

INCH-POUND

MIL-PRF-53068B (AT)

16 September 2010

SUPERSEDING

MIL-PRF-53068A(AT)

15 March 1996

PERFORMANCE SPECIFICATION

TANKS, LIGHTWEIGHT, COLLAPSIBLE, PILLOW 160 GALLON (NOMINAL), DRINKING WATER

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

1. SCOPE

1.1 Scope. This specification covers tanks, lightweight, collapsible, pillow 160 gallon (nominal) for drinking water storage and transport, hereinafter called "tank", complete with fittings and repair items.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this standard. This section does not include documents cited in other sections of this standard 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 of documents cited in sections 3, 4, or 5 of this standard, whether or not they are listed.

2.2 Government documents.

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 cited in the solicitation or contract (see 6.2).

Comments, suggestions, or questions on this document should be addressed to U.S. Army RDECOM, Tank Automotive Research, Development and Engineering Center, ATTN: RDTA-EN/STND/TRANS MS #268, 6501 E. 11 Mile Road, Warren, MI 48397-5000 or emailed to DAMI_STANDARDIZATION@conus.army.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.daps.dla.mil>.

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FEDERAL STANDARDS

- | | | |
|-------------------|---|----------------------|
| FED-STD-191 | - | Textile Test Methods |
| FED-STD-595/30277 | - | Sand Brown |

COMMERCIAL ITEM DESCRIPTIONS

- | | | |
|--------------|---|---|
| A-A-59326 | - | Coupling Halves, Quick-Disconnect, Cam-Locking Type |
| A-A-59326/10 | - | Coupling Half, Cap, Dust, Type IX |
| A-A-59326/12 | - | Reducer, Male by Female and Female by Male, Type XI |
| A-A-59566 | - | Hose, Rubber, and Hose Assemblies, Rubber, Smooth Bore, Water Suction and Discharge |

DEPARTMENT OF DEFENSE SPECIFICATIONS

- | | | |
|-------------|---|---|
| MIL-R-52255 | - | Repair Kit and Repair Kit Components for Collapsible Fabric Tanks, Drums, and Boats |
|-------------|---|---|

(Unless otherwise indicated, copies of the above documents are available from Document Automation and Production Service, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094 or website: <https://assist.daps.dla.mil/quicksearch/>.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

Code of Federal Regulations (CFR)

- | | | |
|---------------|---|---|
| 10CFR40 | - | Domestic Licensing of Source Material |
| 21CFR177.2600 | - | Rubber Articles Intended for Repeated Use |
| 49CFR | - | Transportation |

(Copies of these documents are available from www.gpoaccess.gov/cfr/index.html or U.S. Government Printing Office, P.O. Box 979050, St. Louis, MO 63197-9000.)

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TEST AND EVALUATION COMMAND (TECOM)

ITOP-2.2.610.1 - Tracked-Vehicle Gradeability and Side Slope
Performance

(Application for copies should be addressed to the US Army Test and Evaluation Command,
4501 Ford Ave, Alexandria, VA 22302-1458)

DEPARTMENT OF ARMY

Field Manual (FM) 3-5 - Nuclear, Biological, Chemical (NBC)
Decontamination

(Copies of these documents are available from <http://www.army.mil/USAPA/index.html>.)

2.3 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ASQC Z1.4 - Sampling Procedures and Tables for Inspections by
Attributes (DoD Adopted)

(Application for copies should be addressed to the American National Standards Institute,
25 West 43rd Street, New York, NY 10036 (or website: <http://www.ansi.org/>) or American
Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203 (or website:
<http://www.asq.org/>).

AMERICAN PUBLIC HEALTH ASSOCIATION, (APHA)

Standard Methods for the Examination of Water and Wastewater

(Application for copies should be addressed to the American Public Health Association, 800 I
Street, NW, Washington, DC 20001-3710 or website: <http://www.apha.org/>.)

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ASTM INTERNATIONAL

ASTM D 412	- Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension (DoD Adopted)
ASTM D 413	- Standard Test Methods for Rubber Property - Adhesion to Flexible Substrates (DoD Adopted)
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 (DoD Adopted)
ASTM D 750	- Standard Test Method for Rubber Deterioration in Carbon-Arc Weathering Apparatus (DoD Adopted)
ASTM D 751	- Standard Test Methods for Coated Fabrics (DoD Adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or website: <http://www.astm.org/>.)

MANUFACTURERS STANDARDIZATION SOCIETY OF VALVE AND FITTING INDUSTRY (MSS)

MSS-SP72	- Valves, Ball, With Flanged or Butt-Welding Ends for General Service
MSS-SP110	- Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

(Copies of these documents may be purchased from the Manufacturers Standardization Society of Valve and Fitting Industry, 127 Park Street, N.E., Vienna, Virginia, 22180 or website: <http://mss-hq.org/>.)

NATIONAL SANITATION FOUNDATION (NSF)

NSF Standard 14	- Plastics Piping Components and Related Materials (DoD Adopted)
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(Application for copies should be addressed to the National Sanitation Foundation, P.O. Box 130140, Ann Arbor, MI 48113-0140 or website: <http://www.nsf.org/>.)

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2.4 Order of precedence. Unless otherwise noted herein or in the contract, 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 First article. When specified (see 6.2), a first article sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Materials. Unless specified herein, materials shall be in accordance with the manufacturer's materials specifications for water tanks. Asbestos, cadmium, and radioactive material will not be used in this item. Radioactive material is defined by 10CFR40, and other radioactive material in which the radioactivity is greater than 0.002 microcuries per gram or 0.01 microcuries total activity for the item. The materials shall be capable of meeting all of the operational and environmental requirements specified herein (see 4.5.1 and 4.5.2). Recovered materials shall be used to the maximum extent practicable.

