

MILITARY SPECIFICATION

TANKS, FUEL, ENGINE: GENERAL REQUIREMENTS FOR

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

1. SCOPE

1.1 Scope. This specification covers five types with four classes of engine fuel tanks from 1- through 400-gallon capacity for gasoline, diesel, and multifuel (see 6.4).

1.2 Classification. Fuel tanks shall be of the following types and classes as specified (see 6.2).

1.2.1 Types. The types of fuel tanks shall be of the following:

- a. Type I - Terneplate.
- b. Type II - Steel.
- c. Type III - Aluminum.
- d. Type IV - Plastic.
- e. Type VI - Nonmetallic, nonself-sealing.

1.2.2 Classes. The classes of fuel tanks shall be of the following:

a. Class 1

Industrial - Fuel tanks constructed and intended primarily for use on portable and stationary industrial equipment.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: USA Belvoir Research, Development, and Engineering Center, ATTN: STRBE-TSE, Fort Belvoir, VA 22060-5606 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

b. Class 2

Construction - Fuel tanks constructed and intended primarily for use on earthmoving, construction, and rough terrain material handling equipment.

c. Class 3

Automotive - Fuel tanks constructed and intended primarily for use in roadable vehicular equipment, and commercial materials handling vehicles other than earthmoving and construction equipment.

d. Class 4

Combat - Special fuel tanks constructed and intended primarily for use in tracked vehicles exposed to combat conditions.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards 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

QQ-S-571	- Solder; Tin Alloy, Tin-Lead Alloy, and Lead Alloy.
TT-C-490	- Cleaning Methods for Ferrous Surfaces and Pretreatments for Organic Coatings.
TT-E-489	- Enamel, Alkyd, Gloss, Low VOC Content.
PPP-B-601	- Boxes, Wood, Cleated Plywood.
PPP-T-60	- Tape: Packaging, Waterproof.
PPP-T-97	- Tape, Packaging/Industrial, Filament Reinforced.

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MIL-T-704	- Treatment and Painting of Materiel.
MIL-C-1283	- Can, Gasoline, Military, 5-Gallon.
MIL-R-7575	- Resin, Polyester, Low Pressure Laminating.
MIL-R-9299	- Resin, Phenolic, Laminating.
MIL-T-14442	- Tank, Fuel, Engine: Nonmetallic Non-Self-Sealing for Military Vehicles.
MIL-L-21260	- Lubricating Oil, Internal Combustion Engine, Preservative and Break-in.
MIL-C-46081	- Coating Compound, Thermal Insulating (Intumescent).

STANDARDS

FEDERAL

- FED-STD-H28 - Screw-Thread Standards for Federal Services.

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
 MIL-STD-129 - Marking for Shipment and Storage.
 MIL-STD-130 - Identification Marking of US Military Property.
 MIL-STD-193 - Painting Procedures and Marking for Vehicles, Construction Equipment and Material Handling Equipment.
 MIL-STD-889 - Dissimilar Metals.
 MS 35644 - Filler Neck: Fuel Tank - Military Vehicles.
 MS 35645 - Cap, Fuel Tank: Tactical Vehicle, Fording.
 MS 51300 - Cap, Fuel Tank: Combat Vehicle, Spill-Proof.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government publications. The following other Government publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DEPARTMENT OF TRANSPORTATION (DOT)

- 49CFR393 - Federal Motor Carrier Safety Regulation (FMCSR).

(Copies of the DOT FMCSR are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-0001.)

2.2 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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A 240 - Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
 ASTM A 308 - Steel Sheet, Cold-Rolled, Long Terne Coated.
 ASTM A 366/A 366M - Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
 ASTM A 569/A 569M - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality.

ASTM A 606	- Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
ASTM A 607	- Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled.
ASTM A 619/A 619M	- Steel, Sheet, Carbon, Cold-Rolled, Drawing Quality.
ASTM A 620/A 620M	- Steel, Sheet, Carbon, Drawing Quality, Special Killed, Cold-Rolled.
ASTM A 682	- Steel, Strip, High-Carbon, Cold-Rolled, Spring Quality, General Specification for.
ASTM B 209	- Aluminum and Aluminum-Alloy Sheet and Plate.
ASTM D 256	- Impact Resistance of Plastics and Electrical Insulating Materials.
ASTM D 635	- Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
ASTM D 638	- Tensile Properties of Plastics.
ASTM D 746	- Brittleness Temperature of Plastics and Elastomers by Impact.
ASTM D 790	- Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
ASTM D 1238	- Flow Rates of Thermoplastics by Extrusion Plastometer.
ASTM D 1505	- Density of Plastics by the Density-Gradient Technique.
ASTM D 1525	- Vicat Softening Temperature of Plastics.
ASTM D 1693	- Environmental Stress-Cracking of Ethylene Plastics.
ASTM D 4066	- Nylon Injection and Extrusion Materials (PA).

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.

(Applications for copies should be addressed to the American Society of Mechanical Engineers, Inc., 345 East 47th Street, New York, NY 10017-2304.)

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 - Structural Welding Code - Steel.
 AWS D1.2 - Structural Welding Code - Aluminum.

(Application for copies should be addressed to the American Welding Society, Inc., 550 N.W. LeJeune Road, P.O. Box 351040, Miami, FL 33135-3030.)

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC., AGENT

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Association, Inc., ATTN: Traffic Department, 2200 Mill Road, Alexandria, VA 22314-4654.)

SOCIETY OF AUTOMOTIVE ENGINEERS, INC (SAE)

SAE Handbook, Volume 1 - Materials.
SAE J403 - Chemical Compositions of SAE Carbon Steels.
SAE J512 - Automotive Tube Fittings.
SAE J829 - Fuel Tank Filler Cap and Cap Retainer.

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

UNDERWRITERS LABORATORIES, INC. (UL)

UL 395 - Automotive Fuel Tanks.

(Application for copies should be addressed to the Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062.)

