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MILITARY SPECIFICATION

CAP; PRESSURE FUEL SERVICING

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

1. SCOPE

1.1 Scope. This specification covers the requirements for procurement of caps for pressure fuel servicing adapters.

1.2 Classification. Tank filler caps shall be one of the following types as specified:

MS29525	Cap - Pressure Fuel Servicing, 2 1/2 Inch Flush Type
MS29526	Cap - Pressure Fuel Servicing, Non Flush Type

2. APPLICABLE DOCUMENTS

2.1 Issue of documents. The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

P-D-680	Dry Cleaning Solvent
QQ-C-320	Chromium Plating
QQ-P-416	Plating, Cadmium (Electrodeposited)
TT-E-489	Enamel, Alkyd, Gloss (For Exterior and Interior Surfaces)
TT-S-735	Standard Test Fluids, Hydrocarbon

Military

MIL-J-5161	Jet Fuel, Referee
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Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Engineering Center, ESSD (Engineering Specifications and Standards Department), Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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SPECIFICATIONS (cont'd)

Military

MIL-T-5624	Turbine Fuel, Aviation Grades JP-4 and JP-5
MIL-S-7742	Screw Thread, Standard, Aeronautical
MIL-P-7936	Parts and Equipment, Aeronautical, Preparation for Delivery
MIL-A-8625	Anodic Coatings for Aluminum and Aluminum Alloys
MIL-N-25027	Nut, Self-Locking, 250°F, 550°F, and 800°F
MIL-T-25524	Turbine Fuel, Aviation Thermally Stable

STANDARDS

Military

DoD-STD-100	Engineering Drawing Practices
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking for US Military Property
MIL-STD-143	Specifications and Standards, Order of Precedence for the Selection of
MIL-STD-889	Dissimilar Metals
MIL-STD-1523	Age Control of Age Sensitive Elastomeric Material
MS20995	Wire, Lock
MS24484	Adapter, Pressure Fuel Servicing Aircraft, Nominal 2 1/2 Inch Diameter
MS29513	Packing "O" Ring Hydrocarbon Fuel Resistant
MS29525	Cap, Pressure Fuel Servicing, 2 1/2 Inch Flush Type
MS29526	Cap - Pressure Fuel Servicing, Non-flush Type
MS33588	Nuts and Plate Nuts, Self-locking, Functional Limitations of

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

3. REQUIREMENTS

3.1 Qualification. The cap unit furnished under this specification shall be a product which is qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 6.3).

3.2 Materials. Materials and processes used by the manufacturer of filler caps shall be of high quality, suitable for the purpose, and shall conform to applicable Government specifications. Materials conforming to contractor's specifications may be used provided the specifications are released by the Services and contain provisions for adequate tests. The use of contractors' specifications will not constitute waiver of Government inspection. All materials used in the cap shall be sufficiently resistant to fuels conforming to MIL-J-5161, MIL-G-5572, MIL-J-5624, MIL-T-25524, and TT-S-735 of aromatic content from 0 to 30 percent, to assure satisfactory operation as herein defined.

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3.2.1 Metals. Only (nonsparking) nonferrous metals shall be used on the exterior of the cap. All metals used in the construction of filler caps not of a corrosion-resisting type shall be suitably protected to resist corrosion during the normal service life of the cap. The use of dissimilar metals, especially brass, copper, or steel in contact with aluminum or aluminum alloy shall be avoided where practicable. Dissimilar metals are defined by MIL-STD-889.

3.2.2 Selection of materials. Specifications and standards for all materials, parts, and Government certification and approval of processes and equipment, which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with MIL-STD-143, except as provided in the following paragraph.

3.2.2.1 Standard parts. Standard parts (MS, AN, or JAN) shall be used wherever they are suitable for the purpose, and shall be identified on the drawing by their part numbers. Commercial utility parts such as screws, bolts, nuts, cotter pins, etc, may be used, provided they possess suitable properties and are replaceable by the standard parts (MS, AN or JAN) without alteration, and provided the corresponding standard part numbers are referenced in the parts list and, if practicable, on the contractor's drawings. In the event there is no suitable corresponding standard part in effect on date of invitation for bids, commercial parts may be used provided they conform to all requirements of this specification.