3.2.1 Metals. All metals used in the construction of the tank shall be of a corrosion-resistant type or shall be suitably protected to resist corrosion during the normal storage and service life of the tank (see 3.5.5). The use of dissimilar metals in intimate metal to metal contact shall be avoided.

3.2.2 Liner. The liner and all surfaces that contact drinking water shall conform to the 21CFR177.2600 and 21CFR1-1299 for contact with food, or be listed acceptable for contact with drinking water by NSF Standard 14.

3.2.3 Coating compounds. Each and every compound used for the formulation of elastomeric coating, tie gums, diffusion barrier (if used), and any other materials applied to the coated fabric shall conform to table I and shall be suitable for use with drinking water. The coating compounds shall be suitable for use when in continuous contact with rainwater and ground water, and shall be fungus and weather resistant (see 4.5.3.10).

3.2.4 Coated fabric. The coated fabric shall be free from blisters or pin-holes and shall show no signs of coating delamination. The coated fabric shall withstand the effects of humidity, fungus, ozone, and weather elements without damage, deterioration, or failure of meeting performance requirements specified herein. The exterior coating of the coated fabric shall be Sand Brown, # 30277 of FED-STD-595. The coated fabric shall conform to the requirements of table II (see 4.5.3.12).

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TABLE I. Characteristics of coating compounds.

Item	Property	Requirement	Test paragraph, ASTM or applicable test method
1	Tensile strength (initial)	1500 pounds per square inch (psi) (minimum (min))	D 412
2	Ultimate elongation	300 percent (%) (min)	D 412
3	Tensile strength after immersion in distilled water at 160±2 degrees Fahrenheit (°F) for the following durations: 14 days 42 days	80% of initial 70% of initial	D 471 D 471
4	Resistance to light after 750 hours accelerated weathering at 10% elongation <u>1/</u>	75% of initial tensile strength	D 750 <u>2/</u>
5	Taste and odor <u>3/</u>	Threshold odor number shall not exceed 2. The Taste rating scale value shall not exceed 4.	APHA Standard Methods for Examination of Water and Wastewater

1/ Applicable to all exterior compounds. That is, compounds between the nylon cloth and the outside of the tank.

2/ Alternate corex D filters in place.

3/ Applicable to all interior compounds.

3.3 Design and construction. The tank shall conform to the manufacturer's design and construction for lightweight, collapsible, 160 gallon, drinking water storage and transportation tank (see 4.5.2).

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TABLE II. Characteristics of coated fabric.

Item	Property	Requirement	Test paragraph or test method of FED-STD-191
1	Weight (ounces per square yard (oz/sq yd))	30 min/62 maximum (max)	5041
2	Tearing strength warp and fill	25 pounds (lbs) (min)	5134
3	Breaking strength	350 psi (min)	5102
4	Weathering resistance after 750 hours exposure at 5% elongation, warp and fill	80% retention of initial breaking strength (min)	5804/5102 <u>1/</u>
5	Puncture resistance	110 lbs (min)	4.5.3.13/5120
6	Low temperature crease resistance: a. Appearance after unfolding	No cracking, peeling or delamination	4.5.3.14
7	Fungus resistance	No cracking, blistering, or delamination of coating. Retention of breaking strength 70% (min).	5762 <u>2/</u>
8	Blocking	Specimens to separate within 5 seconds	4.5.3.15
9	Coating adhesion (initial)	15 psi (min)	4.5.3.16 and 4.5.3.16.1
10	Coating adhesion after immersion in distilled water at 160±2 °F for the following durations: 14 days 42 days	12 psi 10 psi	4.5.3.16.1 4.5.3.16.1

1/ Specimens shall have exterior coating facing carbon arc. Alternate corex D filters shall be removed.

2/ Except that the specimens shall be prepared in accordance with method 5102 and the number of specimens shall be reduced from 40 to 5 warp and 5 fill. Leaching of specimens is unnecessary. The specimens shall be exposed to the soil for eight weeks.

3.3.1 Seams. All tank seams including end closures, handle patches, chafing patches and fabric flanges of fittings, shall conform to the requirements of table III. Seams between adjacent panels of coated fabric shall be constructed as to prevent wicking of water through the fabric.

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TABLE III. Characteristics of seams.

Item	Property	Requirement	Test paragraph, test methods of ASTM test methods
1	Breaking strength (initial) <u>1</u> /	500 psi (min)	D751 <u>2</u> /
2	Breaking strength after immersion in distilled water at 160±2 °F for the following durations:		
	14 days	280 psi	D471/D751/4.5.3.17
	42 days	280 psi	D471/D751/4.5.3.17
3	Dead load shear resistance under 50 psi stress at 180±5 °F for 8 hours	0.1 inch slippage (max)	4.5.3.18
4	Peel adhesion (initial)	15 psi (min)	D413 machine methods
5	Peel adhesion after immersion in distilled water at 160±2 °F for the following durations:		
	14 days	12 psi	D413 machine methods/ D471/4.5.3.17
	42 days	10 psi	D413 machine methods/ D471/4.5.3.17

1/ All specimens must break in the coated fabric. Failure of any specimen in a seam area at any value shall constitute failure of this test.

2/ Specimens shall be 2 inches in width.

3.3.2 Chafing patches. The interior and exterior of the tank, opposite the location of each fitting shall be provided with bonded coated fabric chafing patches. The chafing patches shall be the same coated fabric used to fabricate the tank.

