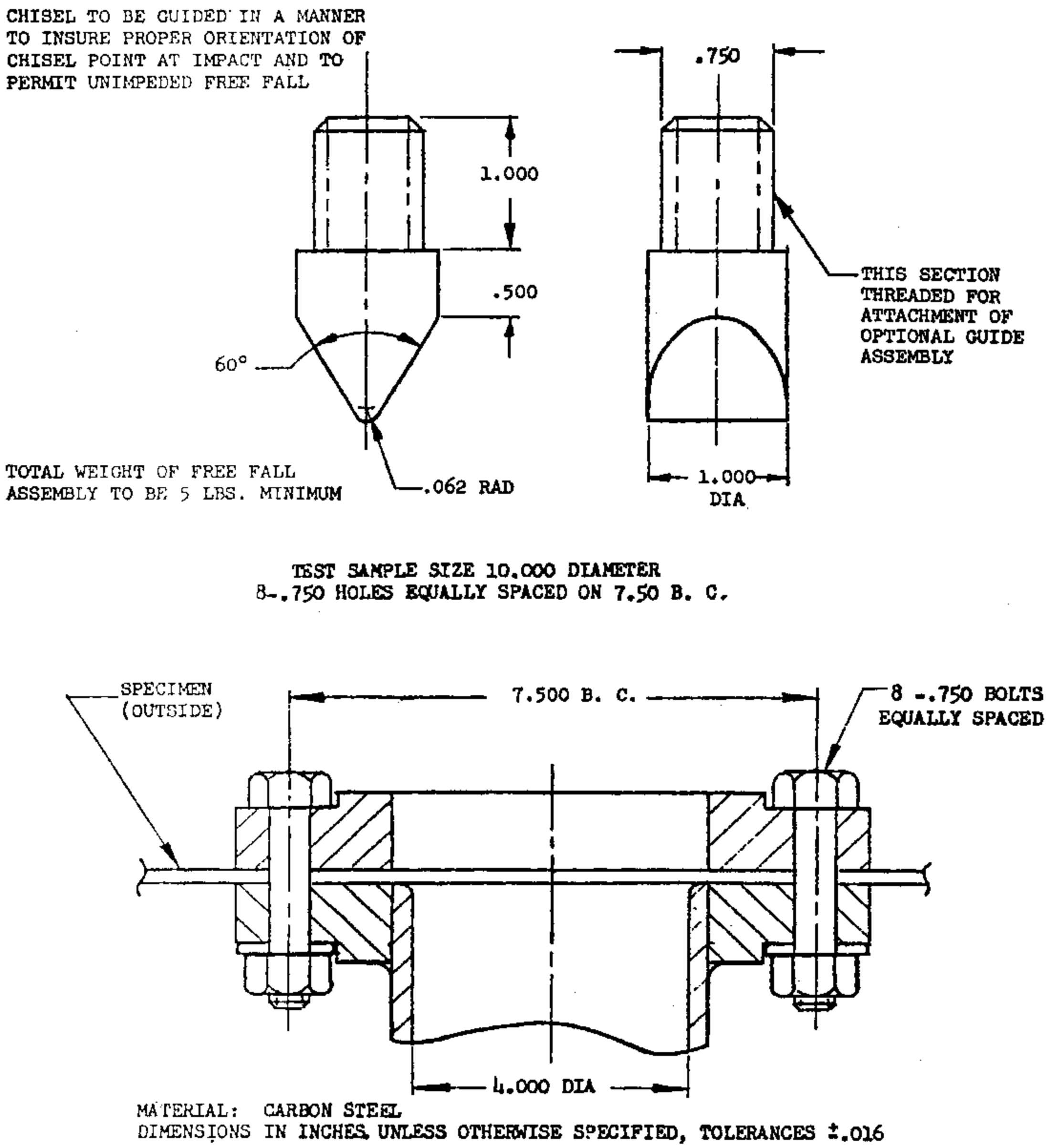
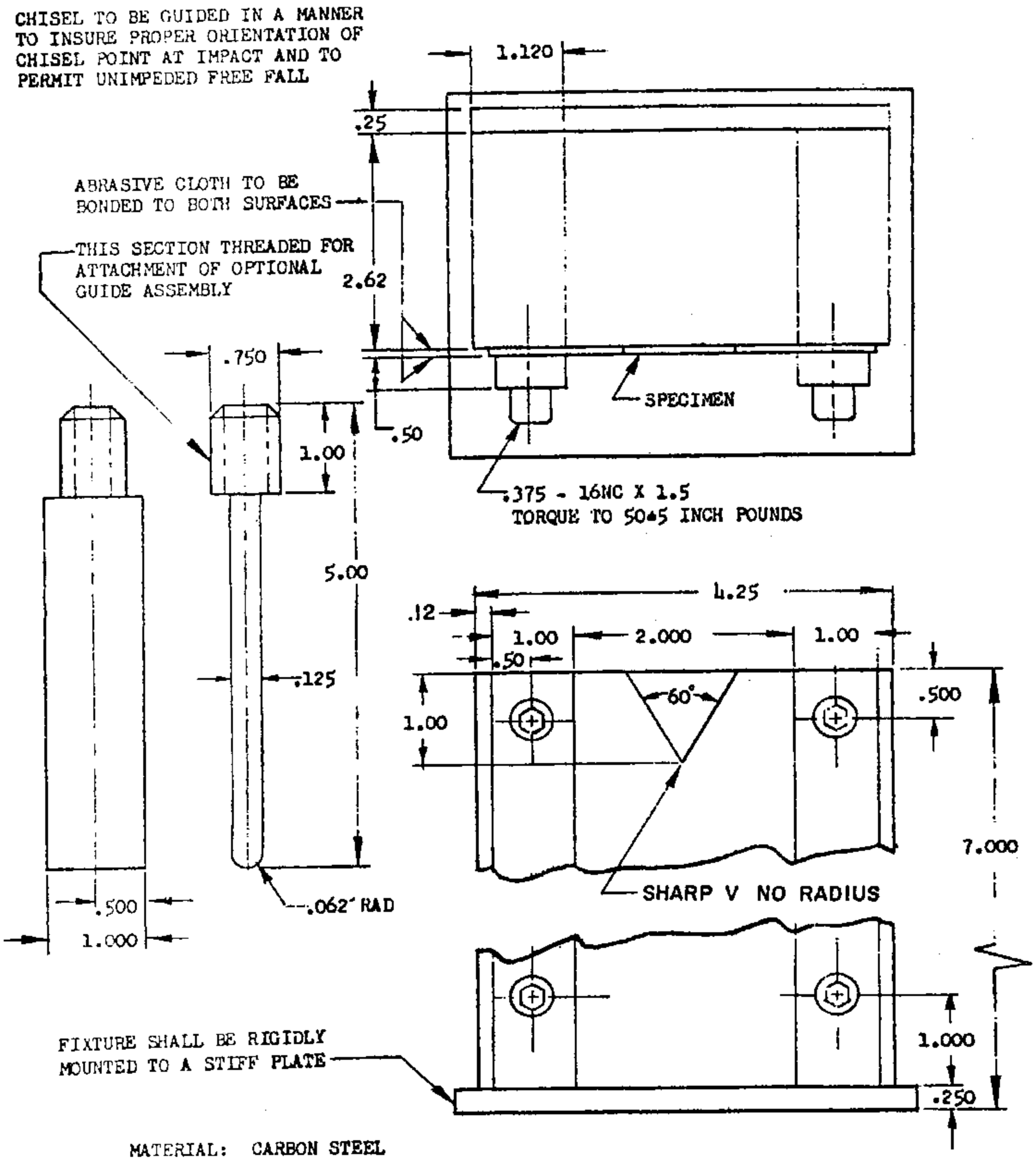