3.3 Design and Construction.

3.3.1 Design. The cap shall be designed to close and seal aircraft pressure fuel servicing connections incorporating a bayonet flange conforming to that shown in MS24484. The design shall be such that removal of the cap will not be hindered by negative pressures acting between the cap and the MS24484 adapter. If necessary automatic relief venting shall be provided. The design shall include a means of connecting and disconnecting the cap easily by one gloved hand without the use of tools. The outside surface of flush-type caps shall be as flat as practicable in order to reduce air resistance.

3.3.1.1 Standard. The cap shall conform to the applicable MS standard.

3.3.1.2 Main seal. The cap to flange main seal shall be self-adjusting to compensate for wear or compression.

3.3.2 Construction. The cap shall be so constructed that it will withstand the strains, jars, vibrations, and other conditions incident to shipping, storage, and service use.

3.3.2.1 "O" rings. All "O" rings shall conform to MS29513.

3.3.2.2 Direction of rotation. The cap rotation to engage and seal shall be in a clockwise direction.

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3.3.2.3 Lubrication. The cap shall operate satisfactorily without the use of lubricants.

3.3.2.4 Locking. The cap when fully engaged shall be locked automatically and positively. Once locked the formation of negative pressures behind the cap shall not allow it to unlock or loosen.

3.3.2.4.1 Locking indication. Flush caps shall be marked in accordance with MS29525 to show when the cap is in the locked position.

3.3.2.5 Chain attachment. The chain attachment to the cap shall be such that a pull up to the specified tensile strength of the chain in any direction will not cause the chain attachment to fail. The attachment shall be such that the chain can be readily attached or removed.

3.4 Interchangeability. All component parts shall be governed by the part numbering system of DoD-STD-100.

3.5 Threaded parts.

3.5.1 Screw threads. Screw threads shall be in accordance with MIL-S-7742.

3.5.2 Locking of threaded parts. All threaded parts shall be securely locked by safety wiring, self-locking nuts, cotter pins, or other approved means. Safety wire shall have a minimum diameter of 0.032 inch and shall conform to MS20995. Self-locking nuts shall be of the all-metal type conforming to MIL-N-25027, and shall be used in accordance with MS33588. Staking and the use of lock washers is not permitted.

3.6 Synthetic rubber parts. The assembly date marking shall be in accordance with MIL-STD-1523.

3.6.1 Serviceability. All synthetic rubber parts shall be readily replaceable with a minimum replacement of attaching parts.

3.7 Finishes and protective coatings.

3.7.1 Finishes. The cap finish shall be smooth and free from sharp edges. Any painted parts shall be finished in accordance with MIL-F-18264 and the finish coat shall be insignia red enamel conforming to type II or type III of TT-E-489.

3.7.2 Protective coatings. The cap shall be adequately protected against corrosion by the use of corrosion resistant materials or protective coatings acceptable to the procuring activity. Such coatings shall not chip or flake and shall prevent deterioration of the base metal under all conditions of service. Aluminum-alloy parts shall be anodized in accordance with MIL-A-8625. Cadmium or chrome plating, when used, shall conform to QQ-P-416, Class 2, Type II and QQ-C-320, Class 2, respectively. Cadmium plating shall not be used on surfaces which would normally be in contact with fuel, unless specifically approved by the procuring activity.

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3.8 Performance. The cap shall satisfy the performance tests of Section 4.

3.9 Markings. All markings shall be durable to prevent obliteration resulting from service use.

3.10 Identification. All assemblies and parts shall be marked in accordance with MIL-STD-130. The information may be etched, engraved, embossed, or stamped in a suitable location on the assembly except the following:

- (a) Parts or assemblies which do not have a suitable or sufficient surface for a part number.
- (b) Assemblies which are permanently assembled by welding, brazing, soldering, or riveting. These shall carry their assembly part number.

3.10.1 Accessibility. The part number shall, when practicable, be located to permit being read after assembly in the complete unit.

3.10.2 Color identification. The component shall be color coded to indicate fuel use by means of a red color. The color covering the entire exterior surface shall be permanent and shall not deteriorate, loosen or fade due to contact with fuel or the operational environment.

3.10.3 Nameplate. The following information shall be suitably marked on the top of the cap:

CAP; PRESSURE FUEL SERVICING
MS Part No.
Manufacturer's name or trade-mark

"Suitable instructions shall be stamped on the exterior surface of the cap to provide information concerning proper installation and locking methods."