3.3.3 Bonded fittings.

3.3.3.1 Fitting type. Unless otherwise specified (see 6.2), each tank shall be furnished with a 2-inch male quick disconnect inlet/outlet mounted on the tank top. The fittings shall be compression type and shall be bonded to the tank fabric. The fittings must meet the requirements of table IV. The design of all cam-locking type, quick disconnect couplings shall conform to A-A-59326. The maximum torque for all fitting bolts shall be stamped onto the fitting flange plates or stenciled on the tank fabric adjacent to the respective fittings, in .18-inch lettering. The tank shall be supplied with a 2-inch anodized aluminum ball valve conforming to MSS-SP72 or MSS-SP110. The valve shall be female to male, quick disconnecting and shall have a one quarter turn handle with a locking mechanism. Also included shall be a 2-inch cam-lock dust cap with keeper chain. The tank shall be equipped with a valve for bleeding air from the tank.

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TABLE IV. Characteristics of bonded fittings.

Item	Property	Requirement	Test paragraph or ASTM test methods
1	Aluminum to coated fabric bond strength (initial)	350 psi (min)	4.5.3.19 and 4.5.3.19.1
2	Bond strength of fitting after immersion in distilled water at 160±2 °F for the following durations:		
	14 days	280 psi (min)	4.5.3.19 and 4.5.3.19.2
	42 days	180 psi (min)	4.5.3.19 and 4.5.3.19.2
3	Dead load shear resistance under 50 psi stress at 180±5 °F for 8 hours	0.1 inch slippage (max)	4.5.3.19.3
4	Peel adhesion aluminum strip to coated fabric (initial)	15 psi (min)	4.5.3.20 and 4.5.3.20.1
5	Peel adhesion of aluminum strip to coated fabric after immersion in distilled water at 160±2 °F for the following durations:		
	14 days	12 psi	D429 method B, 4.5.3.20 and 4.5.3.20.1
	42 days	10 psi	D429 method B, 4.5.3.20 and 4.5.3.20.1

3.3.3.2 Thread sealant. A thread sealant shall be used on threaded fasteners when those threaded fasteners are subject to leakage.

3.4 Maintainability. The tank shall exhibit no degradation in performance after maintenance operations using the repair parts furnished with the tank (see 4.5.2).

3.5 Tank performance.

3.5.1 Description. The tank shall transport water in a safe and efficient manner. The tank and components shall withstand folded storage at ambient temperatures from -30 to 160 °F without damage or leakage when subsequently filled with water (see 4.5.3.3 and 4.5.3.4). The

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tank and components shall be suitable for operational use at ambient temperatures from 32 to 125 °F. The tank shall be capable of holding a minimum of 160 gallons of water and not be damaged when exposed to fungus growth or relative humidity up to 100 percent such as is encountered in tropical climates. The tank shall be suitable for use in continuous contact with rainwater, and ground water (see 4.5.3.5). There shall be no evidence of leakage or seepage when the tank is filled to its rated capacity (+10%, -0%) with water (see 4.5.3.9). The tank shall be capable of withstanding an internal air pressure of 0.50 psi without evidence of leakage (see 4.5.3.2).

3.5.2 Weight and dimensions. The tank, when filled, shall be no more than 75 inches long, 42 inches wide, and 24 inches in height (see 4.5.2 and 4.5.3.6). The tank and accessories shall weigh less than 1500 lbs when full and require less than 5 cubic feet of storage space when empty (see 4.5.3.1).

3.5.3 Transportability and mobility. The empty tank must be capable of being carried by no more than two soldiers. When full, it must be transportable in a high mobility multi-purpose wheeled vehicle (HMMWV), 0.75 ton cargo trailer, or larger vehicle, and must be capable of being sling loaded under existing cargo helicopters. The tank shall be equipped with a tiedown assembly to enable it to be secured when transported in these vehicles and shall not degrade the safe operation of these vehicles. The tank when transported in these vehicles shall be capable of travel over smooth, hard surface primary roads at sustained speeds of up to 55 miles per hour (mph) (see 4.5.3.7). The tank shall be capable of travel over unimproved roads and open, rolling, and hilly cross-country terrain at speeds of up to 30 mph (see 4.5.3.8).

3.5.4 Operational capability. The tank will operate by gravity flow when ground, vehicle, or trailer mounted. It shall be equipped with a pressure relief valve to vent air during fill operations. The tank will be issued with the associated hoses and nozzles which shall use standard cam-lock fittings.

3.5.5 Storage and service life. The tank shall have a storage life of at least 10 years. The service life shall be a minimum of 2 years which is based on the assumption of 200 days per year of operation, 3 trips per day.

3.5.6 Climatic design types. The tank shall be capable of operating in the basic hot and cold climatic categories. Thermal protection may be required during cold weather operations.

3.5.7 Nuclear, Biological, and Chemical (NBC) contamination survivability and decontamination. The tank shall be capable of resisting penetration of chemical agents and must be capable of being decontaminated by Super Tropical Bleach (60% calcium hypochlorite solution) (see 4.5.3.21.1 through 4.5.3.21.4).

3.5.8 Compatibility with existing systems. The tank will be compatible with the existing Forward Area Water Point Supply System (FAWPSS), 125 gallons per minute (gpm) pump, and the standard water hoses and connections currently in the inventory.

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3.6 Repair items. Unless otherwise specified (see 6.2), the tank shall be furnished with a repair patch kit, conforming to MIL-R-52255 (see 4.5.2).

3.7 Accessories. Unless otherwise specified (see 6.2), each tank shall be provided with the accessories in table V (see 4.5.2).