UNIFORM CLASSIFICATION COMMITTEE, AGENT

Uniform Freight Classification Rules.

(Application for copies should be addressed to the Uniform Classification Committee, ATTN: Tariff Publishing Officer, Room 1160, 222 South Riverside Plaza, Chicago, IL 60606-5808.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 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. REQUIREMENT

3.1 Description. Unless otherwise specified (see 6.2), the fuel tank shall be of any configuration applicable to the equipment on which it is mounted. When specified (see 6.2), the minimum fuel tank requirements for the capacity specified shall conform to table I.

3.1.1 Conflicting requirements. In the event the requirements of this specification conflict with the specification for a specific equipment, the requirements of the equipment specification shall govern.

3.1.2 Additional requirements. Requirements in this specification shall not be construed as precluding the equipment specification from establishing additional requirements or limitations. Further, no requirements in this specification shall be interpreted to preclude furnishing fuel tanks in excess of the specific minimum requirements.

TABLE I. Tank materials.

Type	Material	Reference	Minimum Thickness (inch)	Capacity (gallons)
I	Terneplate	Standard ASTM A 308	0.0359	10 or less
I	Terneplate	Standard ASTM A 308	0.0478	11 thru 25
I	Terneplate	Standard ASTM A 308	0.0598	26 thru 60
I	Terneplate	Standard ASTM A 308	0.0747	61 thru 100
II	Steel	Standard ASTM A 569 ^{1/}	0.0747	26 thru 100
II	Steel	Standard ASTM A 240 ^{1/}	0.0747	26 thru 100
		Type 304	"	"
		Type 304L	"	"
		Type 321	"	"
II	Steel	Standard ASTM A 619 ^{1/}	0.1046	101 thru 400
II	Steel	Standard ASTM A 620	0.1046	101 thru 400
II	Steel	Standard ASTM A 240 ^{1/}	0.1046	101 thru 400
		Type 304	"	"
		Type 304L	"	"
		Type 321	"	"
II	Steel	Standard ASTM A 366 ^{1/}	"	"
II	Steel	Standard ASTM A 606 ^{1/}	"	"
II	Steel	Standard ASTM A 607 ^{1/}	"	"
III	Aluminum	Standard ASTM D 209 ^{2/}	0.050	5 or less
III	Aluminum	Standard ASTM B 209 ^{2/}	0.072	6 thru 15
III	Aluminum	Standard ASTM B 209 ^{2/}	0.093	16 thru 60
III	Aluminum	Standard ASTM B 209 ^{2/}	0.125	61 thru 99
III	Aluminum	Standard ASTM B 209 ^{2/}	0.156	100 thru 400
IV	Plastic	^{3/}	0.090	20 or less
IV	Plastic	^{3/}	0.100	21 thru 40
IV	Plastic	^{3/}	0.115	41 thru 125
IV	Plastic	^{3/}	0.125	126 thru 250
IV	Plastic	^{3/}	0.140	251 thru 400
VI	Rubber Non-Self-Sealing	MIL-T-14442		1 thru 400

^{1/} With the exception of terneplate, steel materials conforming to the Ferrous Metals Section, Numbering System, Chemical Composition Group and General Data on Steels Group, of the SAE Handbook, may be used as alternate standards to ASTM Standards. SAE standard steel materials shall have physical properties equal to or greater than the ASTM standards.

^{2/} Shall conform to applicable ASTM designations (see 3.6.3).

^{3/} Shall conform to one or more of the standards specified in 3.11.

3.2 First article. Unless otherwise specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.3.

3.3 Materials. Materials shall be as specified in table I. Materials not specified shall be selected by the contractor, and shall be subject to all provisions of this specification.

3.3.1 Material deterioration prevention and control. The fuel tank shall be fabricated from compatible materials, inherently corrosion resistant or treated to provide protection against the various forms of corrosion and

deterioration that may be encountered in any of the applicable operating and storage environments to which the fuel tanks may be exposed.

3.3.1.1 Dissimilar metals. Dissimilar metals shall not be used in intimate contact with each other unless protected against galvanic corrosion. Dissimilar metals and methods of protection are defined and detailed in MIL-STD-889.

3.3.1.2 Identification of materials and finishes. The contractor shall identify the specific material, material finish or treatment for use with component and subcomponent, and shall make information available upon request to the contracting officer or designated representative.

3.3.2 Recovered materials. For the purpose of this requirement, recovered materials are those materials which have been collected from solid waste and reprocessed to become a source of raw materials, as distinguished from virgin raw materials. The components, pieces and parts incorporated in the fuel tanks may be newly fabricated from recovered materials to the maximum extent practicable, provided the fuel tanks produced meet all other requirements of this specification. Used, rebuilt or remanufactured components, pieces and parts shall not be incorporated in the fuel tanks.

3.4 Threaded parts. Threads shall be in accordance with FED-STD-H28. Self-tapping screws and sheet-metal screws shall not be used.

3.5 Fuel tank construction. Unless otherwise specified herein, fuel tank construction shall conform to engineering practices of the fuel tank industry. Fuel tanks shall be constructed in accordance with the requirements of the equipment specifications (see 3.1.1). Fuel tanks shall not incur leaks, structural failure, or permanent deformation when tested as specified in 4.5.2.3, 4.5.2.4, and 4.5.2.5.

3.5.1 Baffles. Unless otherwise specified (see 6.2), baffles shall be required. Baffles shall not be located under the filler back and shall not interfere with the operation of the fuel measuring device. When specified, (see 6.2), reticulate foam may be used for baffling and safety purposes in all types provided the fuel acceptance requirement specified in 3.5.10 is met and the operation of the fuel measuring device (see 3.5.6) is not affected.

3.5.2 Filler and fittings. A cap (see 3.5.2.1), strainer (see 3.5.2.3), chain (see 3.5.2.1), filler neck (see 3.5.2.2), and other necessary fittings shall be provided with each tank. Unless otherwise specified (see 6.2), these items shall conform to engineering practices of the fuel tank industry and as specified herein (see table II). The diameter of the filler neck and subsequent fittings shall be as specified (see 6.2).

