

INCH-POUND

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## PERFORMANCE SPECIFICATION

## FILTER/SEPARATORS, LIQUID FUEL

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

## 1 SCOPE

1.1 Scope. This specification covers 15-, 50-, 100-, and 350-gallon-per-minute (gpm) filter/separators for use in removing undissolved water and solid contaminants from petroleum fuels.

1.2 Classification. Filter/separators (F/S) covered by this specification are of the following types and classes as specified (see 6.2). Hereinafter references to the rated flow shall correspond to the respective Type vessel:

- Type I - 15 gpm (57 liters/min) F/S, frame mounted.
- Type II - 50 gpm (189 liters/min) F/S.
  - Class A - Frame mounted.
  - Class B - Unmounted.
- Type III - 100 gpm (379 liters/min) F/S, frame mounted.
- Type IV - 350 gpm (1325 liters/min) F/S, frame mounted.

## 2 APPLICABLE DOCUMENTS

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

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meet all specified requirement documents cited in sections 3 and 4 of this specification, 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 cited in the solicitation or contract.

### SPECIFICATIONS

#### FEDERAL

- A-A-55804 - Rods, Ground (With Attachments)
- A-A-59326 - Coupling Halves, Quick-Disconnect, Cam-Locking Type.

#### DEPARTMENT OF DEFENSE

- MIL-DTL-5624 - Turbine Fuel, Aviation, Grades JP-4 and JP-5.
- MIL-PRF-52308 - Filter Element, Fluid Pressure.
- MIL-DTL-64159 - Camouflage Coating, Water Dispersible Aliphatic Polyurethane, Chemical Agent Resistant.
- MIL-DTL-83133 - Turbine Fuels, Aviation, Kerosene Types, JP-8 (NATO F-34), NATO F-35, and JP-8+100 (NATO F-37).

### STANDARDS

#### DEPARTMENT OF DEFENSE

- MIL-STD-810 - Environmental Test Methods and Engineering Guidelines.

(Copies of these documents are available online at <https://quicksearch/dla.mil/>)

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

#### NORTH ATLANTIC TREATY ORGANIZATION (NATO)

- AFLP-3747 - Guide Specifications for Aviation Turbine Fuels.
- STANAG 1135 - Interchangeability of Fuels, Lubricants and Associated Products Used by the Armed Forces of the North Atlantic Treaty Nations.

(Copies of these documents are available online at <http://nsa.nato.int/nsa/>)

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DRAWINGS

13216E2773 - Canister.

(Copies of these documents are available online at [usarmy.detroit.rdecom.mbx.tardec-standardization@mail.mil](mailto:usarmy.detroit.rdecom.mbx.tardec-standardization@mail.mil).)

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus (DoD Adopted).
- ASTM D975 - Standard Specification for Diesel Fuel Oils (DoD Adopted).
- ASTM D1655 - Standard Specification for Aviation Turbine Fuel. (DoD Adopted).
- ASTM D2276 - Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling (DoD Adopted).
- ASTM D3240 - Standard Test Method for Undissolved Water in Aviation Turbine Fuels (DoD Adopted).

(Copies of these documents are available online at [www.astm.org](http://www.astm.org).)

ENERGY INSTITUTE (EI)

- EI 1581 - Specification and Qualification Procedures for Aviation Jet Fuel Filter / Separator

(Copies of these documents are available online at <https://www.energyinst.org/technical/technical-publications>)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

- SAE AMS-STD-595 - Colors Used in Government Procurement

(Copies of these documents are available online at [www.sae.org](http://www.sae.org).)

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 (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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### 3 REQUIREMENTS

3.1 First article. When specified (see 6.2), complete F/S unit(s) shall be subjected to first article inspection in accordance with 4.1.1.

3.2 Materials. The manufacturer shall select materials for F/S capable of meeting all the operational and environmental requirements specified herein. All metal parts in contact with the fuel shall be free of zinc, cadmium, copper and their alloys. The use of lightweight materials, such as composites, should be considered. Materials used shall be compatible with petroleum fuels containing water and additives as specified in 3.3.1 with no evidence of deleterious effect. Recycled, recovered or environmentally preferable materials shall be used to the maximum extent possible (see 6.7). The F/S should have a minimum useful life of 15 years.

3.2.1 Material deterioration, prevention and control. The F/S shall be fabricated from compatible materials, inherently corrosion resistant or treated to provide corrosion and deterioration protection for the F/S's expected service life in any operating and storage environment.

3.2.2 Dissimilar metals. Dissimilar metals shall not be used in intimate contact with each other unless protected against galvanic corrosion.

3.2.3 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 Operational requirements.

3.3.1 Military fuels and additives. The F/S specified herein shall satisfactorily process all the following military and commercial kerosene based fuels, containing the maximum allowable concentrations of all required and allowed fuel additives at the prescribed flow rates, without restrictions or kits. Rated flow shall be defined by the Type of F/S as specified in the contract or order (see 1.2 and 6.2), when using JP-8 fuel. Minimum acceptable flow rate for all diesel fuels shall not be less than 50% of rated flow.

- a. MIL-DTL-83133 (JP-8) (NATO F-34) (see 6.13)
- b. MIL-DTL-5624 (JP-5) (NATO F-44) (see 6.13)
- c. ASTM D975 (Standard Specification for Diesel Fuel Oils) (see 6.13)
- d. ASTM D975 (Diesel-US commercial)
- e. MIL-DTL-83133 (NATO F-35) (see 6.13)
- f. ASTM D1655 (Jet A-1)
- g. AFLP-3747 (NATO F-24) (see 6.13)

3.3.2 Water removal. The F/S shall remove water at the maximum water injection rate of 3 percent (%) by volume at 100 % of rated flow. The effluent fuel samples shall contain not greater than 15 parts per million (ppm) by volume of undissolved water when measured with a

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type II or type III Aqua-Glo water detector, in accordance with ASTM D3240. (Results to the nearest whole number as ppm of undissolved water in fuel.)

3.3.3 Flow conditions. The F/S shall meet the performance requirements as specified herein on an intermittent and continuous flow basis. The F/S shall continue to perform satisfactorily when subjected to pressure surges resulting from supply pump start and stop, and the opening and closing of dispensing nozzles and system valves.

3.3.4 NBC decontamination survivability. The F/S shall be hardened against the effects of NBC contamination and the decontamination process (see 3.5.6). There is no requirement for nuclear hardening.

3.3.5 Hydrostatic pressure. Each F/S, as a minimum, shall be capable of withstanding the hydrostatic test pressure specified for a period of 10 minutes:

Type I	60 psi (4.14 bars)
Type II (both classes)	115 psi (7.93 bars)
Type III	115 psi (7.93 bars)
Type IV	225 psi (15.52 bars)

The maximum working pressure shall be equal to 2/3 of the hydrostatic pressure.

3.3.6 Differential pressure. The differential pressure measured across the inlet and outlet couplings of the F/S, with the filter-coalescer element(s) and separator stages installed, shall not exceed 10 psi at any flow rate up to 100 % of rated flow.