TABLE V. Accessories.

Item	Description	Conformance	Quantity
1	Tiedown assembly	49CFR	plus a spare
2	Hose, suction, 2-inch, 20-foot, female to male, quick disconnect	A-A-59566, Hose color No. 30277 of FED-STD-595 NSN 4720-01-163-4684	1 each
3	Valve, Ball, 2-inch, aluminum, quarter turn handle, locking mechanism	Class 150 per MSS-SP72 or MSS-SP110	1 each
4	Reducer, female to male, 2-inch to 1.5-inch, quick connect, type XI	AA59326/12-3-A-2 NSN 4730-00-951-3295	1 each
5	Nozzle, distribution, portable water, quick connect, female	NSN 2910-01-188-8198	1 each
6	Dust cap, aluminum, 2-inch quick connect, cam- locking	AA59326/10-6	1 each

3.8 Identification marking. Marking shall be permanent and legible. The following information shall appear on the tank identification label (see 4.5.2):

TANK, LIGHTWEIGHT, COLLAPSIBLE, PILLOW:

160 GALLONS (NOMINAL), DRINKING WATER

NSN: (Specify)

SERIAL NO.: (Specify)

MFR: (Mfr name and location of plant)

MFR DATE: (month and year)

WEIGHT EMPTY: (Specify approximate number of pounds)

CONTRACT OR ORDER NO.: (Specify)

LOT: (Specify)

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3.8.1 Drinking water label. In 4-inch lettering, the tank shall be permanently marked “Drinking Water” (see 4.5.2).

3.8.2 Tank caution label. The following warning shall be in black letters of the heights indicated (see 4.5.2):

CAUTION (2-inch letters)

DO NOT OVERFILL (1-inch letters)

Overfilling will permanently damage the tank (0.75-inch letters)

Maximum capacity (specify). When full tank height

is (specify) inches/(specify) centimeters

(0.75-inch letters)

3.9 Workmanship. Workmanship shall be to the highest quality as to assure that water tanks furnished under this specification are free of defects that compromise, limit, or reduce performance in intended use (see 4.5.2).

3.10 Taste and odor. The tank material (compounds between nylon cloth and the inside of the tank) shall not impart odor to chlorinated water such that the threshold odor number exceeds 2. The material shall not impart taste to chlorinated water such that the taste rating scale exceeds 4 (see Table I and 4.5.3.11). APHA Standard Methods for Examination of Water and Wastewater for taste and odor shall be adhered to for testing taste and odor imparted to water by tank material.

4. VERIFICATION

4.1 Classification of inspection. The inspection conditions specified herein are classified as follows:

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

4.2 First article inspection. Unless otherwise specified (see 6.2), first article inspection shall be performed on three tanks and shall include one type of repair when first article sample is required (see 3.1). This inspection shall include the examinations of 4.4 (see table VI) and the applicable tests of 4.5.3.1 through 4.5.3.21.4 (see table VII).

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TABLE VI. Classification of defects.

Category	Defect	Method of examination
Major:		
101	Materials are not resistant to corrosion or deterioration or treated to be made resistant to corrosion or deterioration for the applicable storage and operating environment as specified (see 3.2 and 3.2.1).	Visual
102	Dissimilar metals are not effectively insulated from each other (see 3.2.1)	SIE 1/
103	Blisters or pinholes or coating delamination in coated fabric (see 3.2.4)	Visual
104	Exterior color of tank not as specified (3.2.4).	Visual
105	Chafing patches or fittings not located as specified (see 3.3.2 and 3.3.3)	SIE and Visual
106	Fittings not as specified (see 3.3.3).	SIE and Visual
107	Valve locking mechanism inadequate (see 3.3.3.1).	Visual
108	Thread sealant not used where required (see 3.3.3.2).	Visual
109	Maintainability not as specified (see 3.4).	SIE
110	Dimensions not as specified (see 3.5.2).	SIE
111	Repair items missing or not as specified (see 3.6).	Visual
112	Accessories not as specified (see 3.7).	SIE and Visual
113	Identification label not as specified (see 3.8).	Visual
114	Drinking water label not as specified (see 3.8.1).	Visual
115	Tank caution label not as specified (see 3.8.2).	Visual
116	Extraneous material inside tank (see 3.9).	Visual
117	Workmanship not as specified (see 3.9).	SIE and Visual

1/ SIE = Standard Inspection Equipment.

TABLE VII. Classification of inspections.

Title	Requirement	Inspection	First article	Conformance
Coating Compounds				
Tensile strength	3.2.3, Table I	4.5.3.10	X	X
Ultimate strength	3.2.3, Table I	4.5.3.10	X	X
Tensile strength after 14 day water immersion	3.2.3, Table I	4.5.3.10	X	X
Tensile strength after 42 day water immersion	3.2.3, Table I	4.5.3.10	X	-
Resistance to light	3.2.3, Table I	4.5.3.10	X	-

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TABLE VII. Classification of inspections - continued.