TABLE II. Cap and strainer requirements.

Item No.	Neck	Cap	Strainer
2	Commercial, SAE J829	SAE J829	60-mesh, minimum
2	*MS35644	MS35645	MS35644
3	*MS35644	MS51300	MS35644
4	Commercial	DOT side-mounted tank requirement	60-mesh, minimum
5	4-3/4-inch standard pipe	See figure 2	60-mesh, minimum

*Not to be used on type II and type III fuel tanks.

3.5.2.1 Filler caps. The filler cap shall be constructed of either material treated to resist corrosion or material inherently corrosion resistant. The cap shall be captive chained or cabled to the strainer, when provided, or to the tank, to prevent loss of the cap. The chain or cable shall include a swivel joint and shall permit unobstructive refueling of the tank. The captive cap components shall inherently resist corrosion and deterioration.

3.5.2.2 Filler neck. Filler necks shall be constructed of materials treated to resist corrosion, compatible with the fuel tank, and shall be affixed to the fuel tank in a manner compatible with the type of fuel tank construction (see table III).

TABLE III. Means of attaching filler necks to fuel tanks.

Tank type	Attaching method	Reference
Type I	Solder, weld, or combination of both.	3.6.1
Type II	Welded.	3.6.2
Type III	Welded.	3.6.3
Type IV	Bonded, formed, or molded.	3.6.4
Type VI		MIL-T-14442

3.5.2.3 Filler strainer. Filler strainers shall be removable, constructed of noncorrosive materials, 60-mesh screen, and shall be protected to prevent damage caused by contact with the refueling nozzle.

3.5.3 Fuel tank drain. Fuel tanks shall be provided with a drain connection separated from the fuel supply line and shall be of sufficient size and located to permit complete drainage of condensation, contaminants, and fuel. Unless otherwise specified herein, the drain connection shall be a leakproof, threaded plug. When specified (see 6.2), a leakproof drain valve, stopcock, or ball check release valve shall be acceptable. Drains or other bottom fittings shall be protected against damage from impact.

3.5.4 Auxiliary fuel supply connection. When specified (see 6.2), an auxiliary, 3-way, sealed, plug-type, selector valve, labeled "FUEL SUPPLY", shall be provided with provisions to accept a 5/16-inch, standard, flared fitting conforming to SAE J512. A protective cap secured against loss shall be provided with the fitting. A corrosion-resistant circular faceplate shall be mounted on the fuel selector valve and shall be marked with a double-ended arrow indicating direction of rotation and labeled "OFF", "UNIT TANK", and "AUXILIARY". A balance line shall be included when multiple tanks are furnished.

3.5.5 Fuel line shutoff valve. When specified (see 6.2), a fuel line shutoff valve shall be provided and shall be attached directly to the fuel tank permitting removal of the tank prior to draining. The shutoff valve shall be constructed of noncorrosive materials compatible with the fuel tank and the fuel supply line. The valve shall be labeled "FUEL SHUTOFF". The valve shall be provided with double-ended arrows showing direction of operations and labeled at each end to indicate functional result (e.g., open and off).

3.5.6 Fuel measuring device. When specified (see 6.2), the fuel tank shall be equipped with a fuel measuring device as specified herein.

3.5.6.1 Fuel liquid quantity transmitter and indicator. When specified (see 6.2), a liquid quantity fuel transmitter shall be furnished and installed. The

in-tank mounted transmitter shall incorporate noncorrosive materials compatible with the fuel tank and the panel mounted liquid quantity fuel indicator.

3.5.6.2 Nonelectrical fuel-level indicator. When specified (see 6.2), a non-electrical fuel-level indicator shall be furnished and installed. The mechanically actuated indicator shall incorporate noncorrosive materials compatible with the fuel tank and shall have an indicating dial graduated "EMPTY", "1/4", "1/2", "3/4", and "FULL". The indicator shall be labeled "FUEL LEVEL" and located for ease of replacement and reading.

3.5.6.3 Bayonet type dipstick. When specified (see 6.2), a bayonet type dipstick shall be furnished and installed. A separate duct and leakproof receptacle provided in the top of the fuel tank shall be acceptable. The dipstick shall be constructed of spring steel conforming to ASTM A 682, or SAE J403 steel of greater or equal quality, heat treated to Rockwell C-35 to 45, compatible with the fuel tank, and calibrated in increments of 1/4 tank capacity. The dipstick shall be etched, knurled, sandblasted, or phosphate-coated to facilitate reading. The dipstick shall be marked in graduations of 1/4, 1/2, 3/4 and FULL and labeled "FUEL LEVEL".

3.5.7 Grounding. Metal fuel tanks shall be metal-to-metal contact with frame, or ground strap to the frame, permitting the discharge of static electricity.

3.5.8 Mounting. Each fuel tank, including its filler neck, shall be constructed to permit mounting in a location where it shall not be damaged by chafing with other parts of the equipment. Mounting attachments provided shall be of a type that will not loosen when the fuel tank is attached to the equipment and the equipment is subjected to vibration encountered in operation and transport as specified in the equipment specification. When mounting straps are furnished, a barrier of fuel-resistant material shall be provided to prevent chafing of the straps and the fuel tank.

3.5.9 Suction tube or standpipe. The fuel tank shall be equipped with a suction tube or a standpipe as specified (see 6.2), and the fuel pickup point shall be not less than 1/2 inch above the bottom of the tank. The location of the suction tube or standpipe shall be near the longitudinal center of the tank to preclude starving of the engine on grades or slopes.