3.3.7 Differential pressure dial gauge. Each F/S shall be provided with a differential pressure dial gauge or device that shall provide a direct reading of differential pressure across the F/S filter-coalescer elements and separator canisters without manipulation of valves or subtraction of pressure readings. Accuracy of the gauge or device shall be plus or minus 2 psi (0.138 bar). The gauge or device shall be color-coded to indicate normal operating condition, marginal operating condition, and immediate service required ranges according to filter-coalescer element manufacturer's recommendation, unless otherwise specified (see 6.2). The maximum gauge or device reading shall not exceed 50 psi (3.45 bar).

3.3.8 Element replacement time. The F/S shall be capable of being disassembled and reassembled to fully operational condition in 30 minutes or less to replace all filter-coalescer elements. Any tools used shall be restricted to those identified on the Maintenance Allocation Chart (MAC) approved for conducting this task.

### 3.3.9 Controls.

3.3.9.1 Water drain valve. Each F/S shall be provided with a device to manually drain the water from the sump under operating conditions before it reaches the bottom of the elements. The drain shall be installed to maximize water removal and inhibit discharge of fuel with the water. There shall be no leakage when the device is not functioning to discharge, nor discharge

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from any points other than the discharge point. The discharge outlet shall be equipped to control the discharge flow and direct it safely into a receptacle, and minimize potential safety hazards for discharge of fluid under pressure.

3.3.9.2 Water level sight gauge. Each F/S shall be provided with a device that shall clearly show the level of collected water within the F/S sump. A mark on this device shall be provided to indicate when the water should be discharged before it reaches the bottom of the elements.

3.3.9.3 Air relief valve. Each F/S shall be provided with a device to manually or automatically vent trapped air from the top of the F/S while minimizing release of fuel during venting. There shall be no leakage when the device is not functioning to discharge air.

3.3.9.4 Grounding. Each F/S shall be provided with grounding equipment, to dissipate static charge, conforming to A-A-55804, Type III, Class B.

3.3.9.5 Bonding. Each F/S shall provide complete electrical continuity throughout the unit, and shall include a metal-to-metal contact from the F/S to the ground. This includes all electrically conductive components of the unit that the operator and/or fuel may come in contact with. All bonding and/or grounding connections shall be mechanically secure and shall measure 1 (one) ohm or less.

3.3.9.6 Adapter and sampling probe. Each F/S shall be furnished with an adapter and sampling probe that can be used on the outlet side of the F/S. Figure 1 is provided for reference only. The sampling probe shall be as specified in ASTM D2276 and ASTM D3240. See 3.5.3 for the coupling interface size.

### 3.4 Environmental requirements.

3.4.1 Operational temperatures. The F/S shall permit rated flow during and after exposure to ambient temperatures ranging from minus 25°F (-32°C) to plus 140°F (60°C).

3.4.2 Storage temperatures. The F/S shall withstand storage in temperatures ranging from minus 50°F (-46°C) to plus 160°F (71°C), after which it shall perform as specified herein.

3.4.3 Sand and dust. The F/S shall permit rated flow during and after exposure to a desert environment.

3.4.4 Salt Spray. The F/S shall permit rated flow during and after exposure to a salty sea atmosphere.

3.4.5 Vibration. The F/S shall withstand the vibration of being transported by a 5-ton cargo truck, over cross-country tactical terrain, at an average speed of 8 mph (13 kph) for a total of 100 miles.

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3.4.6 Shock. The F/S, with the exception of the Type II Class B, shall withstand the dynamic shock of being dropped on an 8 inches (20 cm) thick bed of dry sand without deformation, fracture, or breakage of the protective frame or damage to the F/S or its components.

3.5 Interface requirements. The F/S shall conform to the following interface requirements.

3.5.1 Filter-coalescer element. The F/S shall incorporate filter-coalescer element(s) in accordance with MIL-PRF-52308. Figure 2 is provided as reference for the interface dimensions of the filter-element.

3.5.2 Separator stages. The F/S shall incorporate separator stages conforming to drawing 13216E2773 for use with elements defined in 3.5.1.

3.5.3 F/S inlet and outlet interfaces. Unless otherwise specified (see 6.2), inlet and outlet fittings shall be the same for both the F/S and the Adapter & Sampling Probe. Inlet fittings shall be female, quick-disconnect, cam-locking coupling in accordance with A-A-59326 Class A, and shall be provided with captive dust plug in accordance with A-A-59326/11 attached via connecting chain to prevent loss. Outlet fittings shall be male, quick-disconnect, cam-locking coupling in accordance with A-A-59326 Class A, and shall be provided with captive dust cap in accordance with A-A-59326/10 attached via connecting chain to prevent loss. All coupling halves called out in accordance to A-A-59326 shall have a minimum working pressure of 150 psi (10.34 bar). The coupling halves and gaskets shall be compatible for use with the fuels listed in 3.3.1. The inlet and outlet connections' nominal sizes shall be per respective Type F/S as below:

- Type I – 1-inch (Nominal Size 1).
- Type II – 1½-inch. (Nominal Size 1-1/2)
- Type III – 2-inch (Nominal Size 2).
- Type IV – 4-inch (Nominal Size 4).

3.5.4 Dimensions and weights. The F/S shall be configured to present low silhouettes and have low centers of gravity. The F/S shall not exceed the following dimensions or weight, with the filter-coalescer element(s) and separator stages installed, including protective frames that are required.

TABLE I. F/S maximum dimensions and maximum weights.

Type	Dimension (inches) (H x W x L)	Weight (pounds)
I	27 x 14 x 22	37
II, Class A	36 x 17 x 20	74
II, Class B	33 x 17 x 16	74
III	34 x 20 x 24	92
IV	40 x 33 x 47	350

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3.5.4.1 Type II, class B. The interface configuration requirements for the Type II, Class B, F/S are shown in Figure 3.

3.5.5 Protective frame. The F/S, with the exception of the Type II Class B, shall contain a permanently attached frame and/or enclosure to prevent damage caused by loading/unloading, transport, inadvertent rollover and usage in the environment specified herein and to facilitate mechanical handling.

3.5.6 Treatment and painting. Unless otherwise specified (see 6.2), all external surfaces of the F/S except as noted below, regardless of the material selected, shall have a finish coat of Coating, Water Dispersible Aliphatic Polyurethane, Chemical Agent Resistant (Waterborne CARC) paint IAW MIL-DTL-64159. The color shall be Desert Tan 686A, color number 33446 IAW SAE AMS-STD-595. Camouflage pattern painting may be required (see 6.2).

- a. The color of all other surfaces, to include those within a housing, those behind insulation material, and the insulation retainer, if used, shall be Desert Tan 686A, color number 33446 or black, color number 37030 IAW SAE AMS-STD-595 or the manufacturer standard color, if approved by the Government.
- b. The following items shall not be painted: terminal wiring connections, governor linkage, instruction diagrams and plates, rectifiers, relays, switches, circuit interrupters, instrumentation, rubber, lubrication fittings, hoses, nozzles, dry break couplings, and all other parts whose operation or function would be adversely affected by paint. Insulation material shall be painted unless the sound absorbing characteristics of the material are compromised.
- c. Identification plates shall be installed following application of the final finish coat.
- d. CARC paint shall not be applied to surfaces that may exceed temperatures of 400°F.

