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INCH-POUND
MIL-PRF-32233
20 December 2006

PERFORMANCE SPECIFICATION

TANKS, COLLAPSIBLE, 3,000, 10,000, 20,000, 50,000, & 210,000 U.S. GALLONS, FUEL

1. SCOPE

1.1 Scope. This performance specification covers 3,000, 10,000, 20,000, 50,000, and 210,000 U.S. gallon capacity, collapsible fuel storage tank assemblies.

1.2 Classification. Tanks will be of the following sizes as specified (see 6.2).

Size I	-	3,000 gallon
Size II	-	10,000 gallon
Size III	-	20,000 gallon
Size IV	-	50,000 gallon
Size V	-	210,000 gallon

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Tank-automotive and Armaments Command, ATTN: AMSRD-TAR-E/268, MS-268, Warren, MI 48397-5000 by letter or emailed to standardization@tacom.army.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

AMSC N/A FSC 3835

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2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

FED-STD-595	–	Colors in Government Procurement; Color chip 33446 (sand matte), general match or lighter
A-A-52557	–	Fuel Oil, Diesel; For Posts, Camps and Stations

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins, Philadelphia, PA 19111-5094, or at http://assist.daps.dla.mil/online/start/).

DEPARTMENT OF DEFENSE

ATPD-2262	–	Berm Liner Assemblies

(Unless otherwise indicated, copies of the above ATPD are available from the office of the Contracting Officer or can be requested at standardization@tacom.army.mil).

MIL-DTL-83133	_	Turbine Fuel, Aviation, Kerosene Types, NATO F-34 (JP-8) and NATO F-35, JP-8+100
MIL-DTL-5624	_	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-PRF-370	–	Performance Specification, Hose and Hose Assemblies, Nonmetallic: Elastomeric, Liquid Fuel

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins, Philadelphia, PA 19111-5094, or at http://assist.daps.dla.mil/online/start/).

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 111	–	Weather Resistance of Textiles: Exposure to Daylight and Weather

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(Application for copies should be addressed to the American Association of Textile Chemists and Colorists, 1 Davis Drive, P.O. Box 12215, Research Triangle Park, NC 27709-2215, or at www.textileweb.com).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 381	–	Standard Test Method for Gum Content in Fuels by Jet Evaporation – JP Designation
ASTM D 412	–	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers Tension
ASTM D 413	–	Standard Test Methods for Rubber Property Adhesion to Flexible Substrate
ASTM D 429	–	Standard Test Methods for Rubber Property - Adhesion to Rigid Substrates (DoD Adopted)
ASTM D 471	–	Standard Test Method for Rubber Property Effect of Liquids
ASTM D 750	–	Standard Test Method for Rubber Deterioration in Carbon Arc Weathering Apparatus.
ASTM D 751	–	Standard Test Methods for Coated Fabrics
ASTM D 910	–	Standard Specification for Aviation Gasolines
ASTM D 1149	–	Standard Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber
ASTM D 1655	–	Standard Specification for Aviation Turbine Fuels
ASTM D 5035	–	Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
ASTM G 155	–	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure on Non-Metallic Materials

(Application for copies can be obtained from the American Society for Testing and Materials, 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken, PA 19428-2959, or at www.astm.org).

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Description. The tank assembly shall consist of a collapsible tank with attached handles and fittings, accessories, berm liner, ground cloth, emergency and permanent repair kits, and tank chest, unless otherwise specified (see 6.2). The tank assembly shall be for storage of military specification fuels in accordance with 3.3.3.

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3.2 First article. When specified (see 6.2), a tank assembly (or assemblies) shall be subjected to first article inspection in accordance with 4.2.

3.3 Materials. The contractor shall verify that the materials used meet all of the operational and environmental requirements specified. The tank assembly shall be newly fabricated from recovered materials to the maximum extent practicable, provided the components meet all other requirements of this specification. The materials shall be of sufficient durability to meet all the requirements as specified herein. No material shall have an adverse effect on the health of personnel when used for its intended purposes.

3.3.1 Deterioration prevention and control. The tank assembly shall be fabricated from compatible materials, inherently corrosion resistant, or treated to provide protection against various forms of corrosion or deterioration to which they are susceptible.

3.3.2 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs. Used, rebuilt, or remanufactured components shall not be permitted.

3.3.3 Fuel compatibility. The contractor shall certify that each tank assembly is compatible for service with all of the fuels listed below:

a. JP-8 IAW, MIL-DTL-83133;
b. JP-5 IAW, MIL-DTL-5624;
c. Diesel Fuel IAW, A-A-52557;
d. Aviation Gasoline IAW, ASTM D 910.

3.3.4 Additional material tests. The tank material shall also meet the requirements of Tables I & II.

TABLE I. Characteristics of Tank Material Interior/Exterior.

Test property	Requirements	Test reference		Application
		ASTM	Para	
Fuel contamination: Unwashed gum- Existent gum-	 20 mg/100 ml (max) 5 mg/100 ml (max)	D 381	4.5.2.2	Internal
Diffusion rate (fl oz/sq ft/24 hr)/tank material	0.06 (max)			4.5.2.4

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Test property	Requirements	Test reference		Application
		ASTM	Para	
Puncture resistance (lb)/tank material	150 (min) for tank sizes I, II, and III 225 (min) for tank sizes IV and V	D 751		4.5.2.5
Blocking/tank material	Separation within 5 seconds			4.5.2.7
Low temperature crease resistance/tank material	No cracking, peeling, or delamination under 7X lens			4.5.2.6
Ozone resistance-	No cracks under 7X lens	D 1149	4.5.2.3	External

TABLE II. Characteristics of Tank Material and Seams.