3.5.10 Venting. Fuel tanks shall be vented to accept fuel without spill-back from a fueling nozzle and from a military 5-gallon fuel can. Venting shall permit consumption of the fuel at twice the maximum volumetric capacity of the fuel pumps, without creating a vacuum in the fuel tank of more than 3 inches of mercury. Venting shall extend to the maximum height of the filler neck to prevent fuel from escaping through the vent should the fuel tank be filled to its utmost capacity. When specified (see 6.2), the venting system shall be separate from the filler cap. The venting system shall prevent the entrance of water, dirt, or foreign matter into the fuel tank. When specified (see 6.2), fuel tanks shall be vented above the fording depth of the equipment on which they will be installed. The venting system, in the event that the tank is subjected to fire, shall prevent internal tank pressure from exceeding 30 psig.

3.6 Type and construction.

3.6.1 Type I fuel tanks. Type I fuel tanks shall be constructed of terneplate having a specified coating of not less than 0.45 ounce per square foot (see table I). Joints and intersections shall be spot welded, projection welded, arc welded, or seam welded, as applicable. When specified (see 6.2), type I fuel tanks shall be soldered. Joints and intersections shall have seam

welded lap joints, machine locks, or equivalent, as shown in figure 1. Solder shall conform to QQ-S-571, composition range SN 30 TO SN 70, form, type, size, and condition optional. When a corrosive flux has been used during soldering, the residue shall be removed.

3.6.2 Type II fuel tanks. Type II fuel tanks shall be constructed of prime pickled, hot-or cold-rolled sheet or plate, steel or steel alloy (see table I). Joints and intersections shall be welded as specified herein.

3.6.3 Type III fuel tanks. Type III fuel tanks shall be constructed of aluminum alloy (see table I) conforming to the ASTM designations for aluminum sheet and plate. The aluminum alloy shall have a yield point of not less than 26,000 psi for sheet and plate. Joints and intersections shall be welded.

3.6.4 Type IV fuel tanks. Type IV fuel tanks shall be constructed of plastic conforming to current standards of the plastic fuel tank industry and as specified herein (see table I and 3.11). The specific plastic material used shall be as specified (see 6.2). Plastic fuel tanks shall conform to the following minimum requirements:

- a. The exterior (depth of .004 plus or minus .001 inch) surface of all fuel tanks which are not pigmented with at least 2.5 percent carbon black plus or minus 0.25 percent shall contain 0.5 percent ultraviolet ray deterioration preventative.
- b. The plastic material shall contain a minimum of 0.025 percent concentration of antioxidant. This is not required in nylon polyamide.
- c. Plastic fuel tanks shall be marked "CAUTION: DO NOT APPLY DIRECT HEAT OR FLAME TO THIS PLASTIC FUEL TANK."
- d. Quality of exterior surface shall be smooth to the extent that lows shall not exceed 0.050 inch in any direction when bridged by a 4-inch long straightedge.

3.6.4.1 Polyamide, rigid plastic fuel tanks. When specified (see 6.2), type IV plastic fuel tanks shall be constructed of molding plastic, conforming to ASTM D 4066, PA212.

3.6.4.2 Fiberglass-reinforced plastic fuel tanks. When specified (see 6.2), type IV plastic fuel tanks shall be constructed of fiberglass-reinforced plastic. The fiberglass-reinforced plastic material shall contain not less than 40 percent fiberglass or glass filament strands or yarns of uniform length, randomly distributed, and bonded with resins conforming to or exceeding MIL-R-7575 grade, class, and form optional or MIL-R-9299, grade optional. When tested in accordance with MIL-R-7575 or MIL-R-9299, the fiberglass-reinforced plastic materials shall conform to the following minimum requirements:

- a. Tensile strength shall be not less than 15,000 psi.
- b. Flexural strength shall be not less than 25,000 psi.
- c. Flexural modulus at 73 °F shall be not less than 1,000,000 psi.
- d. Flexural modulus at 180 °F shall be not less than 140,000 psi.
- e. Modulus and flex of retention shall be 50 percent after 2 hours' conditioning in boiling water.
- f. Flammability shall comply with ASTM D 635 (nonburning).

3.6.4.3 High density polyethylene fuel tanks. When specified (see 6.2), plastic fuel tanks shall be constructed of high density polyethylene conforming to the minimum physical requirements listed in table IV and as specified herein (see table I):

TABLE IV. Physical requirements for high-polyethylene fuel tanks.

Property	ASTM Test Method	Unit	Value
Density	D 1505	gms/cc	0.936-0.950
Melt index	D 1238	gms/10 min	.3 max
Tensile strength	D 638 2 in./min	psi	3,300 min
Elongation	D 638 2 in./min	%	400 min
Impact strength (1/8-inch bar)	D 256	ft-lb/inch notch	4 min
Vicat softening temp.	D 1525	°F	252 min
Brittleness temp.	D 746	°F	-100 (or colder)
Flexural modulus	D 790	psi	150,000 min
Environmental stress cracking resistance	D 1693	F50, hrs	225 hrs min

3.6.5 Type VI fuel tanks. Type VI fuel tanks shall be flexible, laminated, nonself-sealing tanks conforming to MIL-T-14442.

3.7 Safety. Fuel tanks shall be constructed so that the refueling nozzle or fuel supply container does not come in contact with any exposed electrical component of the tank or of the equipment on which it is mounted.

3.8 Refueling. Unless otherwise specified (see 6.2), the fuel tank, when mounted on the equipment, shall permit refueling to an amount specified in the specific equipment specification. Refueling to the specified amount shall be accomplished when the equipment is tilted 15 degrees plus or minus 2 degrees in any direction. The filler neck shall permit the tank to be refueled directly from a military 5-gallon fuel can conforming to MIL-G-1283, equipped with a flexible refueling nozzle.

3.9 Identification marking. All fuel tanks shall be identified in accordance with MIL-STD-130 and shall include the supplier's name, date, and tank capacity. DOT labels shall be attached to all tanks that have been fabricated to conform to DOT side-mounted fuel tank regulations. All labels shall be placed in a position where they will be visible after installation of the fuel tank on the equipment. Type IV fuel tanks shall have special markings as specified in 3.6.4.