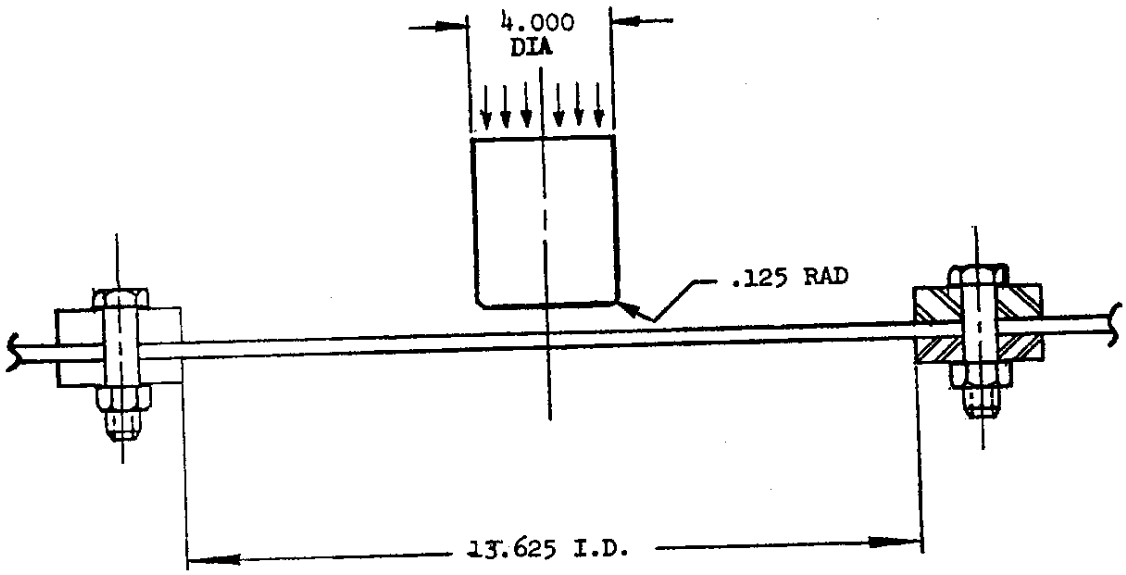