Test property/application	Requirements	Test reference		
		ASTM	AATCC	Para
Weather resistance after fuel extraction, 1500 hr exposure at 5% elongation: Breaking strength (material & seam) retention (warp & fill)/tank material & seams (See note)	Meet or exceed 2.5 Safety Factor	D 750, G155, & D 751 procedure B	111 option A	4.5.4 and 4.5.2.1
Dead load shear resistance under load (equivalent to the 2.5 safety factor) stress while immersed in JP-8 at 160°F for 70 hrs)/seams	0.125 inch separation (max) and no seam delamination			4.5.2.8

NOTE: For all seam tests, all specimens shall break in the coated fabric. Failure of any specimen in a seam area at any value shall constitute failure of this test.

3.4 Tank construction.

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3.4.1 Seams and Joining of Materials. All seams and any other areas of the tank where two materials are joined shall meet or exceed all the strength properties of the tank material.

3.4.2 Weight. The weight of the crated tank assembly shall not exceed the following:

Size I, II, III and IV	5,000 lbs
Size V	10,000 lbs

3.4.3 Fittings. Each tank shall be furnished with fittings. The quantity required and location for the filler/discharge and vent fittings shall be as shown in Figures A1 and A2. The connection between fittings and tank shall meet or exceed all the properties of the un-seamed tank material. All fittings shall be capable of withstanding 150 psig of fuel pressure without leaking.

3.4.3.1 Filler/discharge fitting. The male coupling halves (terminating ends) and coupling half caps shall be in accordance to A-A-59326 compatible with the corresponding filler/discharge elbows and filler/discharge hose assembly accessories noted in 3.8. All fittings shall include a respective size coupling half, dust cap with chain in accordance with A-A-59326 and shall be installed with the chain tethered to the fitting and the cap. The fitting size and quantities shall be as specified below:

Size I	-	One 2-inch, and one 4-inch male coupling half.
Size II	-	Two 4-inch male coupling halves.
Size III	-	Two 4-inch male coupling halves.
Size IV	-	Two 4-inch male coupling halves.
Size V	-	Four 6-inch male coupling halves.

3.4.3.1.1 Filler/discharge fitting flow rates. Each filler/discharge fitting shall be designed for a flow rate as specified without excessive restriction or damage to the tank. The 2-inch fittings shall be rated at 200 Gallons per Minute, 4-inch fittings shall be rated at 600 Gallons per Minute, and 6-inch fitting shall be rated at 1200 Gallons per Minute.

3.4.3.2 Drain fittings. For Sizes II through V, the tank shall be provided with a means to drain sediment, water and residual fuel. The draining capability shall interface with the drain hose accessory noted in 3.8. The drain fitting/s shall have a minimum 2-inch ID. The drain assembly shall not be a threaded type fitting. Each drain shall come with an installed blind flange on the drain for quick deployment where drains are not required or desired. Each collapsible tank shall be equipped with spare drain gaskets.

3.4.3.3 Vent fitting. The tank vent shall be of a passive type design and ensure complete venting of fuel vapor in the tank and located in accordance with Figures A1 and A2. The weight of the vent shall minimize the accumulation of water on top of the tank. The vent shall provide vapor pressure relief, be fitted with a flame arrestor, and provide protection against water or airborne contamination of the stored fuel.

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3.4.4 Maximum tank dimensions. The tank shall not exceed the following dimensions:

Size I - 14 feet x 14 feet
Size II - 22 feet x 22 feet
Size III - 30 feet x 30 feet
Size IV - 30 feet x 75 feet
Size V - 75 feet x 75 feet

3.5 Performance.

3.5.1 Safety Factor. The tank shall have a rated capacity as specified below with a minimum safety factor of 2.5 times the maximum in-plane principal stress (manufacturer calculated design stress) that is dependent upon the material used and the materials rate of degradation. This calculated safety factor shall apply throughout the minimum three year service life with exposure to all other environmental conditions contained in this specification.

3.5.2 Cycling. The tank assembly shall be capable of withstanding cycling throughout the service life.

3.5.3 Environmental. The tank assembly shall be suitable for service (operation) in ambient temperatures ranging from –25 to 140 °F with continuous exposure to direct sunlight, rain, hail, sleet, snow, wind, blowing sand, and in any combination thereof. The tank assembly shall not be damaged when exposed to fungal growth or relative humidity of up to 100%.

3.5.4 Service life. The tank assembly shall have a service life of a minimum of three (3) continuous years in environmental conditions as specified. Tank assembly shall be reusable (capable of being drained, cleaned, packaged and redeployed a minimum of 3 times during its service life).

3.5.5 Storage life. The tank assembly shall withstand folded storage at ambient temperatures from -25 to 160°F for a minimum of 12 years, without damage or leakage when subsequently filled with fuel. The tank assembly shall not require any cleaning or maintenance when taken out of storage prior to being placed in service.

3.6 Capacity. For design purposes the tank assembly shall be capable of storing the volumes listed below without leaking.

Size I - 3,000 U.S. gallons
Size II - 10,000 U.S. gallons
Size III - 20,000 U.S. gallons
Size IV - 50,000 U.S. gallons
Size V - 210,000 U.S. gallons

3.7 Tank Overload. The tank shall be designed to accept a 10% overfill condition without leaking or failure.

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3.8 Accessories. If specified (see 6.2), each tank shall be provided with the accessories in the quantities shown Table III. Each accessory in Table III shall be suitable for use in continuous contact with the fuels referenced in 3.3.3. Each assembly in Table III shall be provided fully assembled complete with coupling halves, dust caps and plugs conforming to A-A-59326. Plugs and caps shall be tethered. Accessories such as butterfly valves, fittings, plugs, caps, etc., shall be rated for minimum working pressure of 150 psig. Valve shall not be capable of opening or closing during flow without human operation. Hoses shall be IAW MIL-PRF-370 and certification (CoC) shall accompany or be attached to each hose.