3.10.3.1 Use of MS or MIL designations. MS or MIL designations shall not be applied to a product, except for Qualification test samples, nor referred to in correspondence, until notice of approval has been received from the activity responsible for qualification.

3.11 Workmanship. All details of workmanship shall be in accordance with high-grade manufacturing practice covering this class of aircraft accessories.

3.11.1 Cleaning. All parts shall be clean and free from dirt, sand, and metal chips being assembled and after assembly.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. The contractor may use his own or other suitable facilities unless disapproved by the Government. The Govern-

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

4.2 Classification of inspections. The inspection and testing of the component shall be classified as follows:

- (a) Qualification tests: Qualification tests are those tests accomplished on samples submitted for qualification as a satisfactory product.
- (b) Inspection tests: Inspection tests are those tests accomplished on caps manufactured and submitted for acceptance under contract.

4.3 Qualification Inspection - Qualification inspection shall consist of qualification tests on two caps by the supplier, and verification tests on two caps at a Government facility. The qualification tests shall consist of the complete inspection methods stipulated in 4.6, and performed in the order listed. The verification tests shall consist of any of the tests of 4.6 which the Government desires to perform. Successful completion of this inspection is required for qualification.

4.3.1 Test samples. Test samples submitted for government verification shall consist of two caps identified with the manufacturer's own part number. Samples submitted shall be accompanied by two complete sets of detail and assembly drawings and a complete test report (4.3.1.1 and 4.3.1.2). Samples shall be submitted to the Naval Air Propulsion Center, Trenton, New Jersey 08628.

4.3.1.1 Drawings. The contractor's drawings submitted with the verification test samples shall conform to DoD-STD-100. The drawings shall show a cutaway section of all parts in their normal assembled position and shall specify part numbers of all parts and subassemblies. The following data shall be furnished on or together with the assembly drawings:

- (a) Mounting dimensions
- (b) Over-all dimensions
- (c) Materials and construction, treatment and finish
- (d) Pressure rating

4.3.1.2 Manufacturer's test report. The test reports submitted with the qualification test samples shall include the following:

- (a) Report of all tests, graphically presented when possible, together with a detailed statement indicating compliance or extent of noncompliance with all requirements of this specification, referring specifically to paragraph numbers.
- (b) Summary of endurance test
- (c) Diagrams of all test setups
- (d) Outline and description of test and test conditions
- (e) Copies of test log sheets
- (f) Photographs when available

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4.3.1.3 Tests. Qualification tests of filler caps shall consist of the following tests, conducted in the order listed, as described under "Test methods." The Qualification tests may, at the option of the procuring activity, be supplemented with tests under actual or simulated service conditions, to determine conformance with the requirements of this specification.

Cap No. 1

- (a) Examination of product
- (b) Functional
- (c) Fluid leakage
- (d) Air leakage
- (e) Fuel resistance and extreme temperature
- (f) Proof pressure
- (g) Burst pressure
- (h) Disassembly and inspection

Cap No. 2

- (a) Examination of product
- (b) Functional
- (c) Fluid leakage
- (d) Air leakage
- (e) Vibration
- (f) Endurance
- (g) Accelerated corrosion
- (h) Proof pressure
- (i) Burst pressure
- (j) Disassembly and inspection

4.3.2 Rejection and retest. When the cap fails to meet any of the requirements of the qualification tests, the program will be halted until the extent and cause of failure are determined. The action required to correct the fault will be reported to the qualifying activity prior to reinitiation of the test program. After corrections have been made, all qualification tests shall be repeated.

4.3.3 Retention. The retention of qualification shall consist of a two year review and verification to determine compliance of the qualified cap with the requirements of this specification. Each supplier shall forward to the preparing activity a certification that the listed product is still available from the listed plant, can be produced under the same conditions as originally qualified and meets the requirements of the current issue of the specification.

4.4 Quality Conformance Inspection. Quality conformance inspection shall be performed under the surveillance of the Government inspector on lots submitted for acceptance under contract. The quality conformance tests shall consist of individual tests and sampling tests.