FIGURE 5. Impact penetration test



MATERIAL: CARBON STEEL
DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: ±.032
TEST SAMPLES SHALL BE 4.00 X 6.75 .

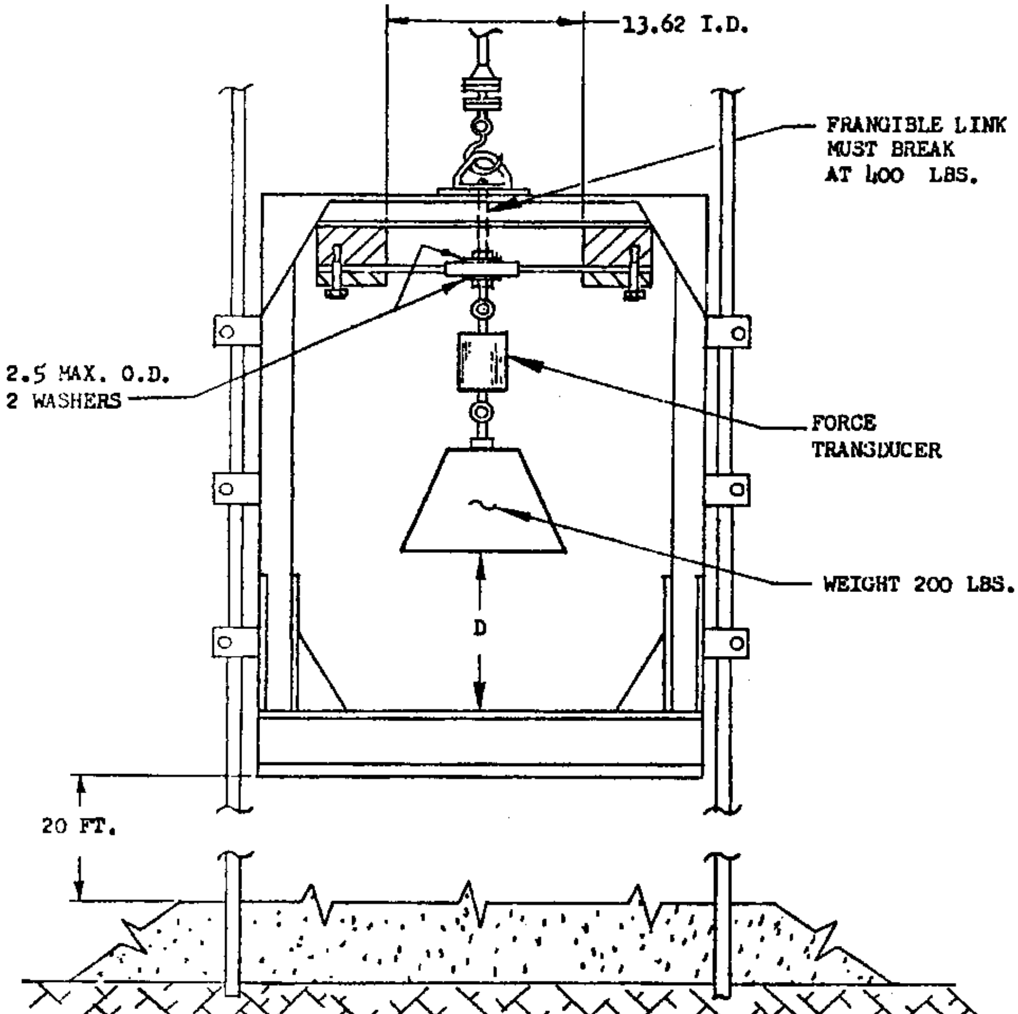
FIGURE 6. Impact tear test



MINIMUM TEST SAMPLE SIZE 16.75 DIAMETER

DIMENSION IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: ±.032

FIGURE 7. Panel strength test



D - THIS DISTANCE SHALL BE SUFFICIENT TO PREVENT BOTTOMING OUT PRIOR TO FITTING PULLOUT

MINIMUM SIZE OF TEST SAMPLE 21.50 DIAMETER

DIMENSIONS IN INCHES.