TABLE III. Tank Accessories.

Item	Conformance	Size				
		I	II	III	IV	V
Drain Hose Assembly	2-inch ID non-collapsible. Length of hose shall be sufficient to extend 5 feet past the footprint of the tank (empty). One end shall have a matching bolted flange for connection to the collapsible tank and the other end shall be a 2-inch male coupling half.	0	1	1	1	1
	2-inch ID non-collapsible hose, 10-feet in length with male-female coupling half ends.	0	1	1	1	1
Drain Valve Assembly	2-inch valve with male-female coupling half ends.	0	1	1	1	1
Filler/Discharge Hose Assembly	4-inch ID non-collapsible hose, 12-feet in length with male-female coupling half ends.	0	2	2	2	0
	6-inch ID non-collapsible hose, 12-feet in length with male-female coupling half ends.	0	0	0	0	4
Filler/Discharge Valve Assembly	4-inch valve with male-female coupling half ends.	0	0	0	2	0
	6-inch valve with male-female coupling half ends.	0	0	0	0	4
Filler/Discharge Elbow (female to female)	4-inch	1	1	1	1	0
	6-inch	0	0	0	0	2
Filler/Discharge Elbow (female to male)	2-inch	1	0	0	0	0
	4-inch	0	1	1	1	0
	6-inch	0	0	0	0	2

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Item	Conformance	Size				
		I	II	III	IV	V
Consumable Items/Overpack Kit	Each tank shall contain spare/overpack consumable item(s) as required for service life. (e.g. gaskets, o-rings, nuts, bolts, etc.)	1	1	1	1	1

3.9 Markings. Unless otherwise specified (see 6.2), each tank assembly shall be provided with the following markings.

3.9.1 Identification. The tank shall be permanently marked (e.g. embossed) in at least two opposing locations and visible at any level of fill. This will be a special interest item. The following information shall be provided using 1.00 inch (minimum) letters:

COLLAPSIBLE FABRIC TANK
(Specify) U.S. GALLONS, FUEL
NSN: (Specify)
MANUFACTURER: (Specify)
DATE MANUFACTURED: (Specify month - 3 letters - and year)
CONTRACT NO: (Specify)
LOT & SERIAL NO: (Specify)
WEIGHT EMPTY: (Specify approximate weight in pounds)

3.9.2 Warning labels. The tank shall be permanently marked (e.g. embossed) with warning labels centered on all four sides of the tank visible at any level of fill. Each label shall contain the following information using letters 1.00 inch high (minimum), except for the word "WARNING" that shall be letters 2.00 inch high (minimum). This will be a special interest item.

WARNING
DO NOT OVERFILL

OVERFILLING MAY RESULT IN PERMANENT
DAMAGE AND FAILURE OF THE TANK

MAXIMUM CAPACITY:
(specify) US GALLONS
(specify) LITERS

MAXIMUM TANK HEIGHT:
(specify) FEET (specify) INCHES

3.9.3 Valve labeling. The valves shall be permanently marked to indicate the status ("OPEN" for the opened position and "CLOSED" for the closed position) as well as the direction of operation (i.e., open, close), see 3.8.

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3.10 Color. Unless otherwise specified (see 6.2), the color of the exposed surfaces of the tank shall be in accordance with FED-STD-595, color chip 33446 (sand matte), general match or lighter. Fittings shall be non-reflective.

3.11 Repair Repairs shall be permitted. Repaired tanks are subject to pass all the requirements as specified herein. Repair of seams shall not be greater than 5 percent of total seam length in the tank. Defects subject to repair (other than those on seams) shall be limited to 6.00 inches in diameter, length, or width as applicable. The 6.00 inch criteria shall apply to the maximum dimensions of the affected condition. Repair of interfaces between fittings and tank shall be permitted, e.g., gasket, plate. Any tank that is repaired due to a leak identified during the air leakage test as specified in 4.3.3 shall be subjected to the overload test as defined in 4.5.1.2 followed by the air leakage test as defined in 4.5.1.1.

3.12 Deployability. The Size I through III tank assembly shall be deployable (not including berm construction and berm liner deployment) by a maximum of eight (8) personnel using only a single 10,000-pound forklift, in under two (2) hours, time beginning upon placement of crated tank assembly at outside edge of lined berm and ending when the tank is ready to accept fuel. For Size IV and V tank assemblies the same applies with the exception of sixteen (16) personnel instead of the eight (8) personnel for the Size I through III tank assemblies. Only common hand tools shall be required. Deployment of tank shall not cause it to leak.

3.13 Retrievability. The Size I through III tank assembly shall be retrievable by a maximum of twelve (12) personnel using only a single 10,000-pound forklift. For Size IV and V tank assemblies the same applies with the exception of twenty five (25) personnel instead of the twelve (12) personnel for the Size I through III tank assemblies. The tank shall be fully drained prior to folding and crating. Only common hand tools shall be required. The retrieval procedure shall not cause the tank to leak.

3.14 Workmanship. The fabric-reinforced flange-type fittings shall contain no gum voids, cracks or tears that could adversely affect the strength of the assembly. All metal parts shall be clean and free of sand, dirt, and scale, flux, burrs, sharp edges, corrosion, and shall not be broken or malformed. Metal surfaces shall be smooth with edges rounded or beveled. The inside and outside of the tank shall be clean and free of foreign materials (excluding talc). Any necessary rework shall meet all applicable requirements of this specification. The cemented surfaces of all spliced areas, fitting flanges, and patch-type repairs shall affect a bond that will result in strength of the cemented area not less than the strength of adjacent tank fabric. Fabric components shall be free of holes, cuts, or tears, thin, or weak areas, caused by abrasion or delamination, exposed fabric, blisters, holidays, tunnels, unadhered pockets, picks, loose edges, or any delamination of coating.