3.9.1 Additional identification marking. Fuel tanks shall have marking or labeling specifying the specific fuel consumed by the equipment on which the tank is to be mounted. The marking or labeling shall be in a position visible to operators or attendants performing refueling operations.

3.10 Treatment, painting, and coating. All welding and soldering shall have been completed prior to cleaning, treating, and painting.

3.10.1 Tank exteriors. When specified (see 6.2), exterior surfaces of types I, II and III fuel tanks, except class 4 combat fuel tanks, shall be treated and painted in accordance with MIL-T-704, type F or G, as applicable. Class 4 combat tanks shall be treated and painted in accordance with MIL-STD-193. The finish coat shall conform to TT-E-489, color as specified (see 6.2). When painting is required on type IV fuel tanks, paint shall conform to the above requirements, except that the paint shall be intumescent thermal insulating coating compound conforming to MIL-C-46081.

3.10.2 Tank interiors.

3.10.2.1 Type I and III fuel tanks. The interior of types I and III fuel tanks shall be treated with a rust-preventing fog oil conforming to MIL-L-21260, type I or II, grade 30, prior to the airtight sealing of all fuel tank openings in preparation for shipment or storage.

3.10.2.2 Type II fuel tanks. The interior of type II fuel tanks, including baffle plates, shall be treated in accordance with TT-C-490, type II, method II, III or IV, prior to treatment with a rust-preventive fog oil conforming to MIL-L-21260, type I and II, grade 30. After the oil-fogging treatment, all fuel tank openings shall be sealed airtight in preparation for shipment or storage.

3.10.2.3 Type III and IV fuel tanks. Unless otherwise specified (see 6.2), the interior of type III and IV fuel tanks shall not be treated prior to the airtight sealing of all fuel tank openings in preparation for shipment or storage.

3.11 Fuel tank standards.

3.11.1 DOT truck type. When specified (see 6.2), type I, II, III and IV fuel tanks shall conform to the side-mounted requirements of the DOT Motor Carrier Safety Regulations 49CFR393 without respect to the installed location of these tanks on the equipment.

3.11.2 Underwriters Laboratories Inc. When specified (see 6.2), types I, II, III and IV fuel tanks shall conform to Underwriters Laboratories Inc., Standards for Safety, Automotive Fuel Tanks, Standard Number UL 395.

3.12 Workmanship. Workmanship of each fuel tank shall be in accordance with the engineering, manufacturing, and production standards of the fuel tank industry. The fuel tanks shall be free from workmanship deficiencies that could impair the operation or serviceability of the fuel tanks when mounted on the equipment.

3.12.1 Metal fuel tanks. All parts, components, and assemblies of metal fuel tanks shall be smooth, clean, and free from sand, dirt, fins, pits, sprues, scale, flux, and other harmful extraneous material. External surfaces shall be free of burrs and sharp edges and corners except when sharp edges and corners are functional.

3.12.2 Plastic fuel tanks. All parts of type IV plastic fuel tanks shall be free from uncured or unbonded areas, gaps, cracks, holes, blisters, areas not homogeneously mixed, wrinkles, delamination, air or gas pockets, patches, porosity, and other defects. External surfaces shall be free from sharp edges and corners except when sharp edges and corners are functional.

3.12.3 Fabrication of fuel tanks.

3.12.3.1 Aluminum and steel. Aluminum and steel used in the fabrication of fuel tanks shall provide original quality surface finish and shall be free from kinks and sharp bends. Aluminum and steel having an eroded surface is not acceptable. The forming of the material shall be done by methods that will not cause damage to the metal. Shearing, punching, and chipping shall be done uniformly, neatly, and accurately. Corners shall be square and true and all sharp edges and burrs shall be removed. The burned surfaces of flame-cut material shall be free of burrs, slag, and sharp edges. Precautions shall be taken to avoid overheating of metal. Heated metal shall be allowed to cool slowly, except where heat treatment is required. All bends of a major

character shall be made with precise, unyielding dies or jig fixtures to ensure uniformity of size and shape.

3.12.3.2 Plastic. The plastic used in the fabrication of fuel tanks shall provide original quality surface finish and shall be free from pits, scratches, scars, and mold imperfections. Plastic material that has been warped out of shape by overheating, mishandling, or incorrect storage is not acceptable. The forming of the plastic material shall be done uniformly, neatly, and accurately. Bonding of plastic to metal or plastic to plastic parts shall be done by methods that will not cause damage to the material. The bonded areas shall be free from adhesive runs, pits, gaps, cracks, blisters, wrinkles, air or gas pockets, porosity, or other defects. Sharp edges, mold flash, or overflow shall be removed.

3.12.4 Welders and welding.

3.12.4.1 Welders. Before assigning any welder or welding operator to welding work covered by this specification, the contractor shall obtain certification that the welder or welding operator has passed qualification tests as prescribed by either of the following listed codes for the materials joined and the type of welding operation to be performed and that such qualification is effective as defined by the particular code:

AWS D1.1, Structural Welding Code - Steel.

AWS D1.2, Structural Welding Code - Aluminum.

ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.

Contractors who only make horizontal welds need not qualify welders for "all position welding." In the event of evidence of poor welds, the Government reserves the right to require retesting of any welder or welding operator. The test results shall be made available for review by the contracting officer or the contracting officer's representative.

3.12.4.2 Welding. The surfaces of parts to be welded shall be free from rust, scale, paint, grease, and other foreign matter. Welds shall transmit stress without permanent deformation of failure when the parts connected by the welds are subject to proof and service loading.