FIGURE 8. Fitting pullout test setup

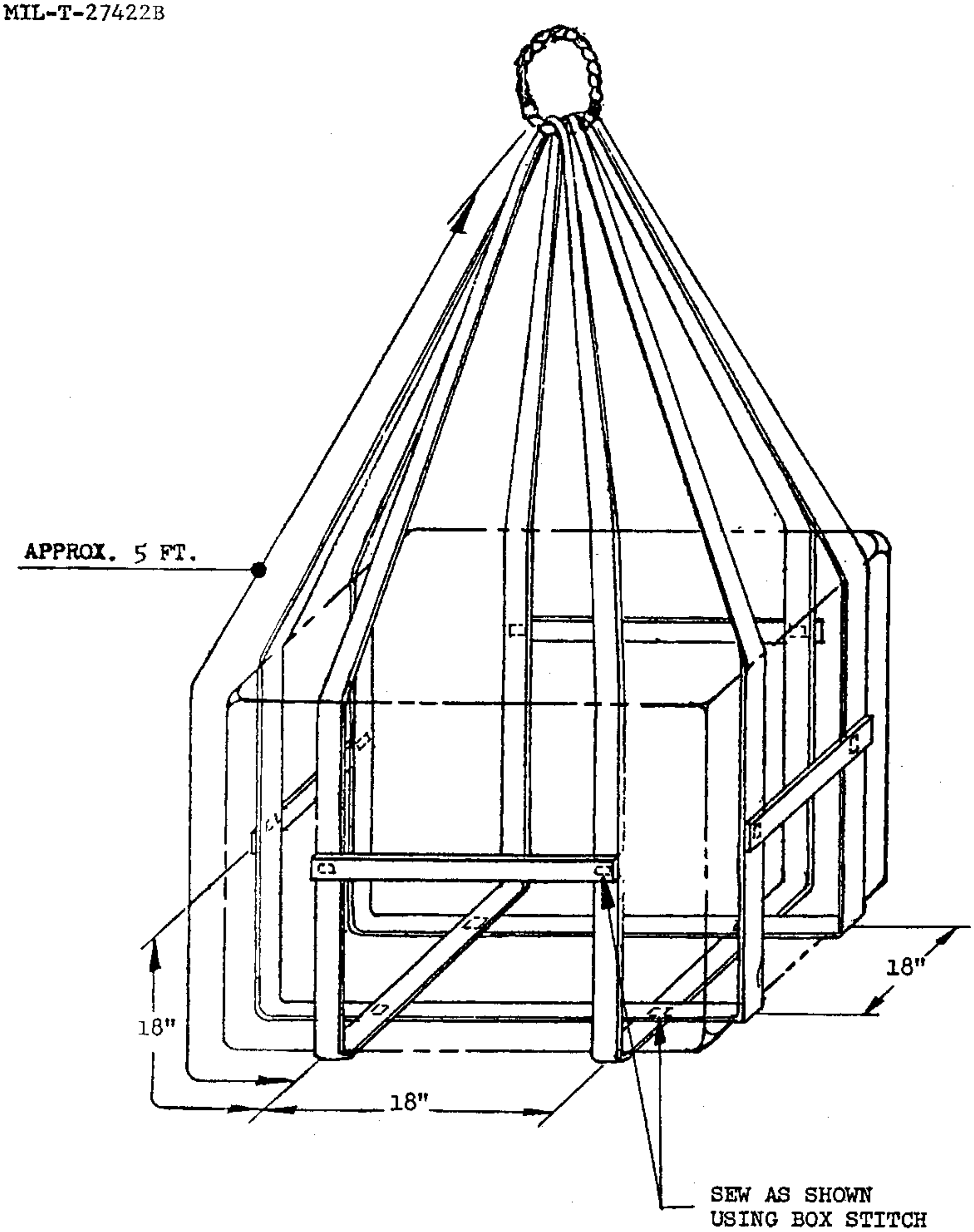