Title	Requirement	Inspection	First article	Conformance
Taste and odor	3.2.3 and 3.10, Table I	4.5.3.11	X	-
Coated Fabric				
Weight	3.2.4, Table II	4.5.3.12	X	X
Tearing strength	3.2.4, Table II	4.5.3.12	X	X
Breaking strength	3.2.4, Table II	4.5.3.12	X	X
Weathering resistance	3.2.4, Table II	4.5.3.12	X	-
Fungus resistance	3.2.4, Table II	4.5.3.12	X	-
Puncture resistance	3.2.4, Table II	4.5.3.13	X	X
Low temperature crease resistance	3.2.4, Table II	4.5.3.14	X	X
Blocking	3.2.4, Table II	4.5.3.15	X	X
Coating adhesion after 14 day water immersion	3.2.4, Table II	4.5.3.16.1	X	X
Coating adhesion after 42 day water immersion	3.2.4, Table II	4.5.3.16.1	X	-
Seams				
Breaking strength (initial)	3.3.1, Table III	4.5.3.17	X	X
Breaking strength after 14 day water immersion	3.3.1, Table III	4.5.3.17	X	X
Breaking strength after 42 day water immersion	3.3.1, Table III	4.5.3.17	X	-
Dead load shear resistance	3.3.1, Table III	4.5.3.18	X	X
Peel adhesion (initial)	3.3.1, Table III	4.5.3.17	X	X
Peel adhesion after 14 day water immersion	3.3.1, Table III	4.5.3.17	X	X
Peel adhesion after 42 day water immersion	3.3.1, Table III	4.5.3.17	X	-
Bonded Fittings				
Bond strength (initial)	3.3.3.1, Table IV	4.5.3.19, 4.5.3.19.1	X	X
Bond strength after 14 day water immersion	3.3.3.1, Table IV	4.5.3.19, 4.5.3.19.2	X	X

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TABLE VII. Classification of inspections - continued.

Title	Requirement	Inspection	First article	Conformance
Bond strength after 42 day water immersion	3.3.3.1, Table IV	4.5.3.19, 4.5.3.19.2	X	-
Dead load shear resistance	3.3.3.1, Table IV	4.5.3.19.3	X	X
Peel adhesion of aluminum strip (initial)	3.3.3.1, Table IV	4.5.3.20, 4.5.3.20.1	X	X
Peel adhesion after 14 day water immersion	3.3.3.1, Table IV	4.5.3.20, 4.5.3.20.1	X	X
Peel adhesion after 42 day water immersion	3.3.3.1, Table IV	4.5.3.20, 4.5.3.20.1	X	-
Tank and Accessories <u>1/</u>				
System dimensions	3.5.2	4.5.3.1	X	X
Air leakage	3.5.1	4.5.3.2	X	X
Low temperature	3.5.1	4.5.3.3	X	-
High temperature	3.5.1	4.5.3.4	X	-
Water storage	3.5.1	4.5.3.5	X	-
Weight and size	3.5.2	4.5.3.6	X	-
Road test	3.5.3	4.5.3.7	X	-
Cross country test	3.5.3	4.5.3.8	X	-
Tank overload test	3.5.1	4.5.3.9	X	-
Water storage after repair	3.5.1	4.5.3.9.1	X	-
Internal inspection	3.5.1	4.5.3.9.2	X	-
Chemical Tests				
Chemical agent resistance test	3.5.7	4.5.3.21.1	X	-
Chemical agent decontamination test	3.5.7	4.5.3.21.2	X	-
Decontamination compatibility test	3.5.7	4.5.3.21.3	X	-
Cycle test	3.5.7	4.5.3.21.4	X	-

1/ The tank assembly shall be tested in the order listed starting with the air leakage test.

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4.3 Conformance inspection. Conformance inspection shall include the examinations of 4.4 (see table VI) and the applicable tests of 4.5.3.1, 4.5.3.2, 4.5.3.10, and 4.5.3.12 through 4.5.3.20.1 (see table VII).

4.4 Examination.

4.4.1 Sampling. Samples from an inspection lot for conformance inspection shall be selected in accordance with ANSI/ASQC Z1.4. Any redesign or modification of the contractor's standard to comply with specified requirements shall receive particular attention for adequacy and suitability. This element of inspection shall encompass all visual examinations and dimensional measurements of requirements listed in table VI. Noncompliance with any specified requirement or presence of one or more defects preventing or lessening maximum efficiency shall constitute cause for rejection.

4.5 Method of inspection.

4.5.1 Materials. Conformance to 3.2 shall be determined by inspection of contractor records providing proof or certification that materials conform to requirements. Applicable records shall include drawings, specifications, design data, receiving inspection records, processing and quality control standards, vendor catalogs and certifications, industry standards, test reports, and rating data.

4.5.2 Defects. Conformance shall be determined by examination for the defects listed in table VI. Examination shall be visual, tactile, or by measurement with SIE.

4.5.3 Tests.

4.5.3.1 System dimensions. The tank shall be empty and its folded volume measured. Inability to meet the volume requirement stated in 3.5.2 shall constitute failure of this test.

4.5.3.2 Air-leakage. To determine conformance to 3.5.1, pressurize each tank to 0.50 psi ± 5 percent internal air pressure, and allow to stand for 0.50 hours. At the end of this period, adjust the internal air pressure to 0.50 psi, ± 5 percent. Then using a soap and water solution, examine all the tank fabric, fittings, and external seams for leakage. Any evidence of air leakage shall constitute failure of this test.

4.5.3.3 Low temperature. To determine conformance to 3.5.1, the tank shall be folded or rolled to a size suitable for placing in the shipping container and then placed in a low temperature environment of -30 ± 2 °F, for a period of 24 hours. The environmental temperature shall then be increased to -25 ± 4 °F, for an additional 24 hours. At the end of this period while still at -25 °F, the tank shall be slowly unfolded in not less than 15 minutes nor more than 30 minutes. Flaking, cracking, or separation of the coated fabric shall constitute failure of this test.

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4.5.3.4 High temperature. To determine conformance to 3.5.1, the procedure for the high temperature test shall be the same as that specified in 4.5.3.3, except that the temperature shall be at 160 ± 2 °F, for a period of 24 hours. Damage to the coating or separation of surfaces shall constitute failure of this test.