3.15 Berm liner. If specified (see 6.2), a berm liner in accordance with ATPD-2262, and of matching size, shall be furnished with each tank.

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3.16 Ground Cloth. If specified (see 6.2), a coated fabric ground cloth shall be furnished with each tank. The ground cloth shall be a coated fabric material to protect the tank bottom from sharp rocks or other protrusions when deployed. Each ground cloth shall have handles on each edge to facilitate in deployment and recovery. The ground cloth shall extend past the outer edges of applicable size tank (when empty and laid flat) by one foot on all sides. The cloth shall have no deleterious effect on the tank when the two are used in conjunction in any applicable environment. The exterior coatings of the coated cloth shall be the same color as the tank. The bond between each handle assembly and ground cloth shall be capable of withstanding a load of 300 pounds in the same plane as the ground cloth.

3.17 Emergency Field Repair Kit. If specified (see 6.2), each tank assembly shall include a field repair kit that contains items necessary to perform on site repairs such as punctures, tears and leaks in an emergency situation. Kit shall include all necessary tools to complete field repairs.

3.18 Permanent Field Repair Kit. If specified (see 6.2), each tank assembly shall include a permanent field repair kit to perform on site repairs. This kit shall include items necessary to perform permanent repairs of punctures, tears and leaks. If this repair kit cannot withstand the environmental service life or the storage life (as specified in 3.5.4 and 3.5.5), it shall be made available through the technical manual that accompanies the tank assembly.

3.19 Tank chest. If specified (see 6.2), an aluminum lightweight tank chest shall be furnished for storage of each tank and components. The tank chest shall have provisions for handling by Material Handling Equipment (10,000-lbs forklift), personnel (when tank chest is empty), and capable of being sling lifted. The tank chest shall be capable of storing the tank, ground cloth, emergency repair kit, and all ancillary components (not including the berm liner). The tank chest shall have a removable lid that can be removed and secured without the use of tools. Tank chest shall be compatible with a standard cargo International Standard Organization (ISO) 8'x8'x20' container.

4. VERIFICATIONS

4.1 Classification of inspections. Inspections are classified as follows:

a. First article inspection (see 4.2).
b. Conformance inspection (see 4.3).

4.1.1 Fabricated samples for inspection. Fabricated samples (FS) shall be produced using the same materials, processes, production personnel and equipment used in fabrication of the tank material and tank assembly (where applicable). Laboratory samples shall not be acceptable (samples produced in a testing facility or by test or quality control personnel using production equipment). If applicable, each tank shall include a sufficient number of fabricated samples to conduct inspection tests in accordance with 4.5. The contractor shall ensure that the fabricated samples are representative of the corresponding production tank or first article tank. Fabricated samples shall be taken from each tank during fabrication (where applicable).

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4.2 First article inspection.

4.2.1 Examinations. Each first article tank assembly (see 6.3) shall be examined as specified in Table IV. Presence of any defects shall be cause for rejection.

4.2.2 Tests. Each first article tank assembly shall be tested as specified in Table V. The number in the 'First Article Sequence' column specifies the order in which the corresponding test shall be performed. Multiple numbers indicate test repetition in the order specified by the number. An 'X' indicates the corresponding test can be performed in any order. FS indicates Fabricated Samples (in accordance with 4.1.1). The actual test to be performed is listed in the 'Test Paragraph' column. Failure of any test shall be cause for rejection.

4.2.3 Certificates of Conformance. A Certificate of Conformance (CoC) shall be provided for items as specified in section 3. If no CoC is available, other certification shall be provided along with industry accepted supporting data.

4.2.4 Safety Factor. The manufacturer shall provide a finite element analysis to determine the highest stress point(s) on the tank and the safety factor shall be based on this analysis, in accordance with 3.5.1.

4.3 Conformance inspection.

4.3.1 Inspection Lot. The lot size shall be a maximum of 25 tank assemblies (per tank size) manufactured successively. The assigned Government representative will randomly select a tank assembly for conformance inspection.

4.3.2 Examination. Each tank assembly selected in accordance with 4.3.1 shall be examined as specified in Table IV. Any nonconformance revealed by the examination shall be cause for rejection of the entire lot.

4.3.3 Tests. All production tanks shall be subjected to the air leakage test. Each tank assembly selected in accordance with 4.3.1 shall be tested as specified in Table V. The number in the 'Conformance Inspection Sequence' column specifies the order in which the corresponding test shall be performed. Multiple numbers indicate test repetition in the order specified by the number. An 'X' indicates the corresponding test can be performed in any order while an 'NR' indicates that the corresponding test need not be performed. FS indicates Fabricated Samples (in accordance with 4.1.1). The actual test to be performed is listed in the 'Test Paragraph' column. Failure of any test shall be cause for rejection of the entire lot.

4.4 Examination schedule.

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TABLE IV. Examination schedule.

Number	Examination Description	Requirement Paragraph
101	Certification of tank assembly components not as specified.	3.3, 3.3.1, 3.3.2, 3.3.3, 3.4.3.1, 3.5, 3.5.3, 3.5.4, & 3.5.5
102	Dimensions of the tank not as specified.	3.4.4
103	Drain fitting assembly not as specified.	3.4.3.2
104	Vent fitting assembly not as specified.	3.4.3.3
105	Berm liner not as specified.	3.15
106	Repair items not as specified.	3.17 & 3.18
107	Quantity of accessories not as specified.	3.8
108	Drain hose assembly(s) not as specified and/or not completely assembled.	3.8
109	Drain valve assembly(s) not as specified and/or not completely assembled.	3.8
110	Filler/discharge hose assembly not as specified and/or not completely assembled.	3.8
111	Filler/discharge valve assembly not as specified and/or not completely assembled.	3.8
112	Identification markings not as specified.	3.9.1
113	Warning labels not as specified.	3.9.2
114	Valves not labeled as specified.	3.9.3
115	Color not as specified.	3.10
116	Repair performed.	3.11

4.5 Test schedule.

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TABLE V. Test schedule.