3.12.4.3 Aluminum welding. Aluminum welding shall be accomplished by the metal-inert-gas method or any other method that will provide equivalent mechanical properties of the filler metal-to-base metal combinations. When machines are available, all aluminum welds shall be made by automatic machines. All welds shall be made at a uniform rate of speed. Complete and uniform penetration and fusion of the metals shall be obtained on all welds. Aluminum welds may be ground, filed, wire brushed, or chipped. Hammered welds shall not be acceptable. Preheating for welding is permissible, providing the temperature does not exceed 400 °F for a total time of 30 minutes. Aluminum weld processes requiring the use of welding flux shall not be used. The welding of aluminum shall be performed in accordance with nationally recognized and accepted recommended procedures of the aluminum industry.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government.

The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Component and material inspection. The contractor is responsible for ensuring that components and materials used are manufactured, examined and tested in accordance with referenced specifications and standards, as applicable.

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

- a. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).
- c. Inspection of packaging (see 4.6).

4.3 First article inspection. First article inspection shall be performed on one complete fuel tank assembly when a first article sample is required (see 3.2 and 6.2).

4.3.1 Examination. The first article fuel tank shall be examined for the defects marked "X" in column 1 of table V. Presence of one or more defects shall constitute cause for rejection.

4.3.2 Tests. The first article fuel tank shall be tested as specified in 4.5.2. Failure of any test shall constitute cause for rejection.

4.4 Quality conformance inspection.

4.4.1 Sampling. Sampling for examination and tests shall be in accordance with MIL-STD-105. Sampling size shall be determined by using MIL-STD-105, table I and IIa. A lot shall be accepted when zero defects are found and rejected when one or more defects are found.

4.4.2 Examination. Each fuel tank shall be examined for the defects marked "X" in column 2 of table V. Presence of one or more defects shall constitute cause for rejection.

4.4.3 Tests. Each fuel tank shall be tested as specified in 4.5.2. Failure of any test shall constitute cause for rejection.

4.5 Methods of inspection.

4.5.1 Examination. The fuel tank shall be examined as specified herein for defects contained in table V.

TABLE V. Examination.

First article	Quality conformance	Examination description	Requirement paragraph
1	2	3	4
X	X	101. Materials not as specified.	3.3 and table I
X	-	102. Material not resistant to corrosion and deterioration or treated to be resistant to corrosion and deterioration for the applicable storage and operating environments.	3.3.1
X	-	103. Dissimilar metals as defined in MIL-STD-889 are not effectively insulated from each other.	3.3.1.1
X	-	104. Contractor does not have documentation available for identification of material, material finishes, or treatment.	3.3.1.2
X	-	105. Used, rebuilt or remanufactured components, pieces, or parts incorporated in the fuel tank.	3.3.2
X	-	106. Threaded parts not as specified.	3.4
X	-	107. Baffles not as specified.	3.5.1
X	-	108. Filler and fittings not as specified.	3.5.2
X	-	109. Filler cap not as specified.	3.5.2.1
X	-	110. Captive chains not as specified.	3.5.2.1
X	-	111. Filler neck not as specified.	3.5.2.2
X	-	112. Means of attaching filler neck not as specified.	3.5.2.2 & table III
X	-	113. Filler strainer not as specified.	3.5.2.3
X	-	114. Fuel tank drain not as specified.	3.5.3
X	-	115. Grounding not as specified.	3.5.7
X	-	116. Mounting not as specified.	3.5.8
X	-	117. Suction tube or standpipe not as specified.	3.5.9
X	-	118. Venting not as specified.	3.5.10
X	X	119. Tank construction not as specified.	3.6
X	-	120. Safety features not as specified.	3.7
X	-	121. Identification marking not as specified.	3.9
X	-	122. Treatment, painting, and coating not as specified.	3.10
X	-	123. Fuel tank not as specified in the applicable standard.	3.11
X	X	124. Workmanship not as specified.	3.12

4.5.2 Tests.

4.5.2.1 Test conditions. Tests shall be conducted on completely assembled fuel tanks.

4.5.2.2 Leakage. Close all openings in the fuel tank and pressurize the tank with air to either 7 psig for cylinder and cylindroid tanks or 3 psig for rectangular tanks. Examine the fuel tanks for leaks while maintaining the specified pressure for not less than 5 minutes on first article inspection, and

not less than 1 minute for quality conformance inspection. Any leakage shall constitute failure of this test.

4.5.2.3 Hydrostatic. Right after the leakage test, increase the internal tank pressure to 45 psig. Evidence of structural failure of the tank shall constitute failure of this test.

4.5.2.4 Slosh. Place the fuel tank on a rocker assembly in a manner that simulates the actual intended installation. Orient the axis of the rocker assembly perpendicular to the centerline of the tank length and not more than 4 inches below the bottom of the lowest horizontal surfaces of the tank. Fill the tank to one-half capacity with water to which a colored dye has been added, and cap all connections. Adjust the rocker assembly to provide a rocking action of 15 degrees plus or minus 2 degrees on each side of the vertical. Rock the tank for not less than 24,000 cycles, at a rate of 1,500 cycles per hour plus or minus 50 cycles. Evidence of more than 1 ounce by weight per minute of fluid leakage or structural failure of the tank shall constitute failure of this test.

4.5.2.5 Venting (vacuum). Gravity flow day tanks are excluded from this test. Close all fuel tank openings except for the fuel supply connection and the venting system. Fill the tank with fuel. Remove all the fuel in the tank at twice the maximum volumetric pumping rate of the fuel pump to be supplied on the equipment. Any permanent deformation such as sagging, buckling, cracking or creating a vacuum in the fuel tank in excess of 3 inches of mercury shall constitute failure of this test.

4.5.2.6 Venting (pressure). Type IV and V fuel tanks are exempt from this test. Fill the tank three-fourths full with fuel having a temperature between 50 °F and 80 °F; seal the fuel outlet, and invert the tank. Apply an enveloping flame to the tank so that the temperature of the fuel rises at a rate of not less than 6 °F and not more than 8 °F per minute. The venting system shall activate before the internal pressure in the tank exceeds 30 psig and the internal pressure shall not thereafter exceed the pressure at which the system activated by more than 5 psi despite any further increase in temperature of the fuel. Failure of the venting system to activate at the prescribed tank internal pressure shall constitute failure of this test.