4.5.3.5 Water storage. Fill the tank outdoors, without any environmental protective covering, with its rated gallon capacity of drinking water and allow to stand for 30 days, ± 2 days. At the end of this period, examine the tank for seepage and leakage. Any evidence of leakage or seepage shall constitute failure of this test. Certification shall be provided by the contractor showing that the tank materials meet the requirements of 3.5.1.

4.5.3.6 Weight and size test. The tank shall be filled to its required capacity and then weighed along with its container and accessories. Inability to meet the weight requirement in 3.5.2 shall constitute failure of this test. The tank dimensions shall then be measured. Inability to meet the dimensions stated in 3.5.2 shall also constitute failure of this test.

4.5.3.7 Road test. To determine conformance to 3.5.3, the road test will cover 50 miles over improved primary and secondary roads at speeds up to and including 55 mph. The tank shall be secured during all road testing. The tank shall not shift or show weakened areas during or after the test. During the road test, perform the following:

- a. Make normal and maximum pedal effort stops at 5 mph increments from 5 to 55 mph. During this test, the tank shall not shift forward or affect vehicle stability in any way. The restraining straps shall not loosen or shift while stopping. The vehicle shall not slew more than 1.50 times its maximum width.
- b. Make a 360 degree turn with a radius of 50 feet at a speed of 10 mph. The tank shall not shift position or affect vehicle stability.

4.5.3.8 Cross country road test. To determine conformance to 3.5.3, the cross country test shall cover 25 miles over bumpy, hilly unimproved roads at speeds up to and including 30 mph. The tank shall be secured during all road testing. The tank must not shift forward or backward on hills and must not shift from side to side on turns. During the cross country test, perform the following:

- a. Drive the vehicle over roadway V-ditches not less than 36 inches wide and 16 inches deep. Negotiate the ditches at least one time perpendicular and at least one time at an angle of 45 degrees to the direction of travel. The tank shall not shift or surge enough to make the vehicle unstable.
- b. Run gradeability and side slopes tests in accordance with Tecom ITOP-2.2.610.1.

4.5.3.9 Tank overload. To determine conformance to 3.5.1, in preparation for the overload tests, the tank will be emptied of the water from the storage test above and allowed to lie empty outdoors for 5 days ± 1 day without any environmental protective covering. The tank will then be filled to its rated capacity +10 percent, -0 percent, of drinking water and allowed to

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stand for 4 hours. Any evidence of rupture, weakened areas, leakage, or seepage shall constitute failure of this test.

4.5.3.9.1 Water storage after repair. Two repairs of 2 inch slits shall be made in the tank wall using the repair kit. The tank shall be filled outdoors, without any environmental protective covering, with its required capacity of drinking water. The tank shall then be tested in accordance with the procedures specified in 4.5.3.5.

4.5.3.9.2 Internal inspection. The tank shall be inspected internally after the water storage after repair test of 4.5.3.9.1. Any evidence of weakened areas, coating, or barrier delamination shall constitute failure of the overload test.

4.5.3.10 Coating compounds. Coating compound properties shall be tested in accordance with test methods shown in table I. Nonconformance to 3.2.3 and table I shall constitute failure of this test.

4.5.3.11 Taste and odor. Samples of cured synthetic rubber compounds shall be immersed for 70 hours in distilled water having a 0.2 parts per million of total available chlorine at the start of the 70-hour test. The samples shall be large enough to expose 36 square centimeters of compound to one liter of chlorinated distilled water. The water shall be tested for taste and odor in accordance with procedures outlined in APHA Standard Methods for the Examination of Water and Wastewater, Parts 207 Odor, and 211B Taste Rating Scale. Nonconformance to 3.10 shall constitute a failure of this test.

4.5.3.12 Coated fabric. Coated fabric properties shall be tested in accordance with test methods in table II. Nonconformance to 3.2.4 and table II shall constitute failure of this test.

4.5.3.13 Puncture resistance. FED-STD-191, method 5120 applies except that the ring clamp mechanism shall have an internal diameter of 3.00 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 shall be rounded to a 0.010 inch 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 3.2.4 and table II shall constitute failure of this test.

4.5.3.14 Low temperature crease resistance. Fold two specimens, each 8 inches square, 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 °F for 46 hours. At the end of the conditioning period, unfold the specimens while still at a temperature -25 °F and examine visually. Signs of cracking, peeling, or delamination of any coating material shall constitute failure of this test (see 3.2.4 and table II).

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4.5.3.15 Blocking. Place two coated fabric specimens 6 inches by 1 inch in an oven on a smooth surface in such a manner that the ends are overlapped 1 inch. Place a 4 lb weight directly on the overlapped area. After conditioning at a temperature of 158 ± 2 °F, for 4 hours, remove the weight and take the specimens from the oven and condition for 1 hour at 73 ± 3 °F. Attach one end of the specimen in a suitable clamping device allowing the free end to hang down. Suspend a 4-ounce weight 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 (see 3.2.4 and table II).

4.5.3.16 Coating adhesion. Samples of coated fabric shall be bonded face-to-face to provide specimens for determining adhesion between the nylon cloth and exterior coating(s); between the nylon cloth and interior coating(s); between laminations of interior coatings and barrier (if used); and between laminations of exterior coatings. In forming this bond the specimens shall be subject to no heat or pressure other than normally encountered in curing the coated fabric, except for minimal pressure necessary to insure contact while the bond is setting (see 3.2.4 and table II).