First Article Sequence	Conformance Inspection Sequence	Test	Test Paragraph	Requirement Paragraph
1	1, 3 (All production tanks)	Air leakage	4.5.1.1	3.5
6, 12	2	Tank Overload	4.5.1.2	3.7
2	NR	Low temperature	4.5.1.3	3.5
3	NR	High temperature	4.5.1.4	3.5
5	NR	Fuel storage	4.5.1.5	3.5
X (FS)	NR	Weather resistance	4.5.2.1	3.3.4, Table II
X (FS)	X (FS)	Existent gum	4.5.2.2	3.3.4, Table I
X (FS)	NR	Ozone resistance	4.5.2.3	3.3.4, Table I
X (FS)	X (FS)	Diffusion rate	4.5.2.4	3.3.4, Table I
X (FS)	X (FS)	Puncture resistance	4.5.2.5	3.3.4, Table I
X (FS)	NR	Low temperature crease resistance	4.5.2.6	3.3.4, Table I
X (FS)	X (FS)	Blocking	4.5.2.7	3.3.4, Table I
X (FS)	X (FS)	Seam dead load shear resistance	4.5.2.8	3.3.4, Table II
9	NR	Cycling	4.5.3.1	3.5.2
4, 8, 11	NR	Deployment	4.5.3.2	3.12
7, 10	NR	Retrieval	4.5.3.3	3.13

4.5.1 Tank assembly tests.

4.5.1.1 Air leakage. Pressurize the tank to a minimum of 0.5 pound per square inch gauge (psig) internal air pressure. Thirty (30) minutes after initial pressurization, adjust the internal air pressure, as required, to maintain a minimum of 0.5 psig. Using a soap and water solution, examine the entire tank, including all seams and fittings for air leakage. Any evidence of air leakage shall constitute failure of this test.

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4.5.1.2 Tank Overload. The tank shall be filled to 110% of its rated capacity (by volume) with JP-8 conforming to MIL-DTL-83133 and allowed to stand for a minimum of 4 hours. At the end of the 4-hour period, the tank shall be inspected for any leakage and/or damage. If the test is conducted outside, the examination shall be postponed if weather conditions, such as rain or high humidity, inhibit inspection and will resume under favorable examination conditions. When this test is conducted in accordance with 4.3, water shall be used instead of JP-8, and at successful conclusion of this test, the tank shall be fully dried internally and externally and the entire tank assembly fully crated. Any leakage, including surface wet spots or droplets, shall constitute failure of this test.

4.5.1.3 Low temperature. The tank shall be folded exactly the same way as for placement in the shipping container and then placed, unshielded, in a low temperature environment for a period of 72 hours where the temperature may not be warmer than -25°F. At the end of this period while still maintaining temperatures, the tank shall be unfolded. Any flaking, cracking, delamination (if applicable), or separation of the coated fabric (if applicable), shall constitute failure of this test.

4.5.1.4 High temperature. The tank shall be folded exactly the same way as for placement in the shipping container and then placed, unshielded, in a high temperature environment at a minimum of 160°F for a period of 48 hours and cooled to a minimum of 100°F for an additional 24 hours. At the end of the test time, while still at final test temperature, the tank shall be unfolded. Any flaking, cracking, delamination (if applicable), or separation of coated fabric (if applicable) shall constitute failure of this test.

4.5.1.5 Fuel storage. Place the tank outdoors, without environmental protective covering, in a berm lined with a berm liner. Unless otherwise specified, fill the tank to a minimum of 100% of rated capacity (by volume) with JP-8 conforming to MIL-DTL-83133 and allow standing for a minimum of 15 days. During the test examine the tank twice daily as well as at the end of the test period for signs of leakage, including wetness. Any examination shall be postponed if weather conditions, such as rain or high humidity, inhibit inspection and will resume under favorable examination conditions. Any leakage (to include wetness) shall constitute failure of this test.

4.5.2 Tank assembly material tests.

4.5.2.1 Weather resistance. Weather resistance testing after fuel extraction and dried is applicable to all coating compounds intended to be located on the outside of the tank. Accelerated weathering testing shall be in accordance with ASTM D 750, G 155, or AATCC 111 using a Xenon Light type weatherometer on samples that have been fuel extracted in accordance with 4.5.4. The breaking strength of the material after aging shall be conducted on both warp and fill samples according to ASTM D 751, Procedure B. Nonconformance to Table II shall constitute failure of the test. Failure of any specimen in a seam area at any value shall constitute failure of this test.

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4.5.2.2 Gum Content. Cut a 0.2-ounce specimen of each tank interior coating compound into approximately 0.0625-inch squares and place in a flask containing 8.5 fluid ounces of Reference Fuel D of ASTM D 471 and allow to stand for 48 hours at 73 ±5 °F. Decant and filter the contaminated fluid through Whatman 41H filter paper or equal. Determine the unwashed gum content of the filtrate in accordance with ASTM D 381, procedures 11.1 through 11.12 using the air jet or steam jet vaporizing medium (which is appropriate for the fuel) and an evaporation time of 45 minutes. Using the same samples after completing the unwashed gum content test above, determine the existent gum in accordance with ASTM D 381, procedures 11.1 through 11.12. A minimum of three specimens shall be used. Nonconformance to Table I shall constitute failure of the test. This test shall be repeated with Reference Fuel B, Aviation Gasoline per ASTM D 910 Grade 100LL, JP-8, and DL2.