3.5.7 Labeling. Labels, legends, placards, signs, markings, or a combination of these shall be provided for personnel to identify, interpret, follow procedures, and to avoid hazards. Label characteristics shall be consistent with the accuracy of identification required, time available for recognition and appropriate response, distance at which the labels must be read, and with label design within and between units. Labels shall be permanently affixed to the F/S and located on or very near the items that they identify, so as to eliminate confusion with other items and labels. Labels shall be clear, distinct, and corrosion resistant; and have a high contrast, foreground to background. Labels shall be easy to read accurately from the operational reading distances and in the anticipated vibration, motion, and illumination environments.

3.5.7.1 Identification marking. The F/S shall be identified and marked in accordance with MIL-STD-130 to include, at a minimum, design activity code, manufacturer Commercial and Government Entity Code (CAGEC), item nomenclature, serial number, NSN, weight, contract number, date of manufacture, technical manual number, and U.S. military property identification.

3.5.7.2 Information markings. The F/S shall be marked with the following information, "DRAIN WATER DAILY OR WHEN FLOAT REACHES MARK", "INLET", "OUTLET", and "WARNING MAXIMUM WORKING PRESSURE (see 3.3.5 ) PSI". If the total weight of the F/S is between 37 lbs up to and including 74 lbs, then the F/S shall be labeled or stenciled "2



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PERSON LIFT”; if the F/S is between 74 lbs up to and including 92 lbs, then the F/S shall be labeled or stenciled “3 PERSON LIFT”; if the F/S is between 92 lbs up to and including 350 lbs, then the F/S shall be labeled or stenciled “4 PERSON OR MECHANICAL LIFT (VERIFY PERSONNEL LIFT LIMITS)”.

3.5.7.3 Instruction markings. The F/S shall be marked with the operation instructions, including filter-coalescer element change procedures, bolt tightening sequence and torques if necessary, and any other instructions specified (see 6.2).

3.5.8 Interchangeability. All components and parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable and shall be replaceable with each other with respect to installation and performance.

3.5.9 Human engineering. Human engineering criteria, principles and practices (see 6.10) shall be considered as part of the F/S. For example, the F/S shall be capable of being transported and operated by 5th through 95th percentile military personnel wearing gloves, mittens, or Mission Orientated Protective Posture (MOPP IV).

3.5.10 Reliability. When specified (see 6.2), the F/S shall decontaminate military fuels to the cleanliness level specified herein for at least 20 hours per day, with four hours per day allowed for scheduled and unscheduled maintenance and repair.

3.5.10.1 Mean-time-between-failure. The specified mean-time-between-failure (MTBF) shall be 140 hours when the F/S is operated at rated capacity and tested as specified in 4.5.2.

3.5.11 Maintenance ratio. The F/S should have a maintenance ratio of not greater than 0.03. Maintenance ratio is defined as the ratio of the total active maintenance man-hours required (scheduled and unscheduled) to the total operating time. Man-hours for repair of replaced components, and scheduled before-and-after-operation checks are excluded. A maintenance schedule shall be established prior to start of any testing.

## 4 VERIFICATION

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

- a. First article inspection (see 4.1.1).
- b. Conformance inspection (see 4.1.2).

4.1.1 First article inspection. First article inspection shall be performed on complete F/S unit(s), as specified in 6.3, when a first article sample is required (see 3.1). The inspection shall include the examinations of 4.2.5.1 and the tests in 4.3. When specified (see 6.2), first article inspection shall include a user evaluation inspection to include one or more of the examinations and tests included in this document.

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4.1.2 Conformance inspection.

4.1.2.1 Examination. The F/S shall be examined for the defects specified in 4.2.5.1. The presence of one or more defects shall be cause for rejection.

4.2 Inspection conditions. Appendix A describes an acceptable facility and general requirements for testing the F/S. The manufacturers testing facility shall be subject to approval by the Government. The facility shall contain calibrated and certified measuring equipment.

4.2.1 Test fluid. Unless otherwise specified (see 4.3.1), the test fluid shall be JP-8 fuel conforming to MIL-DTL-83133 or equivalent.

4.2.2 Test fluid temperature. Unless otherwise specified (see 4.4.1, 4.4.2, and 6.2), the test fluid temperature for each test shall be in the range of plus 40°F (5°C) to plus 86°F (30°C). The temperature shall not vary greater than plus or minus 5°F ( $\pm 3^\circ\text{C}$ ) from the starting temperature of any individual test set or test series.

4.2.3 Test contaminants. Fresh tap water with an undissolved solids content of less than 1.0 mg/L, and having a surface tension of not less than 65 dynes/cm at 24°C, shall be used. The acidity-alkalinity value (pH) shall be between 5 and 8.

4.2.4 Test sampling procedures and data. The test sampling procedures shall be in accordance with the first article and conformance inspection instructions provided by the Government. Figure 4 is an example of a typical test report form. During testing which includes injection of water, the water sump should be monitored carefully and drained to ensure that water does not exceed the maximum design level and impinge elements. General commercial practices as referenced in EI 1581 may be used as guidance where practical, unless otherwise defined in this purchase description.

4.2.5 Inspection procedures.

4.2.5.1 Examinations. The F/S shall be examined as specified for the defects cited in table III.

TABLE III. Examination schedule.

EXAM NO.	EXAMINATION DESCRIPTION	METHOD
101	Materials not as specified (see 3.2).	Visual, Doc
102	Material not resistant to corrosion and deterioration or treated to be made resistant to corrosion and deterioration (see 3.2.1).	Visual, Doc
103	Dissimilar metals (see 3.2.2).	Visual, Doc
104	Water drain valve not as specified (see 3.3.9.1).	Visual
105	Water level sight gauge not as specified (see 3.3.9.2).	Visual
106	Air relief valve not as specified (see 3.3.9.3).	Visual, SIE

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107	Grounding rod not as specified (see 3.3.9.4).	Visual
108	Bonding not as specified (see 3.3.9.5).	Visual, SIE
109	Adapter and sampling probe not as specified (see 3.3.9.6).	Visual, SIE
110	The F/S does not interface with the filter-coalescer element(s) or separator stages specified (see 3.5.1 and 3.5.2).	Visual
111	Filter-coalescers and separator stages are missing or not as specified (see 3.5.1 and 3.5.2).	Visual
112	F/S inlet and outlet fittings are not as specified (see 3.5.3).	Visual
113	The F/S does not present low silhouettes or low centers of gravity as specified, dimensions and/or weight limits exceeded (see 3.5.4).	Visual, SIE
114	Protective frame missing or not as specified (see 3.5.5).	Visual
115	Chemical agent resistant coating not as specified (see 3.5.6).	Visual, Doc
116	Color of F/S not as specified (see 3.5.6).	Visual
117	Labeling incorrect, illegible, or missing (see 3.5.7).	Visual
118	Components and parts of any one F/S not interchangeable with like components or parts from any other F/S of the same type and class (see 3.5.8).	Visual, Doc

SIE = Standard Inspection Equipment      Doc = Documentation

### 4.3 Tests.

4.3.1 Diesel fuel flow. Prior to starting this test, new filter-coalescer elements (see 3.5.1) shall be installed. The F/S shall be filled with diesel fuel (see 3.3.1), and the fuel flow rate shall be adjusted to maintain a differential pressure of 10 psi, plus or minus 1 psi, across the test F/S inlet and outlet couplings. Nonconformance to diesel fuel flow rate as specified in 3.3.1 shall constitute failure of this test. Elements shall be removed and replaced with new elements (see 3.5.1) at the conclusion of this test.