4.6 Inspection of packaging.

4.6.1 Quality conformance inspection of packaging.

4.6.1.1 Unit of product. For the purpose of inspection, a complete pack prepared for shipment shall be considered a unit of product.

4.6.1.2 Examination. Each tank, prepared for shipment shall be examined for the following defects. One or more defects shall constitute as failure.

- 125. Plugs, strainers and caps not installed.
- 126. Openings into the fuel tanks not sealed.
- 127. Type VI fuel tanks not preserved as specified for level A.
- 128. Boxes not as specified for level A or B.
- 129. Tanks of like description not packed as specified for level A, B or C.
- 130. Strapping not zinc coated for level A.
- 131. Marking illegible, incorrect, missing or incomplete.

5. PACKAGING

5.1 First article pack. The contractor shall furnish a first article pack for examination within the time frame specified (see 6.2), to provide, prior to starting production packaging, that the applied preservation, packing and marking comply with the packaging requirements of this specification. Examination shall be as specified in section 4 and shall be subject to surveillance and approval by the Government (see 6.5). The first article pack may be accomplished utilizing either the first article model tank or a production tank. If the first article model tank is utilized, any preservation and packing shall be removed by the contractor at no expense to the Government, when requested by the Government to facilitate comparison between the first article model tank and production tank.

5.2 Preservation. Preservation shall be level A or C as specified (see 6.2).

5.2.1 Level A.

5.2.1.1 Type I, II, III and IV fuel tanks. Types I, II, III and IV fuel tanks shall have the plugs, strainers and caps installed. Openings into the tank shall be sealed with tape conforming to PPP-T-60, type IV, class 1. The grounding strap or wire shall be secured to the tank with tape conforming to PPP-T-97, 3/4-inch wide.

5.2.1.2 Type VI fuel tank. Type VI fuel tanks shall be preserved in accordance with the level A requirements of MIL-T-14442.

5.2.2 Level C. Fuel tanks of like description with the plugs, strainers and caps installed shall be preserved to afford protection against deterioration and damage from the contractor to the initial destination.

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

5.3.1 Level A. Fuel tanks of like description, preserved as specified in 5.2, shall be packed together in close-fitting boxes, conforming to PPP-B-601, overseas type, style A, B, I or J. The boxes shall be closed and strapped in accordance with the appendix to the box specification. Strapping shall be zinc coated.

5.3.2 Level B. The fuel tanks, preserved as specified in 5.2, shall be packed as specified for level A except the boxes shall be domestic type, style optional and the strapping need not be zinc coated.

5.3.3 Level C. The fuel tanks of like description, preserved as specified in 5.2, shall be packed to assure carrier acceptance and safe delivery to destination at lowest rates in containers complying with Uniform Freight Classification Rules and National Motor Freight Classification Rules.

5.4 Marking. In addition to any special marking specified in the contract or purchase order (see 6.2), marking shall be in accordance with MIL-STD-129.

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 fuel tanks covered by this specification are intended for use as components for combat, tactical, and commercial end items of industrial, construction, automotive, and combat tracked equipment. This specification is a design specification and is not intended to be used in procuring replacement fuel tanks as a repair part.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type and class required (see 1.2).
- c. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
- d. Configuration and shape of tank if requirements limit tank design (see 3.1).
- e. When fuel tank requirements will conform to table I (see 3.1).
- f. When a first article is not required (see 3.2).
- g. Fuel tank standard(s) applicable to fuel tank (see table I, footnote 3/ and 3.11).
- h. When baffles are not required (see 3.5.1).
- i. When reticulated foam for baffling is required (see 3.5.1).
- j. Filler and fittings required if other than as specified (see 3.5.2).
- k. Diameter of filler neck and subsequent fitting required (see 3.5.2).
- l. When a leakproof drain valve, stopcock, or ball check release valve is required (see 3.5.3).
- m. When an auxiliary fuel supply connection is required (see 3.5.4).
- n. When a fuel line shutoff valve is required (see 3.5.5).
- o. When a fuel measuring device is required and type of device desired (see 3.5.6).
- p. Type of fuel tank outlet (suction tube or standpipe) required (see 3.5.9).
- q. When venting separate from fuel cap is required (see 3.5.10).
- r. When venting is required above fording depth (see 3.5.10).
- s. When soldering of type I fuel tanks is required (see 3.6.1).
- t. Specific plastic material required for type IV fuel tank construction (see 3.6.4 thru 3.6.4.3).
- u. When refueling amount required is other than as specified (see 3.8).
- v. When type I, II and III fuel tanks (except class 4) will be treated and painted in accordance with MIL-T-704 (see 3.10.1).
- w. Color required (see 3.10.1).
- x. When treatment of type III and IV tank interiors is required (see 3.10.2.3).
- y. When fuel tanks will conform to DOT side-mounted requirements (see 3.11.1).
- z. When fuel tanks will conform to Underwriters Laboratories, Inc., (see 3.11.2).
- aa. Time frame required for submission of first article pack (see 5.1).
- bb. Level of preservation and packing required (see 5.2 and 5.3).
- cc. Any special marking required (see 5.4).

6.3 First article. When a first article inspection is required, the sample should be a preproduction model. The first article should consist of one complete fuel tank assembly. 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. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Technical usage data. Inquiries for technical usage data may be submitted to: USA Belvoir Research, Development and Engineering Center, ATTN: STRBE-FGS, Fort Belvoir, VA 22060-5606.

6.5 First article pack. Any changes or deviations of production pack from the approved first article pack will be subject to the approval of the contracting officer. Approval of the first article pack will not relieve the contractor of his obligation to preserve, pack and mark the tanks in accordance with this specification.

6.6 Marking. Marking in accordance with MIL-STD-129 may not be required when contractors are buying tanks for installation on equipment and the tanks are being shipped from subcontractors to the equipment-assembly plant.