4.5.2.3 Ozone resistance. Ozone resistance after fuel extraction and drying shall be tested as specified in ASTM D 1149, test method A. The specimens shall be conditioned for 14 days at a temperature of 104 ±4 °F in air having a partial pressure of ozone of 50 millipascals. Fuel extraction shall be in accordance with 4.5.4. Nonconformance to Table I requirements shall constitute failure of the test.

4.5.2.4 Diffusion. The test apparatus shall consist of a diffusion cup and ring, using Figure 2 as a guide. Other cup designs are acceptable as long as the inside diameter of the cup and ring is maintained at 2.00 ±0.02 inches and the cup is 1.00 ±0.06 inches deep. Cut a circular test disk of coated fabric to conform to the outside diameter of the cup flange. Punch holes in the disk to correspond to the flange bolt dimensions as needed. The cup shall be filled with approximately 1.4 fluid ounces of JP-8 conforming to MIL-DTL-83133. A suitable solution shall be used to seal the exposed fabric around the outer edge of the test disk and to seal the test disk to the diffusion cup flange. The test disk shall be placed over the cup with the tank "interior" side toward the fuel. The bolts shall be tightened securely. Place the diffusion cup in a suitable rack in a constant temperature of 73.3 ±2 °F, and a relative humidity of 65 ±2 percent. Allow 1 hour for the assembly to reach equilibrium, then weigh the cup to the nearest 0.005 gram and place in the rack face upward. Keep the cup at the above constant temperature and humidity for 24 hours, then weigh and check for vapor loss. Re-torque the bolts if necessary. Invert the cup (test disk down) in a rack that permits free access of air to the test disk. Weigh the cup daily. Defective films or leaks caused by faulty assembly are usually found when the cup is weighed on the third day. Continue to weigh the cup daily until the weight loss is constant to within 0.010 grams per day after two 24-hour periods. Then record daily weight loss for a continuous interval of 72 hours. The diffusion rate (D) in fluid ounces per square foot per 24 hours shall be the average of not less than three specimens when calculated from the following expression:

$$D = \frac{144 \text{ (average daily loss in grams)}}{\text{(Sp. Gr.) } (29.573)(3.142)(R^2)},$$

Where Sp. Gr. is the specific gravity of the test medium and R is the inside radius of the test cup. The diffusion test shall be repeated and diffusion rates recorded for all fuels in accordance with 3.3.3. Nonconformance to the requirement in Table I with JP-8 as the test fluid shall constitute a failure of this test.

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4.5.2.5 Puncture resistance. Puncture resistance testing shall be in accordance with ASTM D 751 (Bursting Strength), except that that the ring clamp mechanism shall have an internal diameter of 3 inches, and the ball shall be replaced by a piercing instrument shaped like a flared, flat-tip screwdriver, having a width of 0.312 ±0.010 inches and a thickness of 0.031 ±0.004 inches at the extreme tip. The piercing tip edges will be rounded to a 0.010 radius. The piercing instrument shall be oriented to intercept the warp and fill threads at an angle of approximately 45 degrees. The average of three test specimens shall be reported. Nonconformance to Table I requirements shall constitute failure of this test.

4.5.2.6 Low temperature crease resistance. Immerse three coated fabric specimens, each 8 inches square, in JP-8 fuel conforming to MIL-DTL-83133, and condition for 24 hours ±1 hour, at 73 ±5 °F. Remove specimens, place on a wire screen, and air dry with forced air at 73 ±5 °F, for 24 hours ±1 hour. Fold the specimens in half in each direction so that a folded corner occurs in the center of each specimen. Place each folded specimen under a 4-pound load and condition at -25 ±2 °F for 46 hours. At the end of the conditioning period, unfold the specimens while still at a temperature of -25 °F, and examine visually. Cracking, peeling, or delamination of any coating material shall constitute failure of this test. If specimens do not fail, then subject them to the diffusion test specified in 4.5.2.4 except position the specimen in the diffusion cup in such a manner that the center of the previous fold coincides with the center of the cup and use only JP-8 as the test fluid. Nonconformance to 3.3.4 and Table I shall constitute failure of the test.

This test shall be repeated with Aviation Gasoline per ASTM D 910 Grade 100LL. Nonconformance to low temperature crease resistance in Table I shall constitute failure of the test. Document and provide diffusion rate results.

4.5.2.7 Blocking. Place three coated fabric specimens 6.00 inches by 1.00 inch on a smooth surface in such a manner that the ends are overlapped 1.00 inch. Place a 4-pound weight (+/- 1 ounce) directly on the overlapped areas. Place prepared specimens in an oven. After conditioning at a temperature of 158 ± 2 °F for 4 hours, take the specimens from the oven; remove the weight, and condition for 1 hour at 73 ± 5 °F and 65 ± 2 percent humidity. Retain one end of the specimen in a suitable clamping device, allowing the other end to hang, and suspend a 4-ounce load from the free end of the specimens. Inability of the strips to separate within 5 seconds under the 4-ounce load shall constitute failure of this test.

4.5.2.8 Seam dead load shear resistance. The test specimens shall be 1.00 ± 0.02 inch wide (parallel to the seam) with coated fabric extending a minimum of 3.00 inches (perpendicular to the seam) on each side of the seam for holding and attaching the weight. One index mark shall be scribed on each side of the seam to facilitate observation and measurement of slippage. Each specimen shall be subjected to a constant (dead load) tension force equivalent to the 2.5 safety factor ± 0.50 pounds while immersed in JP-8 conforming to MIL-DTL-83133 at 160 ± 5 ^{o}F for 70 ± 2 hours. The container holding the sample and fuel shall be leak proof and capable of with standing the JP-8 vapor pressure at the test temperature. After 70 hours examine each specimen while under tension for signs of slippage or seam delamination. Three specimens shall be tested for each determination. Slippage or delamination, by any specimen, greater than

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specified in Table II shall constitute failure of this test. This test shall be repeated with Aviation Gasoline per ASTM D 910 Grade 100LL.