4.3.2. Water removal. This testing shall follow the differential pressure test (see 4.3.6) and as required during testing. Elements may be conditioned prior to start of test by filling the vessel with test fluid, evacuating any trapped air, and flowing at 10% of rated flow for 30 minutes. Flow shall then be adjusted to 100% of rated flow and allowed to stabilize. Water shall be injected at a rate of 0.01% by volume for 30 minutes. Immediately following the 30 minute water injection, the flow of water shall be injected at a rate of 3% by volume for 15 minutes. Nonconformance to 3.3.2 shall constitute failure of this test.

4.3.3 Flow conditions. Elements may be conditioned prior to start of test by filling the vessel with test fluid, evacuating any trapped air, and flowing at 10% of rated flow for 30 minutes. Flow shall then be adjusted to 100% of rated flow and allowed to stabilize. Water shall be injected at a rate of 0.01% by volume for 30 minutes. At 15 minute intervals, the fuel flow shall be stopped by closing a quick-closing valve located downstream from the effluent sampling connection. The fuel flow shall be immediately reestablished and the test continued after each stop. Immediately following the 30 minute water injection, the flow of water shall be injected at a rate of 3% by volume for 15 minutes. No stop/start procedure is performed during 3% water injection. Nonconformance to 3.3.2 or 3.3.3 shall constitute failure of this test.

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4.3.4 NBC decontamination survivability. To verify conformance to 3.3.4, contractor shall submit a Certificate of Conformance (CoC). CoCs required as part of the FAT shall be included in the FAT final report, and IAW contractor format with sufficient supporting technical information to insure adequate evaluation and comment by the Government. Absence of the CoC or failure of the CoC to certify all the requirements of 3.3.4 shall constitute failure.

4.3.5 Hydrostatic pressure. The F/S, filled with test fluid, shall be subjected to a hydrostatic pressure test as specified in 3.3.5. The air relief valve and water drain valve shall be closed during this test. Evidence of leakage, permanent deformation, or other defects that harmfully affect the performance and serviceability of the F/S shall constitute failure of this test.

4.3.6 Differential pressure. Elements may be conditioned prior to start of test by filling the vessel with test fluid, evacuating any trapped air, and flowing at 10% of rated flow for 30 minutes. Flow shall then be adjusted to 100% of rated flow and allowed to stabilize. With the F/S operating at 100% of rated flow, the differential pressure across the test F/S shall be measured prior to the start of the water removal test specified in 4.3.2. Nonconformance to 3.3.6 shall constitute failure of this test.

4.3.7 Differential pressure dial gauge. The differential pressure gauge shall be subjected to a hydrostatic pressure equal to the maximum scale pressure of the gauge, for a minimum of 30 minutes, then the pressure shall be released. Within 10 minutes after the pressure is released, and without re-calibration or adjustment, readings shall be taken at three intervals on the scale: the maximum inlet or operating pressure obtained on the test F/S during the differential pressure test specified in 4.3.6, the pressure at which the filter-coalescer element(s) is required to be changed, and the maximum scale pressure. A dead-weight tester, or mercury manometer with air pressure or calibrated check gauge shall be used in calibrating the gauge, if required. Testing of the gauge shall be in an ambient temperature of 68°F (20°C) plus or minus 10°F (6°C). Nonconformance to 3.3.7 shall constitute failure of this test.

4.3.8 Element replacement time. Following Government-approved maintenance procedures for removal and replacement of filter-coalescer elements, all elements in the F/S shall be removed and reinstalled, and the F/S returned to fully operational ready condition. Failure to complete this process in 30 minutes or less as specified in 3.3.8 shall constitute a failure of this test.

4.3.9 Controls verification. To verify conformance to 3.3.9 and all subparagraphs, the contractor shall submit a CoC. Failure to pass the examinations of 4.2.5.1 or absence of the CoC or failure of the CoC to certify the requirements of 3.3.9 and all subparagraphs shall constitute failure.

#### 4.4 Environmental verification requirements.

4.4.1 High temperature tests. The F/S shall be tested for high temperature storage and operation in accordance with MIL-STD-810, Method 501, Procedure I and II. The maximum test temperature for storage shall be 160°F (71°C) and the maximum operating temperature shall be 125°F (52°C). Test duration for Procedure I shall be seven cycles, with the F/S having filter

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elements and separator canisters installed, and filled with test fuel. The operating conditions for Procedure II shall be at the maximum operating temperature, with constant temperature exposure, conducted in accordance with 4.3.2. Test fuel shall also be at the maximum operating temperature. Nonconformance of the F/S to the requirements specified in 3.4.1 and 3.4.2 during and after exposure to high temperatures shall constitute failure of either temperature test.

4.4.2 Low temperature tests. The F/S shall be tested for low temperature storage and operation in accordance with MIL-STD-810, Method 502, Procedure I and II. The minimum test temperature for storage shall be minus 50°F (-46°C), and the minimum operating temperature shall be minus 25°F (-32°C). Test duration for Procedure I shall be four hours after temperature stabilization, with the F/S having filter elements and separator canisters installed, and filled with test fuel. The operating conditions for Procedure II shall be at the minimum operating temperature, with constant temperature exposure, conducted in accordance with 4.3.2. Test fuel for the operating period shall be raised to, and maintained at, 40°F (4.5°C) to prevent injected water from freezing. Nonconformance of the F/S to the requirements specified in 3.4.1 and 3.4.2 during and after exposure to low temperatures shall constitute failure of either temperature test.

4.4.3 Sand and dust. This testing shall precede the salt spray test in 4.4.4. The F/S shall be tested to verify the effects of sand and dust on performance in accordance with MIL-STD-810, Method 510, Procedure I and II. Operational performance shall be verified after testing of 4.4.4.

4.4.4 Salt Spray. This testing shall follow the sand and dust test in 4.4.3. The F/S shall be subjected to 5 % salt spray test in accordance with ASTM B117 for four 24-hour periods, alternating 24-hour periods of wet-dry-wet-dry. After the fourth period, the F/S shall be operated in accordance with 4.3.2. Nonconformance to 3.4.3 or 3.4.4 or the applicable requirements of ASTM B117 shall constitute failure of either test.