4.4.1 Individual tests. Each cap shall be subject to the following tests as described under "Test methods":

- (a) Examination of product
- (b) Functional
- (c) Fluid leakage (at test pressures of 5, and 60 psi only)
- (d) Proof pressure

4.4.2 Sampling tests. One cap shall be selected by the Inspector from each lot of not more than 200 on the contract or order and subjected to the Individual tests and the following tests, as described under "Test methods":

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- (a) Burst pressure
- (b) Disassembly and inspection

4.4.3 Rejection and retest. Failure of any inspection sample shall be cause for the rejection of the lot represented. Caps which have been rejected may be reworked to correct the defects and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original shall be furnished the Inspector. Caps rejected after retest shall not be resubmitted without the specific approval of the procuring activity.

4.5 Test conditions.

4.5.1 Test flange. An approved flange conforming to MS24484 shall be used where a test flange is specified herein.

4.5.2 Cleaning. Prior to testing the cap, all internal parts normally in contact with the fuel shall be thoroughly cleaned to remove all foreign matter.

4.5.3 Test fluid. Unless otherwise specified, fluid in accordance with TT-S-735 type I, shall be used for all tests. Any fluid complying with P-D-680 (or any other fluid acceptable to the procuring activity) may be used as a substitute for the test fluid in all tests, except wherein a specific fluid is specified.

4.5.4 Room temperature. Unless otherwise specified, all tests shall be conducted with the cap and test fluid at a temperature between 60° and 90°F.

4.6 Test methods.

4.6.1 Examination of product. Each cap shall be examined to determine conformance with all requirements of this specification for which there are no specific tests.

4.6.2 Functional. The cap shall be connected (inserted and locked) to the test flange. The cap shall then be disconnected (unlocked and removed) from the flange. This procedure shall be repeated five times. The maximum force in the direction of the axis of the cap and the maximum torque required to connect or disconnect the cap shall not exceed 25 pounds and 75 pound-inches, respectively. A torque of 80 pound-inches shall not be sufficient to unlock the cap when no axial pressure is applied. With a pressure of 9 psia applied to the cap through the flange, the minimum torque required to unlock and remove the cap shall be 10 pound-inches. For caps designed to vent negative pressures, the 9 psia pressure may not be possible to attain. The maximum negative pressure attainable will be recorded and the test shall be performed at that pressure. There shall be no evidence of binding or of failure to lock and unlock.

4.6.3 Fluid leakage. The cap shall be connected to a test flange and test fluid pressures from +1 to +5 psi in 1-psi increments, and from 10 to 60 psi in 10-psi increments shall be applied to the cap through the flange. Each test pressure shall be maintained for at least 1 minute. There shall be no evidence of leakage.

TABLE I
Fuel resistance and extreme temperature tests

Period <u>1/</u>	Fuel resistance				Extreme temperature	
	Phase I soak <u>2/</u>	Phase I dry	Phase II soak <u>2/</u>	Phase II dry	Low temperature	
Component configuration	Cap connected to test to test flange and filled	Drain and connect to test flange	Cap connected to test flange and filled	Drain and connect cap to test flange	Cap connected to test flange and filled	
Test fluid	TT-S-735 Type III	Dry Air	TT-S-735 Type III	Dry Air	TT-S-735 Type I	
Period duration	96 Hours	24 Hours	18 Hours	30 Hours	18 Hours	
Temperature	158° +20°F	158° +20°F	158° +20°F	158° +20°F	-67° +20°F	
Operation or tests during	Disconnect and connect to test flange twice daily	None	Same as for phase I soak	None		
Operation or tests immediately after period	Conduct fluid leakage test, using TT-S-735 type III	(a) Connect and disconnect cap to test flange five times (b) Conduct fluid leakage test, using TT-S-735 type I	Same as for phase I soak.	Same as Phase I dry.	Conduct the following tests with ambient and test fluid still at -67° +20°F Functional - fluid leakage - Air leakage, using TT-S-735 Type I test fluid	

1/ Each period shall follow immediately after preceding period.

2/ During period of soaking in the test fluid, the cap shall be maintained in such a manner as to insure complete contact of all synthetic parts with the fluid as would be expected under service conditions.