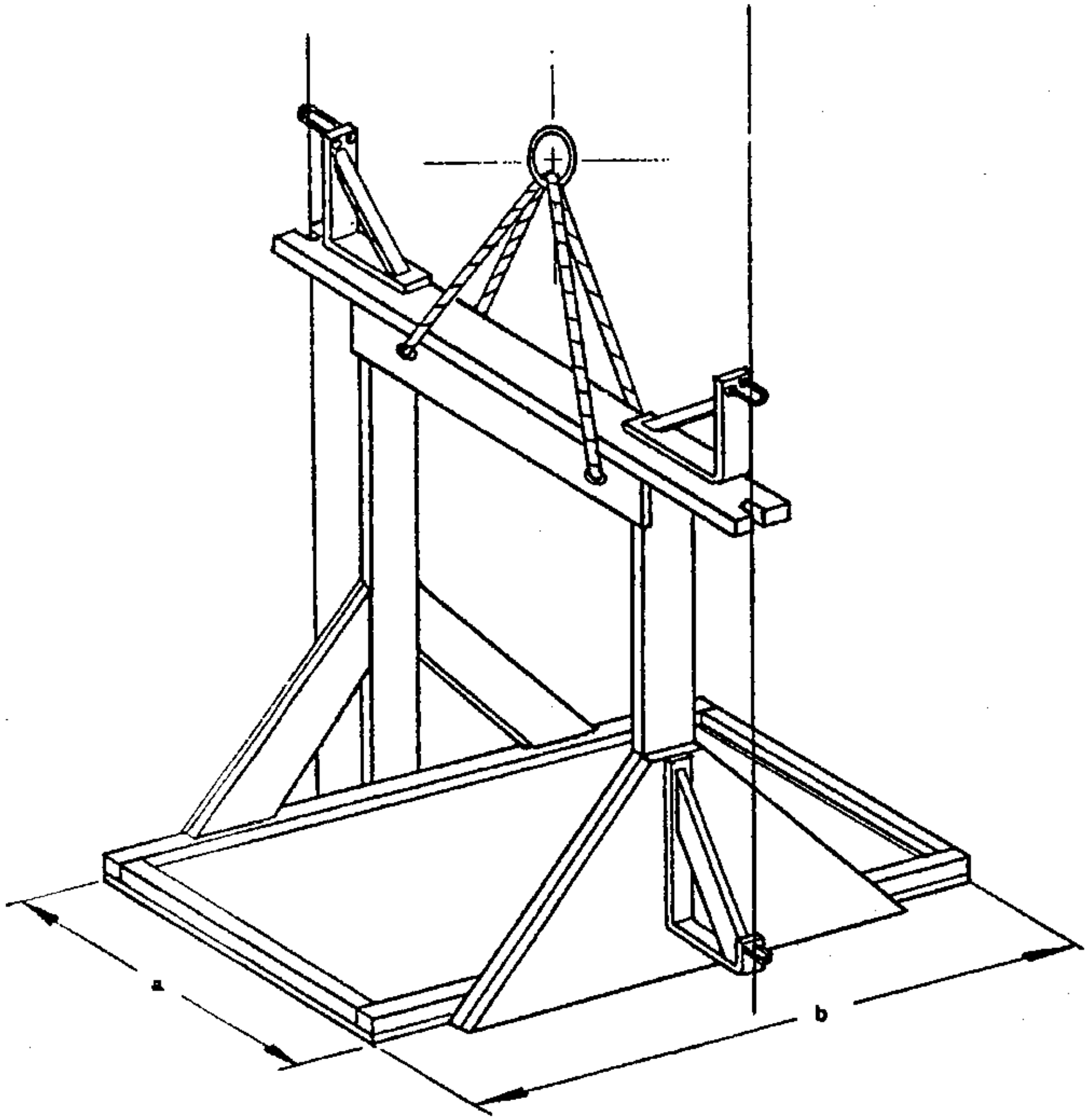