4.4.5 Vibration. The F/S shall be transported by a 5-ton cargo truck, over cross-country tactical terrain, at an average speed of 8 mph (13 kph) for a total of 100 miles. Simulation shall be acceptable, and shall be conducted in accordance with MIL-STD-810, Method 514, Procedure II. The F/S shall be tested as specified in 4.3.2 upon conclusion of the 100 miles. Breakage of the frame or damage to the F/S or components or nonconformance to 3.4.5 or 4.3.2 shall constitute failure of this test.

4.4.6 Shock. The F/S, with the exception of the Type II Class B, shall be tested for shock in accordance with MIL-STD-810, Method 516, Procedure IV, Transit Drop. The F/S shall be dropped on an 8 inches (20 cm) thick bed of dry sand. The F/S shall be dropped two times on each bottom corner, for a total of eight drops. Upon conclusion of the drops, the F/S shall be tested as specified in 4.3.2. Breakage of the frame or damage to the F/S or components or nonconformance to 3.4.6 or 4.3.2 shall constitute failure of this test.

#### 4.5 Interface requirements verification.

4.5.1 Human factors. The F/S shall be evaluated throughout the entire first article inspection for conformance to the human factors criteria specified in 3.5.9. Nonconformance shall constitute failure of this test.

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4.5.2 Reliability. Using the MTBF specified in 3.5.10.1, the F/S shall be evaluated during the first article inspection with “accept” and “reject” criteria in accordance with Figure 5. At completion of above testing, continue testing in accordance with 4.3.2 until an “accept” or “reject” decision is reached. A failure is defined as any malfunction that causes or may cause:

- a. Failure to commence operation, cessation of operation, or degradation of performance below specified levels.
- b. Damage to the F/S by continuing operation.
- c. Safety hazard to personnel.

Nonconformance to 3.5.10 shall constitute failure of this test. Dependent failures or malfunctions occurring as a result of improper maintenance or operator error are excluded from consideration as chargeable failures. Replacement of the filter-coalescer element(s) shall not be considered failures.

4.5.3 Maintenance ratio. The F/S shall be evaluated during the first article inspection for conformance to the maintenance ratio requirement specified in 3.5.11. Nonconformance shall constitute failure of this test.

## 5 PACKAGING

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

## 6 NOTES

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

6.1 Intended use. The types and classes of F/S identified below are intended for the uses indicated, and for other uses that may be specified, for the removal of undissolved water and solid contaminants from aviation, diesel or motor fuels:

- |                  |   |  |
|------------------|---|--|
| Type I           | - | 15 gpm intended for use in portable refueling systems.   |
| Type II, class A | - | 50 gpm intended for open field installations.  |
| Type II, class B | - | 50 gpm intended for use only with the tank and pump units.   |
| Type III.        | - | 100 gpm intended for use in airfield refueling systems, motor fuel servicing equipment, and military pipeline systems. |

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- Type IV - 350 gpm intended for use in air field refueling systems, motor fuel servicing equipment, and the inland petroleum distribution system.

The filter/separators cover by this performance specification are military unique because they must be able to operate satisfactorily at temperatures ranging from minus 25 °F to 140 °F and interface with the military standard filter-coalescer element, which is 3.75 inches in diameter. Commercial filter/separators are not designed to withstand such extreme and sudden operating environmental conditions and their filter-coalescer elements are commonly 6 inches in diameter.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type and class of F/S required by the government (see 1.2).
- c. When a first article is required for inspection and approval, time frame for submission, and the number of units required (see 3.1).
- d. When the differential pressure dial gauge is to be other than as specified (see 3.3.7).
- e. When the inlet and outlet fittings on the F/S will be other than as specified (see 3.5.3).
- f. When the coating is other than as specified (see 3.5.6).
- g. When camouflage pattern painting is required (see 3.5.6).
- h. When instruction marking is to be other than as specified (see 3.5.7.3).
- i. When reliability test is required (see 3.5.10).
- j. When a user evaluation inspection is required (see 4.1.1).
- k. When test fluid temperature is to be other than as specified (see 4.2.2).
- l. Packaging requirements (see 5.1).

6.3 First article. When a first article inspection is required, the item(s) to be tested should be an initial production unit(s). When the Government will conduct some of the examinations and tests (see 3.5.12), the contracting officer should specify which examinations and tests will be conducted by the Government and which examinations and tests will be conducted by the contractor. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, tests, approval, and disposal of the first article (see 3.1).

6.4 Technical manuals. The requirement for technical manuals should be considered when this specification is applied on a contract. If technical manuals are required, specifications and standards that have been cleared and listed in DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be listed on a separate Contract Data Requirements List (DD Form 1423), which is included as an exhibit to the contract. The technical manuals should be acquired under a separate contract line item in the contract.

6.5 Provisioning. The requirement for provisioning documentation for spare parts, consumables, and test measurement and diagnostic equipment should also be considered when this specification is applied on a contract.

6.6 Superseded F/S drawing packages. The following list of Government drawing packages document each F/S formerly used by the military. The drawings referenced are provided as

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information only. They provide examples of F/S assemblies that have been found to be acceptable in the past. There is, however, no guarantee that these designs meet current requirements. Manufacturers may use these or provide their own design(s). Either must meet the performance requirements specified herein.

Type I	TL-MIL-F-52429/TA13217E6620
Type II, Class A	TL-MIL-F-52667/TA13217E6310
Type II, Class B	TL-MIL-F-52667/TA13217E7140
Type III	TL-MIL-F-52556/TA13217E5350
Type IV	TL-MIL-F-52666/TA13217E9320

6.7 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 element may be newly fabricated from recovered materials to the maximum extent practicable, provided the element produced meets all other requirements of this specification. Used, rebuilt or remanufactured components, pieces and parts should not be incorporated in the element.

6.8 Separator stages. The following list of Government drawings and NSNs have previously been used by the military for the separator stages. The drawings referenced are provided for reference only.

Type I	13217E6631, NSN 4330-00-197-4976
Type II, Both	13217E6316, NSN 4330-00-072-6700
Type III and Type IV	13216E2773, NSN 4330-00-112-0256

6.9 Part Identification Number (PIN). The following part identification numbering procedure is for government purposes and does not constitute a requirement for the contractor.

This example describes a part numbering system for specification MIL-PRF-52666G:

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┌	1 - Class A: Frame mounted (Type II only)
	2 - Class B: Unmounted (Type II only)
└	1 - Type I: 15 gpm F/S, skid mounted
	2 - Type II: 50 gpm F/S
	3 - Type III: 100 gpm F/S, frame mounted
	4 - Type IV: 350 gpm F/S, frame mounted

6.10 Human engineering. MIL-STD-1472 may be used as a source for anthropomorphic data on these military personnel, and MIL-HDBK-759 may be used for information and guidance on human factors engineering for Army materiel as specified in 3.5.9.