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4.6.4 Air leakage. This test procedure is similar to that of the Fluid leakage test, except air shall be substituted for the test fluid. There shall be no evidence of leakage, except at the seal. Seal leakage at pressures from +1 to +5 psi shall not exceed 10 milliliters of free air per minute. At pressures from 10 to 60 psi, the leakage shall not exceed 50 milliliters of free air per minute.

4.6.5 Fuel resistance and extreme temperature. The fuel resistance and extreme temperature tests shall be conducted in accordance with table I.

4.6.6 Accelerated corrosion. The assembly shall be immersed in a solution of 2 1/2 percent (by weight) sodium chloride in distilled water. After immersion, the solution shall be drained, and the assembly shall be placed in an air oven and maintained at a temperature of $130^{\circ} + 5^{\circ}\text{F}$ for a period of at least 1 hour. This entire procedure shall be repeated for a total of 50 immersions. Immediately following the final immersion the assembly shall be washed with warm water to remove all salt accumulations. Any evidence of corrosion that might cause failure of this cap shall be cause for rejection. The assembly shall be dried and the cap subjected to the following tests:

- (a) Functional
- (b) Fluid leakage
- (c) Air leakage

4.6.7 Vibration test. The cap shall be connected to the test flange. The assembly shall be adequately mounted on the vibration device and subjected to the four vibration-scanning cycle tests listed in table II. The test shall be conducted at room temperature. There shall be no evidence of leakage during the test, damage or loosening of parts, or leakage as a result of the test.

TABLE II

Vibration test				
Scanning cycle test	1	2	3	4
Axis of vibration	Along axis of symmetry	Along axis of symmetry	Normal to axis of symmetry	Normal to axis of symmetry
Fluid pressure	60 psi	-3 psi	60 psi	-3 psi
Scanning cycle time	15 min	15 min	15 min	15 min
No. of scanning cycles per test	2	2	2	2
Procedure	The frequency shall be uniformly increased with respect to time through a frequency range from 10 to 500 cycles/sec, with an applied double amplitude of 0.036 inch up to 75 cycles/sec, and from there an applied vibration acceleration not less than $\pm 10g$. The			

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frequency shall be similarly decreased such that the complete cycle is accomplished in the specified cycle time.

4.6.8 Endurance. The cap connected to the test flange shall be subjected to 60-psi fluid pressure for 1 minute. At the end of this period, the pressure shall be released and the cap disconnected. The cap shall be reconnected to the test flange and the assembly subjected to -3 psi fluid pressure for 1 minute. The pressure shall be released and the cap removed. This entire procedure shall be repeated 1,250 times. There shall be no evidence of deterioration that might cause malfunctioning of the cap. The cap shall then be subjected to the following tests:

- (a) Functional
- (b) Fluid leakage
- (c) Air leakage

4.6.9 Proof pressure. With the cap connected to test flange, test fluid at a pressure of 120 psi shall be applied through the flange for at least 1 minute. There shall be no evidence of leakage, distortion, or failure of any part of the cap.

4.6.10 Burst pressure. The burst pressure test procedure shall be similar to the proof pressure procedure, except that the pressure shall be 180 psi. There shall be no failure or evidence of distortion of the cap as a result of this test, and with the pressure lowered to 60 psi there shall be no evidence of leakage.

4.6.11 Disassembly and inspection. The cap shall be disassembled and inspected. There shall be no evidence of excessive deterioration wear or corrosion.

5. PREPARATION FOR DELIVERY

5.1 Preservation and interior packaging. The cap shall be preserved, packaged, and packed in accordance with MIL-P-7936.

5.2 Marking of shipments. Interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129.

5.2.1 In addition, the following marking shall be added for all packages and exterior shipping containers:

"IF IN STORAGE AFTER (DATE)**, THE CAP SHALL BE TESTED AND INSPECTED BEFORE ISSUE."

** This date shall be 18 months after curing date of oldest synthetic rubber part used in the cap.

6. NOTES

6.1 Intended use. The caps covered by this specification are intended for use in sealing aircraft hydrocarbon fuel-tank filling ports.

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6.2 Ordering data. Requisitions, contracts, and orders should specify whether overseas packing is required.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government, tested for qualification, in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Air Systems Command, Washington, DC 20361, and information pertaining to qualification of products may be obtained from that activity.

Custodians:

Navy - AS
Air Force - 11
Army - AV

Preparing Activity:

Navy - AS
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