6.7 Classification change. Type V, self-sealing nonmetallic fuel tank per MIL-T-13467, has been deleted by this revision of the specification. MIL-T-13467 has been canceled.

6.8 Subject term (key word) listing.

Aluminum tank
Automotive fuel tank
Combat fuel tank
Construction fuel tank
Industrial fuel tank
Nonself-sealing nonmetallic tank
Plastic tank
Steel tank
Terneplate tank

6.9 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.

Custodians:

Army - ME
Navy - YD

Preparing activity:

Army - ME

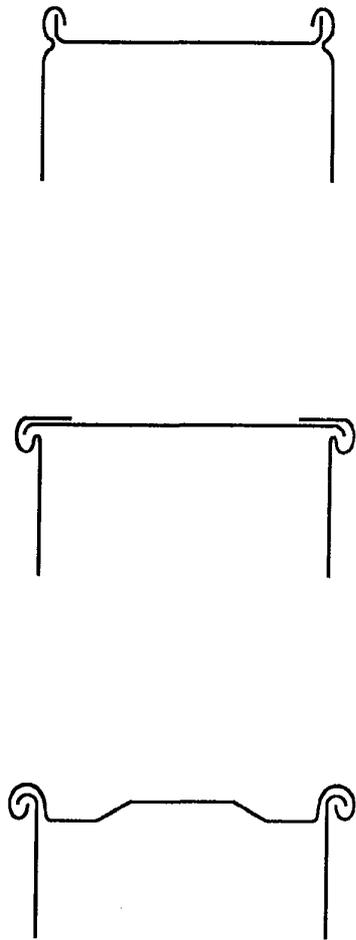
Review activities:

Army - AT
DLA - GS

Project 2910-0188

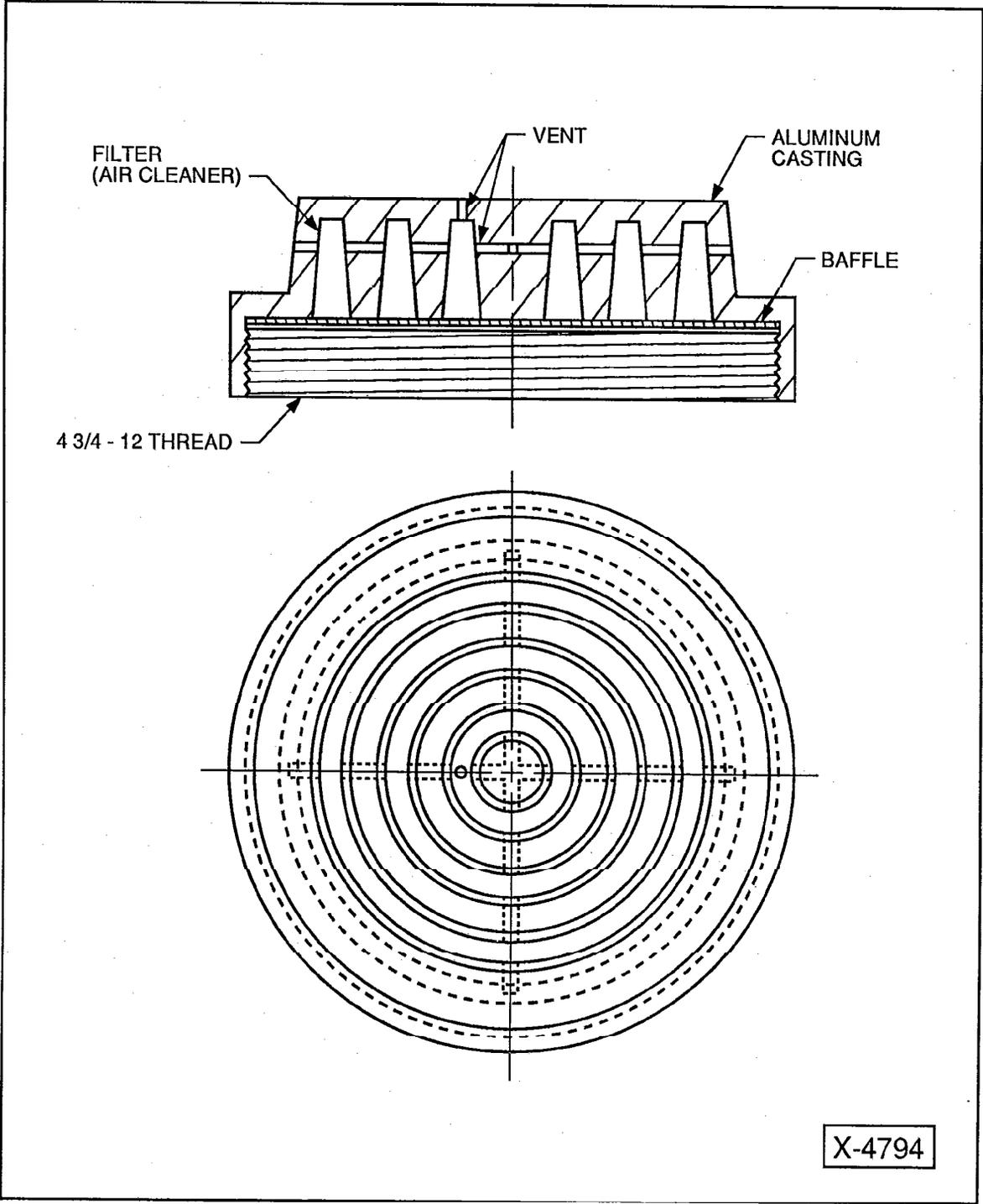
User activity:

Navy - MC



X-4793

FIGURE 1. TYPES OF MECHANICAL LOCKED JOINTS THAT CAN BE SOLDERED.



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FIGURE 2. FUEL CAP FOR EARTHMOVING EQUIPMENT.