6.11 Subject term (key word) listing.



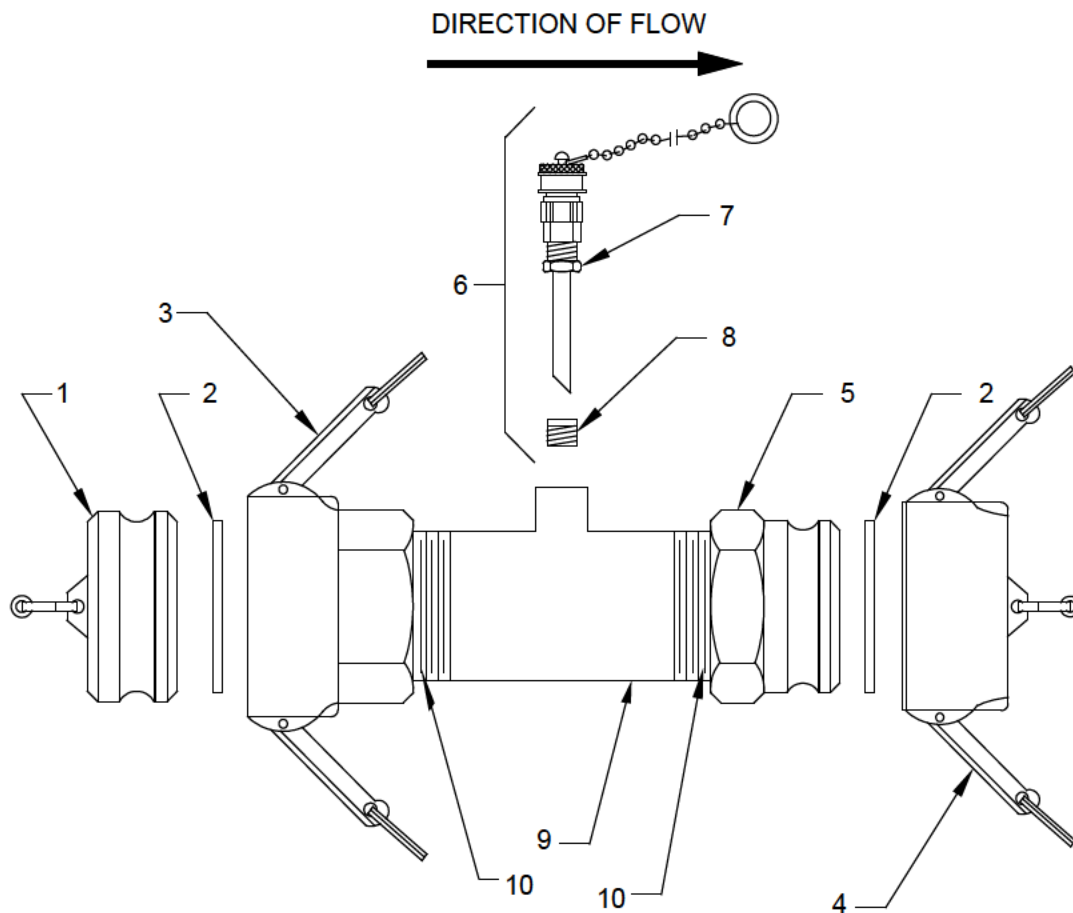
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Airfield refueling system  
Aviation fuel  
Diesel fuel  
Fuel decontamination equipment  
Inland petroleum distribution system  
Jet turbine fuel  
Marine diesel fuel  
Water separation

6.12 Changes from previous issue. Marginal notations were used, to the best extent, in this revision to identify changes with respect to the previous issue, but some may be missed due to the extensiveness of some changes.

6.13 NATO fuel designations. STANAG 1135 and AFLP 3747 describe the NATO fuel designations F-24, F-34, F-35, F-44 and F-54.

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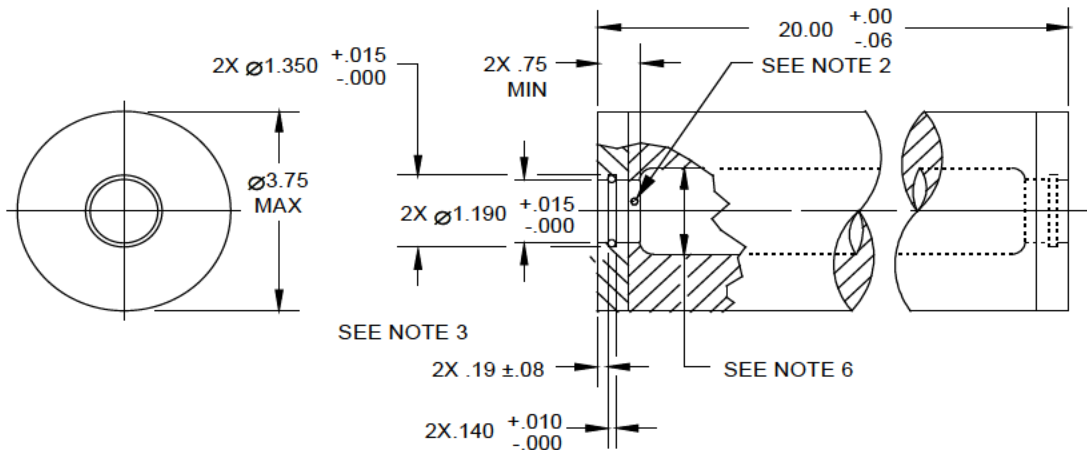


FIND NO.	NOMENCLATURE	REFERENCE
1	Dust Plug	A-A-59326
2	Gasket	A-A-59326
3	Coupling Half, Female	A-A-59326
4	Dust Cap	A-A-59326
5	Coupling Half, Male	A-A-59326
6	Probe Assembly, Detector Kit	ASTM D 2276 and ASTM D 3240
7	Hexagonal Nut	ASME B18.2.2
8	Pipe Coupling	SAE AS 4859
9	Pipe Nipple	SAE AS 4860
10	Antiseize Tape	A-A-58092

Reference: NSN 6640-00-244-9478

FIGURE 1. Detector kit adapter. – Example

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## NOTES:

1. DIMENSIONS ARE INCHES.
2. THIS AREA TO BE LEFT FREE FROM FILTER ELEMENT MATERIAL, BOTH ENDS.
3. PROVIDE O-RING IN EACH END GROOVE.
4. APPLY LIGHT COATING OF SILICONE COMPOUND TO O-RING GROOVES AND O-RING.
5. FLOW SHALL BE FROM INSIDE TO OUTSIDE.
6. INSIDE DIAMETER AND CONFIGURATION ARE OPTIONAL.
7. REFERENCE: FOR USE WITH 1.182-1.187 MALE GLAND AT 100 PSI MIN, BOTH ENDS.
8. NOMINAL RATE OF FLOW IS 20 GPM.

FIGURE 2. Filter-coalescer element.