4.5.3 Tank assembly tests.

4.5.3.1 Cycling. The tank shall be filled to 100% of rated capacity with JP-8 at the designed flow rate described in 3.4.3.1.1. The tank shall then be drained at the same rate to less than 20% of capacity. The tank shall be inspected for signs of leakage throughout this test. Repeat five (5) times. Any leakage shall constitute failure of this test.

4.5.3.2 Deployment. The fully crated tank assembly shall be deployed in a berm in accordance with 3.12. Tank shall be in the fully crated condition for a minimum of 48 hours prior to conducting this test. Failure to meet the requirements stated in 3.12 constitutes failure of this test.

4.5.3.3 Retrieval. The fully deployed fuel tank assembly shall be retrieved in accordance with 3.13. Failure to meet the requirements stated in 3.13 constitutes failure of this test.

4.5.4 Fuel extraction. Test specimens shall be prepared in accordance with the tests to be performed in Table II and then submitted to the following extraction and drying procedures:

a. Immerse the specimens in JP-8 fuel conforming to MIL-DTL-83133 for 7 days at 160^{o} F.
b. Remove specimens from the fuel and blot with paper towels.
c. Place specimens in a vacuum oven and dry for 16 +/-2 hours at 120^{o} F and 20 inches of mercury.
d. Test as required in Table II.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The tank is intended for use as a storage container for Kerosene based and Naphtha based fuels in accordance with 3.3.3. The tank is military unique and is expected to interface with existing fuel distribution systems and perform as specified in extreme operating terrain and climates. The rigors of the battlefield require a fuel distribution system having

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capabilities exceeding those of commercially available items in areas of safety, durability, and range of performance. The collapsible tanks will be used with current DOD tactical fuel systems in an expeditionary environment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. Issue of DoDISS to be cited in solicitation and, if required, the specific issue of individual documents referenced (see 2.2 and 2.3).
c. When a first article inspection is required, the number and Size of units required, and the time frame for submission (see 3.2).
d. When accessories are not required (see 3.8).
e. When a berm liner is not required (see 3.15).
f. When ground cloth is required (3.16)
g. When emergency repair items are not required (see 3.17).
h. When permanent repair items are not required (see 3.18).
i. When tank chest is required (see 3.19).
j. When special marking or labeling is required (see 3.9).
k. When special colors or patterns are required (see 3.10).
l. Packaging requirements (see 5.1).

6.3 First article. When a first article inspection is required, the item(s) should be a preproduction model for each size tank. The Contracting Officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of the first article test results, and disposition of the first articles. Request for Proposals should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those offerors proposing a product that has been previously acquired or tested by the Government, and that offerors proposing such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is appropriate for the pending contract.

6.4 Definitions. The following definitions apply for this specification.

6.4.1 Blister. A blister is a flaw on the surface caused by non-adherence or by separation of an applied substance.

6.4.2 Holiday. A holiday is a place not covered by coating compound.

6.5 Subject term (key word) listing.
Collapsible tank
Fuel storage bladder

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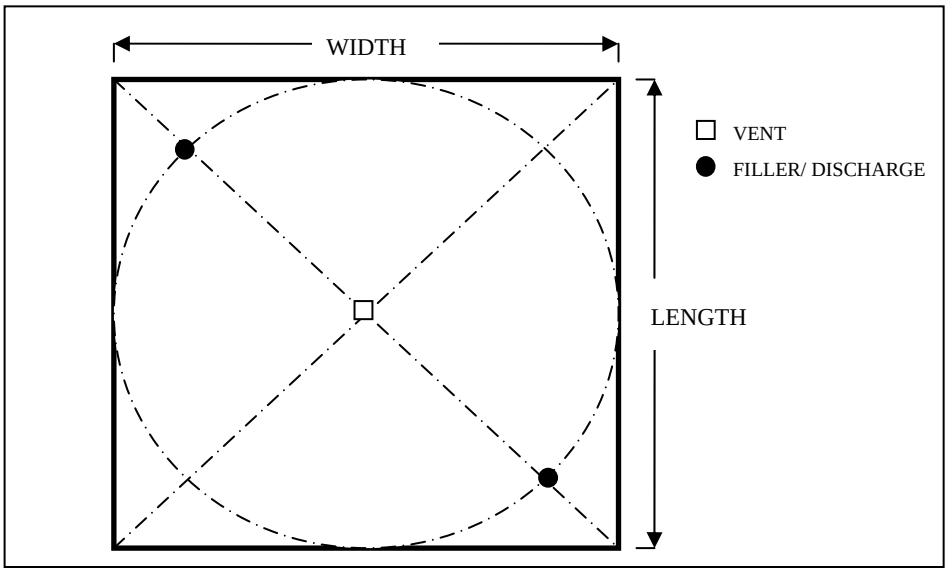

FIGURE A1. Size I, II, III, and IV tanks.