4.5.3.16.1 Test procedure. The adhesion shall be determined in accordance with ASTM D 413, machine method except that the specimens shall be 2 inches wide. The specimens shall be of sufficient length to conduct adhesion test for both initial values and after water immersions. The adhesion results obtained on each immersed specimen shall be compared with the initial adhesion of the same specimen to determine percentage of adhesion retained. The reported adhesion shall be the average of not less than two specimens. Attempts shall be made to cut the coated back to the nylon cloth and to determine the adhesion value at the coating-to-cloth interface. However, if the specimen separated at a plane other than the bond of the coating to cloth (such as between layers of coating materials or between barrier film and coating) the adhesion value at the plane of failure shall be recorded. Immersed specimens shall be conditioned in the test fluid at 73 ± 5 °F, for 30 to 90 minutes before testing. Testing of immersed specimens shall be completed within 3 minutes after removal from the conditioning fluid. Immersion of specimens shall be in accordance with ASTM D 471. Nonconformance to 3.2.4 and table II shall constitute failure of this test. Any obvious bond failure evident after immersion but before stressing, even if the plane of failure is not sandwiched between the layers of nylon fabric, shall constitute failure of this test.

4.5.3.17 Seam tests. The bonding together of any two or more pieces of coated fabric (such as lap joints, butt joints, and closures, chafing patches, coated fabric flanges of fittings, etc.) shall be considered as seams and shall be subjected to all seam tests specified herein, except chafing patches which will only be tested for peel. The average breaking strength of five specimens for each type seam for each test shall be reported for conformance to table III. Breaking strength specimens shall be 2 inches wide (parallel to the seam) and shall extend (perpendicular to the seam) 3 inches beyond both edges of the seam. No part of the test specimen shall be coated or covered during the water immersion periods. Specimens shall be cooled in the immersion fluid at 73 ± 5 °F, for 30 to 90 minutes before testing. Testing of immersed specimens shall be completed within 3 minutes after removal from the immersion fluids. The average peel adhesion strength of two specimens for each type of seam shall be

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reported for conformance to table III. Peel adhesion specimens shall be of sufficient length to determine both the initial and after water adhesion values on the same specimen. If seam construction involves the use of binding thread, then the peel specimens shall be prepared with threads removed. Nonconformance to 3.3.1 and table III shall constitute failure of this test.

4.5.3.18 Dead load shear resistance. The test specimens shall be 1.0 ± 0.020 inches wide, (parallel to the seam) and coated fabric shall extend a minimum of 3 inches (perpendicular to the seam) on each side of the seam. One index mark shall be described on each side of the seam to facilitate observation and measurement of slippage. Each specimen shall be subjected to a constant (dead load) tension of 50 ± 0.50 lbs, at 180 ± 5 °F. After 8 hours, examine each specimen while still under tension for sign of slippage or separation. Three specimens shall be tested for each determination. Slippage, by any specimen, greater than specified in 3.3.1 and table III shall constitute failure of this test.

4.5.3.19 Strength of bonded fittings. Specimens shall be prepared by cutting through the aluminum flange so that parallel 1.0 inch wide sections are obtained from the straight portion of the oval fitting and 1.0 inch wedge shaped sections are obtained from the vent (or drain) and the curved portion of the oval fitting. The 1.0 inch shall be measured as a chord passing through the midpoint between the inside and outside diameters of the flange for the wedge shaped sections. If contractor's alternate fittings are specified (see 3.3.3.1 and 6.2), samples shall be cut similarly to the above description providing 1.0 inch specimens measured at a chord midway between the internal and external radii.

4.5.3.19.1 Initial bond strength. The coated fabric flanges shall be fastened together in one jaw of the test machine so that the jaw will be at least 1.0 inch from the nearest part of the aluminum flange. The aluminum flange shall be secured in the other jaw of the test machine and this jaw shall clamp only the aluminum and shall compress the embedded part of the coated fabric flanges. The jaws shall be separated at a rate of 2.0 inches per minute at 75 ± 5 °F. The average of three test specimens shall be recorded as initial bond strength in pounds per inch of width. Nonconformance to 3.3.3.1 and table IV shall constitute failure of this test.

4.5.3.19.2 Bond strength fluid immersion. Three test specimens shall be immersed for the appropriate durations in distilled water as specified in table IV. No part of the specimens shall be covered or coated during immersion. Specimens from both the oval and vent/drain fittings shall be included. The specimens shall be cooled in the immersion fluid to 75 ± 5 °F, for up to 60 minutes. The specimens shall be removed one at a time and tested as in 4.5.3.19.1. Each test shall be completed within 3 minutes after removal. The average of three tests shall be reported as bond strength after immersion in pounds per inch of width. Nonconformance to 3.3.3.1 and table IV shall constitute failure of this test.

4.5.3.19.3 Dead load shear resistance aluminum to fabric bond. Three specimens shall be clamped as in 4.5.3.18 and subjected to a constant (dead load) tension force of 50 lbs at 180 ± 5 °F. At the end of 8 hours, the specimens shall be examined for slippage or separation while under tension. Nonconformance to 3.3.3.1 and table IV shall constitute failure of this test.

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4.5.3.20 Peel adhesion of aluminum to coated fabric. Special test specimens shall be fabricated consisting of aluminum strips bonded to lengths of coated fabric. The aluminum strip shall be 12 inches long and shall be of the same alloy as that used in the aluminum fitting flanges. The coated fabric shall be 12 inches long (min) by 2.0 ± 0.050 inches wide, and shall be of the same composition (and of the same state of cure before bonding) as that used in the coated fabric flanges. The coated fabric strip shall be uniformly bonded to the aluminum strip. The bond shall be formed using identical techniques and bonding agents used to bond tank fittings and shall be cured identically (time, pressure, temperature, etc.) to the process used in bonding tank fittings.