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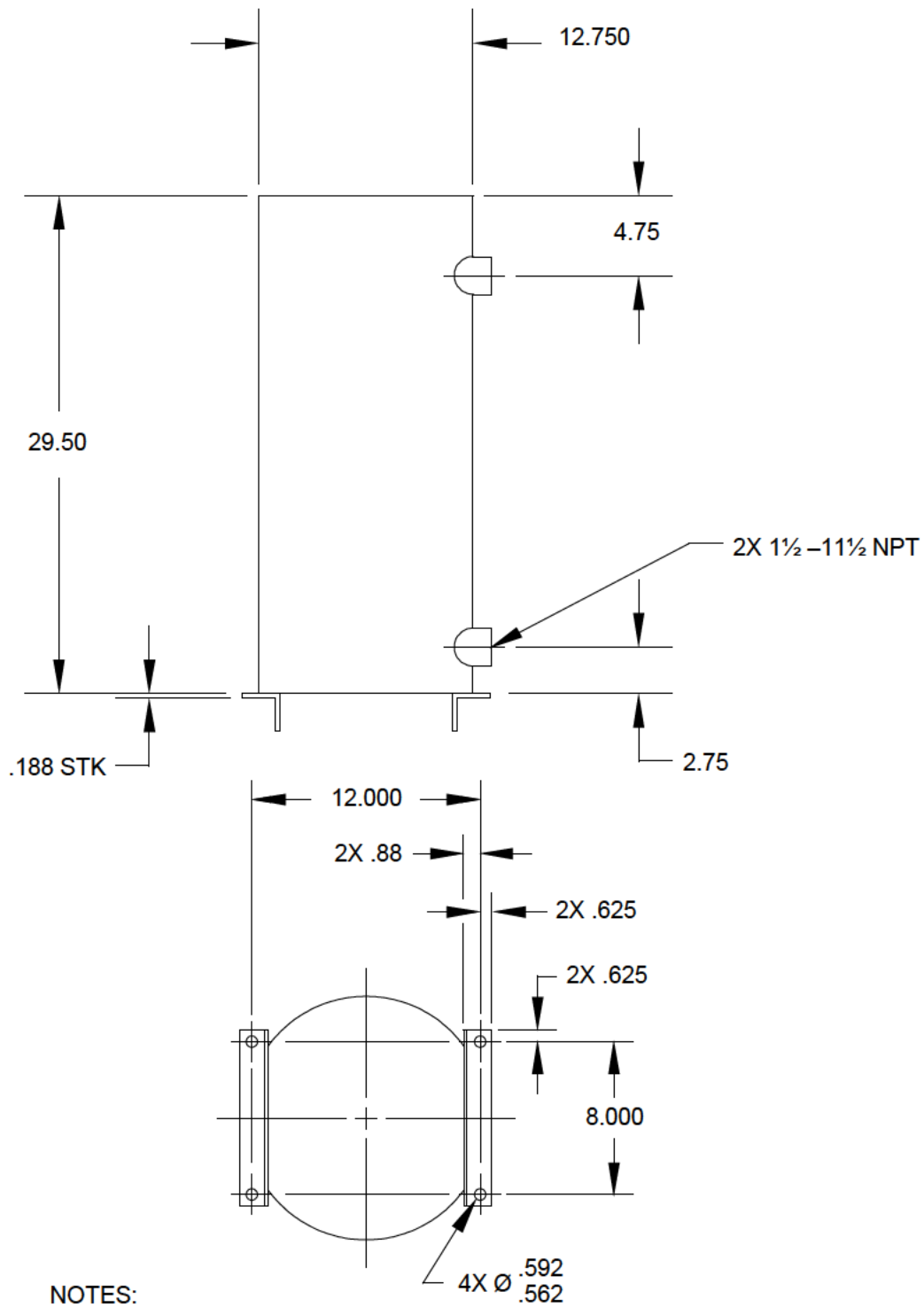


FIGURE 3. Type II Class B Filter/separator interface requirements.

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<b>Test:</b>					<b>Test Date:</b>							
<b>Test Unit:</b>					<b>Test Engineer:</b>							
					<b>Witnesses:</b>							
Time (minutes)	Fuel Flow Rate (gpm)	Test Unit Δ P (psi)	Fuel Temp. ( F )	Conductivity (pS/m)		Water Addition Rate (%)	Solids Addition Rate (mg/gpm)	Pressure Inlet	Pressure Outlet	Free Water (ppm)	Total Solids (mg/L)	Remarks
				Influent	Effluent							

Water Surface Tension:

Corrosion Inhibitor Added:

Water pH Value:

FSII Added:

Fuel in Sump Discharge Water:

Electrical Conductivity Added:

WSIM Before Additives:

WSIM After Additives:

FIGURE 4. Test report form. – Example

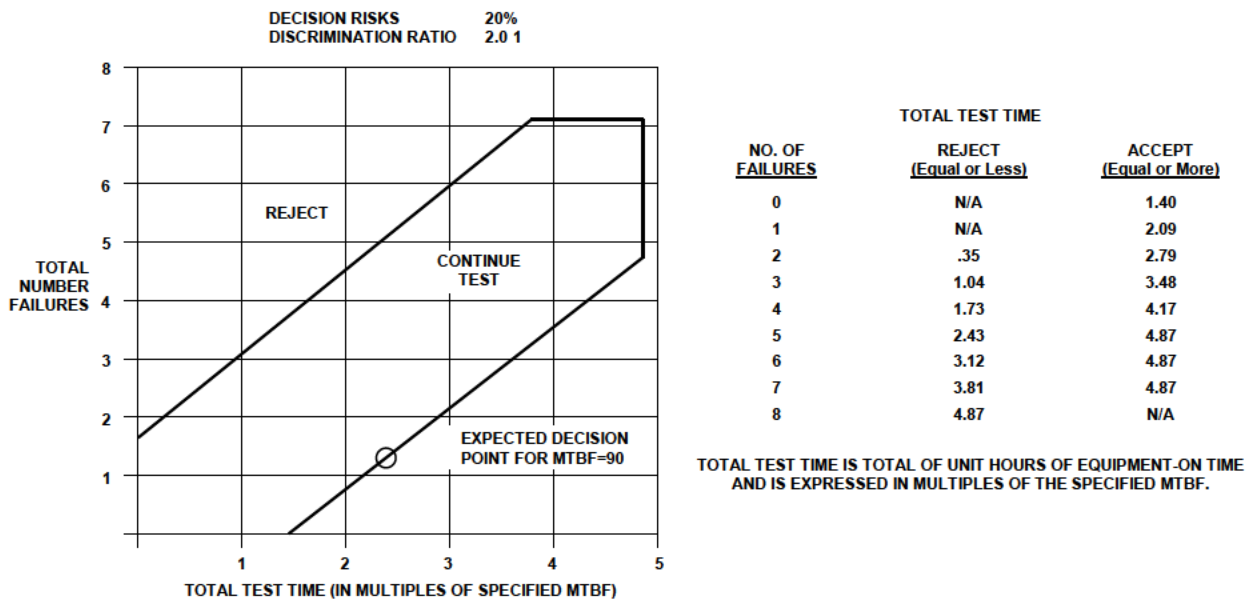


FIGURE 5. Accept/reject criteria.