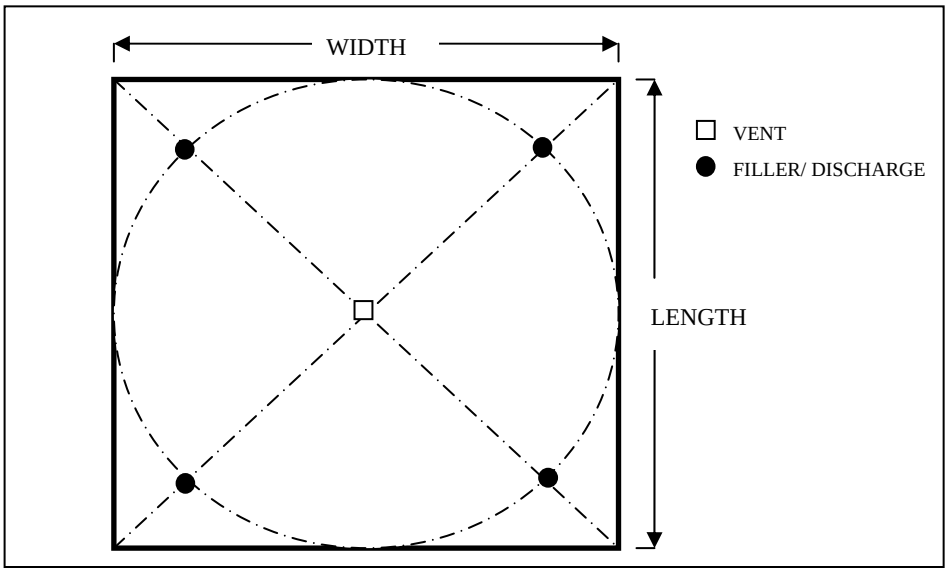

FIGURE A2. Size V tanks.

NOTES:

1. Length and width dimensions as specified in paragraph 3.4.4.
2. Location of filler/discharge and vent fittings shall be as shown +/- 3 feet.
3. Location of filler/discharge fittings shall permit hose removal without spillage.
4. A drain fitting, for the water draining capability, shall be located within 3 feet of the point directly below each filler/discharge fitting.

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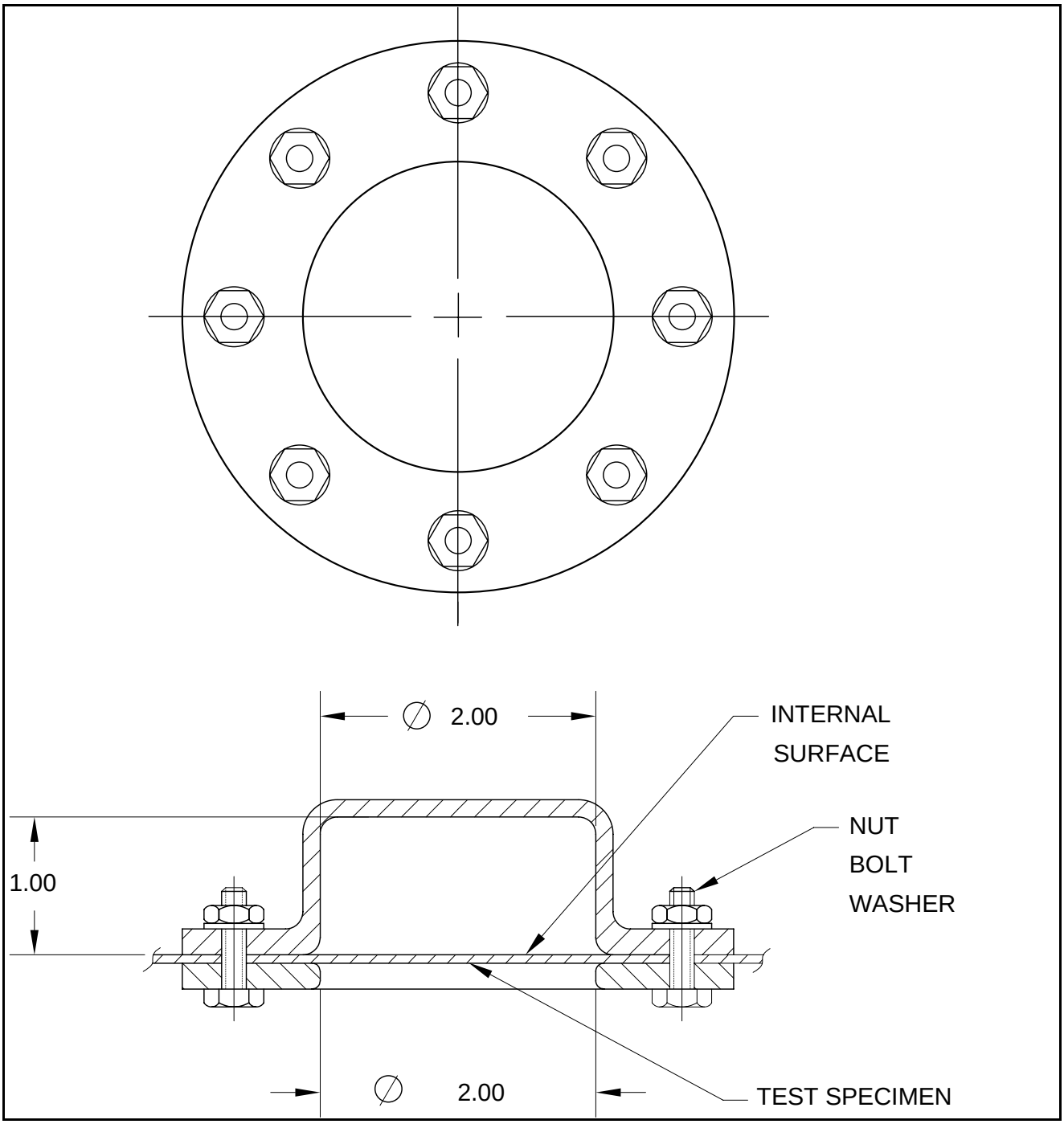

FIGURE A3. Diffusion cup assembly

NOTES:
1. Dimensions are in inches.
2. Unless otherwise specified tolerance is ± 0.06.

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