4.5.3.20.1 Test procedures. Specimens shall be tested as per ASTM D429, method B. Two specimens shall be averaged. The identical specimens shall be used to determine the initial peel strength and after fluid immersion and when computing the percentage of initial adhesion retained. Nonconformance to 3.3.3.1 and table IV shall constitute failure of this test.

4.5.3.21 Chemical tests.

4.5.3.21.1 Chemical agent resistance test. To determine conformance to 3.5.7, this test shall be performed by the Government or a Government-approved laboratory with the contractor supplying material swatches. A sufficient number of swatches with and without seam area shall be tested to provide results with a 90 percent confidence level. The swatches shall be placed under a tensile load equivalent to the pressure exerted by a filled tank. Various chemical warfare (CW) agents shall be used to evaluate the tank materials' resistance to CW agents as follows:

<u>AGENT</u>	<u>CONT. DENSITY (lb/in³)</u>	<u>DROP SIZE (micron)</u>
Mustard (HD)	0.4	2500
Thickened Mustard (THD)	0.4	2500
Soman (GD)	0.4	2500
Thickened Soman (TGD)	0.4	2500
Nerve Agent (VX)	0.2	250

The tests shall be performed at the following temperatures:

<u>AGENT</u>	<u>TEMPERATURE (°F)</u>		
	<u>41</u>	<u>77</u>	<u>113</u>
HD		X	X
THD		X	X
GD	X	X	X
TGD	X	X	X
VX			X

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An appropriate technique, such as the Mandrill or permeation cell test, shall be used to determine CW agent liquid and vapor penetration through the material based on a 1-hour pass/fail criteria.

4.5.3.21.2 Chemical agent decontamination test. To determine conformance to 3.5.7, swatches identical to those used in 4.5.3.21.1 shall be used during this test. The number of swatches used shall be such that the test yields results in the 90 percent confidence level. Swatches, CW agents, drop size and concentration identical to those outlined in 4.5.3.21.1 shall be used. The tests shall be performed at 41 °F and 113 °F for the appropriate CW agents. The decontaminants to be evaluated are as follows:

- a. Super Tropical Bleach (STB)
- b. Decontamination Solution No. 2 (DS2)
- c. Field expedient solutions (e.g. diesel; JP-4; hot, soapy water; and household bleach)

Swatches shall be contaminated by the agent. After weathering for 1 hour, the agent contaminated swatches shall then be decontaminated according to the appropriate procedure stated in FM 3-5. After decontamination, the swatches shall be separated into four groups. Group 1 shall be extracted by a suitable solvent in order to determine the quality of CW agent absorbed. Group 2 shall be used to assess the potential contact hazard to humans after decontamination via silicone rubber contact paper or other appropriate method. Group 3 shall be used to evaluate vapor desorption for 6 hours via the appropriate method. After the 6 hour vapor desorption, the swatches shall be extracted by solvent to determine the quantity of CW agents remaining. Group 4 shall be used to evaluate the potential contact hazard after 6 hours of vapor desorption. The identical test procedures shall be used for all CW agents and decontaminants. Following these tests, a selected portion of the original samples shall be subjected to the appropriate material tests included in tables I-IV. Failure to pass the material tests shall constitute failure of the chemical decontamination test.

4.5.3.21.3 Decontaminant compatibility test. To determine conformance to 3.5.7, a sufficient number of swatches shall be used to provide results with a 90 percent confidence level. During this test, the swatches shall be immersed in the decontaminants listed in section 4.5.3.21.2 for 6 hours with the exception of hot, soapy water (158 °F). All decontaminants shall be kept at 113 °F during the test. Swatches shall be weighed before testing. After the 6 hours of immersion, the swatches shall be rinsed, dried with paper towels and weighed. Following the weighing, a selected portion of the samples shall be subjected to the appropriate materials test outlined in tables I - IV. Failure to pass the material tests shall constitute failure of the decontaminant compatibility test.

4.5.3.21.4 Cycle testing. To determine conformance to 3.5.7, a sufficient number of swatches shall be used to provide results with a 90 percent confidence level. During this test the swatches shall be subjected to five cycles of CW agent contamination, decontamination or any combination of the two (i.e. contaminate twice, decontaminate three times). The contamination and decontamination procedure is identical to those outlined in 4.5.3.21.1 and 4.5.3.21.2, respectively. After the five cycles have been completed, the swatches shall be evaluated by the

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appropriate material tests outlined in tables I-IV. Failure to pass the material tests shall constitute failure of the cycle test.

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 material 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 of 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 lightweight, collapsible, pillow tanks are intended for use as drinking water transportation containers for the Light Infantry Battalions. The tanks can also be used as a temporary water storage container.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. If required, the specific issue of individual documents referenced (see 2.2.1, 2.2.2 and 2.3).
- c. If first article samples are required and number of samples required is other than three (see 3.1 and 4.2)
- d. Fitting assembly required if other than specified (see 3.3.3.1 and 4.5.3.19).
- e. Repair items required if other than specified (see 3.6)
- f. When accessories are not required (see 3.7)
- g. Packaging requirements (see 5.1).

6.3 Subject term (key word) listing.

Bladder
Portable
Rubber and elastomeric

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

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Custodian:
Army - AT

Preparing activity:
Army - AT

(Project 5430-2010-001)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST database at <https://assist.daps.dla.mil/>.