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APPENDIX A  
FILTER/SEPARATOR TEST FACILITY  
AND TEST CONDITIONS

## 1. SCOPE

1.1 Abstract. This appendix describes an acceptable facility for testing Filter/Separators (F/S) (See Figure 6). The following are general requirements and guidance for the test facility. This appendix is not a mandatory part of this specification.

## 2. REQUIREMENTS

2.1 For first article and conformance testing of the F/S, the volume of test fuel shall be at least 10 times the rated flow of the F/S under test. If a first article or conformance test requires the presence of additives in the test fuel, there shall be tanks of sufficient volume to allow completion of these tests on a once-through, single-pass basis.

2.3 The pumping unit in the test system shall be a centrifugal type with a capacity matching the F/S under test, and have a minimum shaft speed of 2,950 rpm.

2.4 If necessary, heat exchangers shall be included to maintain the test fuel temperature within specified limits. Location is optional.

2.5 Flow meters shall be installed in the test fuel system and the water supply system with ranges of flow rates compatible with the rated flows of the F/S. Accuracy of flow meters shall be plus or minus 1.0%.

2.6 The test facility shall contain necessary pressure gauges and a means of measuring test fuel temperature. A differential pressure dial gauge conforming to 3.3.7 shall be connected to measure differential pressure across the F/S under test.

2.7 When required, a means of introducing solid contaminants into the test F/S within plus or minus 3.0% of the nominal add rate shall be provided. To further disperse the solid contaminant, it shall pass through a standard globe valve located on the inlet side of the test F/S, and be no further than 10 feet from this vessel. Throughout the injection of solid contaminants, a differential pressure of 20 psi shall be maintained across the valve.

2.8 A means of introducing test water that meets the quality requirements of 4.2.3 shall be provided. A filter in the water supply system is required. Water shall be injected immediately upstream of the supply pump.

2.9 Sampling taps shall be provided on the inlet and outlet of the test F/S at a distance from the test vessel not to exceed 10 pipe diameters.

2.10 The flow system piping between the points at which contaminants are injected and the fuel sampling points shall have a diameter such that the minimum fuel velocity is six feet/second at the rated flow of the test F/S.

2.11 A clean-up fuel F/S having a rating of at least 115% of the maximum system flow capacity shall be installed. Location downstream from the test F/S is optional.

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2.12 A clay treater shall be available to adsorb fuel additives and other surface active agents during a clean-up process. Location downstream of the test F/S is optional. The clay treater shall be bypassed or removed from the test loop during testing unless single pass tests are being conducted with the effluent fuel being returned to a separate storage tank.

2.13 The test system pressure shall not be less than 20 psi at the sampling connection downstream from the test F/S during the tests specified in this document.

2.14 A quick-closing valve capable of being closed and reopened in approximately four seconds shall be installed at a distance of between three and five pipe diameters downstream from the test F/S outlet sampling connection. Rigid piping is required between the test F/S and this valve.

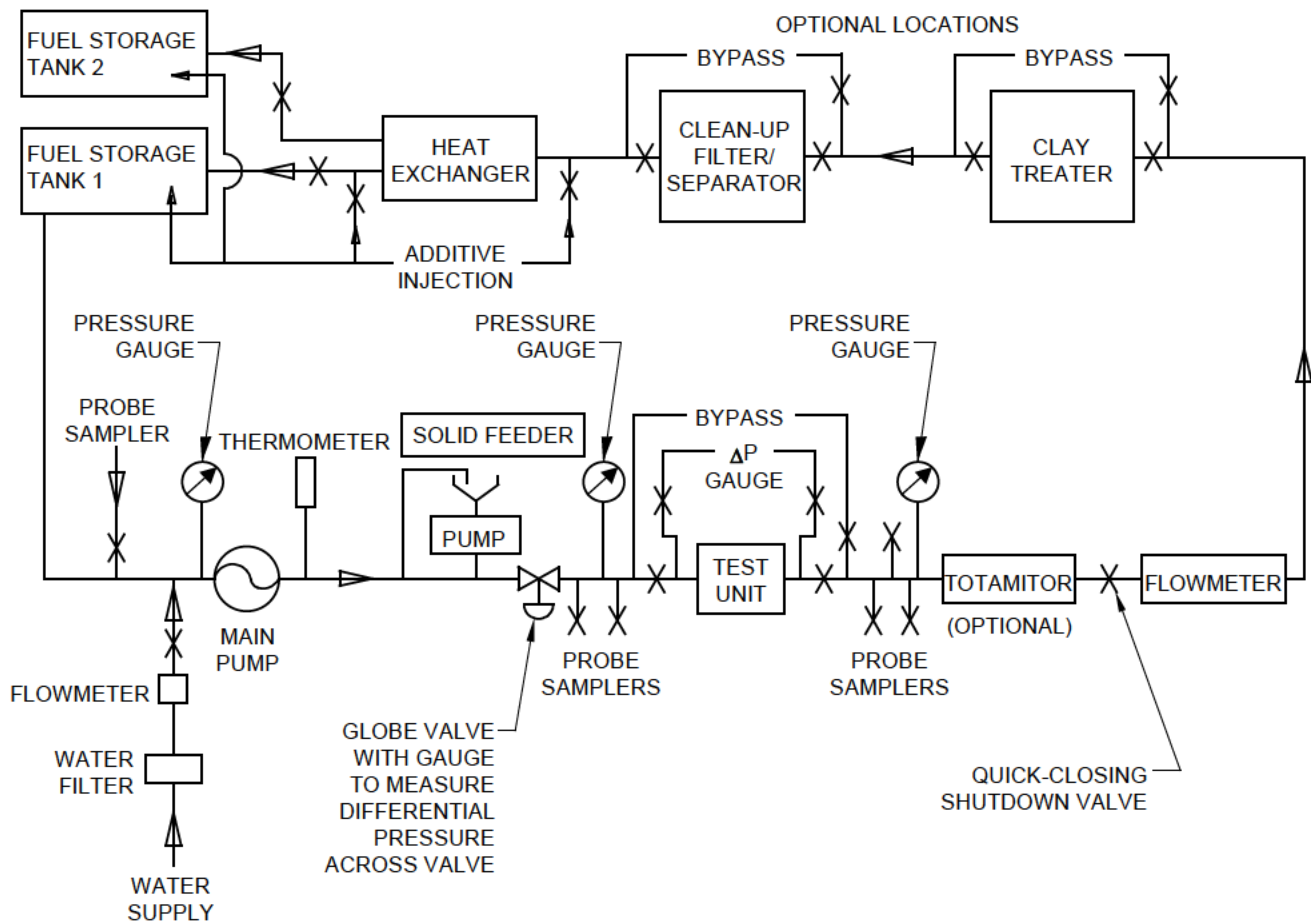


FIGURE 6. Test facility. – Example

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Custodians:

Army – AT  
Navy – AS  
Air Force – 99

Preparing Activity:

Army - AT

(Project 4330-2018-009)

Review Activities:

Army – AV  
Navy – MC, SH  
Air Force – 84  
DLA – CC

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