FIGURE 9. Phase I impact test sling



DIMENSIONS a and b SHALL NOT EXCEED CELL DIMENSIONS(WHEN THE LOADED CELL IS IN PLACE FOR TEST) BY MORE THAN 12 INCHES IN EITHER DIRECTION

FIGURE 10. Crash impact test fixture

6.4.2 Request for information pertaining to the phase I or phase II preproduction tests should be addressed to Commander, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio 45433, Attention: ASNJI-20; or to the Contracting Officer, U.S. Army Aviation Systems Command, P.O. Box 209, Main Office, Saint Louis, Missouri 63166; or to the Naval Aeronautical Systems Command Headquarters, Department of the Navy, Washington, D.C. 20360, Attention: AIR-530, with copies to the other services.

6.4.2.1 Preemptive approval. - Preemptive approval is herein defined as approval for phase I tests, conducted without contractual coverage. Reports of tests, in accordance with MIL-STD-831 should be furnished in duplicate to the addressees as shown in 6.4.2. These reports should be signed by a responsible representative of the manufacturer or the laboratory in which the tests are conducted. Preemptive approvals may be accepted at the option of the procuring activity in lieu of the phase I preproduction approval specified in 4.3.3.1.1.

6.5 Service life. - The service life of fuel cells covered by this specification is equivalent to that of the aircraft life in which they are installed.

6.6 Gunfire. - The procuring activity may have one round of 40 millimeter high explosive statically detonated 24 inches from the outside of the tank. The results of this round will not be utilized in appraising and formulating tank approval decision, but will aid in the development of a possible cell construction that the Services are desirous of obtaining.

6.7 Special environment. - When the test methods specified herein do not represent the tank environment, for example, temperatures resulting from aerodynamic heating in excess of 160° F, the test method should be modified as agreed upon by the contractor and the procuring activity to simulate operation conditions.

Custodians:
Army - AV
Navy - AS
Air Force - 11

Review activities:
Army - AV
Navy - AS
Air Force - 80

Preparing activity:
Air Force - 11

Project No. 1560-0043