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MILITARY SPECIFICATION

MONITOR, CONTAMINATION, AVIATION FUEL DISPENSING SYSTEM

This specification is approved for use by the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification establishes the performance requirements, test procedures, and general design requirements for the aviation fuel contamination monitor elements and housings.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified, the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-B-601	Boxes, Wood, Cleated-Plywood
PPP-B-621	Boxes, Wood, Nailed and Lock-Corner
PPP-T-60	Tape, Packaging, Waterproof

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Naval Air Engineering Center, Systems Engineering and Standardization Department (Code 93), Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 4930

MILITARY

MIL-C-104	Crates, Wood, Lumber and Plywood Sheathed, Nailed and Bolted
MIL-B-121	Barrier Material, Greaseproofed, Waterproofed, Flexible
MIL-G-5572	Gasoline, Aviation, Grades 80/87, 100/130, 115/145
MIL-T-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-P-15024	Plates, Tags and Bands for Identification of Equipment
MIL-I-25017	Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble (Metric)
MIL-I-27686	Inhibitor, Icing, Fuel System
MIL-T-83133	Turbine Fuel, Aviation, Kerosene Type, Grade JP-8
MIL-I-85470	Inhibitor, Icing, Fuel System, High Flash

STANDARDS

MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-810	Environmental Test Methods and Engineering Guidelines

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

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1331	Surface and Interfacial Tension of Solutions of Surface-Active Agents, Test Methods for
ASTM D 2276	Particulate Contaminant in Aviation Turbine Fuels, Test Methods for (DOD Adopted)
ASTM D 3240	Undissolved Water in Aviation Turbine Fuels, Test Method for

ASTM D 3602 Water-Separation Characteristics of Aviation Turbine Fuels, Field Test Method for

ASTM D 3948 Determining Water Separation Characteristics of Aviation Turbine Fuels by Portable Separometer, Method for

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

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

Boiler and Pressure Vessel Code, Section VIII, Division 1

(Application for copies of ASME publications should be addressed to the American Society of Mechanical Engineers, 345 E 47th Street, New York, NY 10017.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Petroleum fuels and inhibitors. Materials used in aviation fuel monitors shall not be adversely affected by and shall have no effect on fuels and inhibitors conforming to MIL-G-5572, MIL-T-5624, MIL-I-25017, MIL-I-27686, MIL-T-83133, and MIL-I-85470.

3.2 Qualification. The fuel monitor elements furnished under this specification shall be products which are qualified for listing on the applicable Qualified Products List (QPL) at the time set for opening of bids (see 4.3 and 6.3).

3.3 Design. The aviation fuel monitor shall be designed to continuously monitor the full flow of fuel and, with no external power, shall allow no fuel beyond the monitor to exceed the contamination limits (see 3.4). The monitor elements shall not include any device that will cause an immediate stoppage of fuel flow.

3.4 Contamination limits. The effluent fuel samples shall conform to the following contamination limit requirments.

a. Water. When analyzed (see 4.6.4.1), the effluent fuel shall contain not more than five parts per million (ppm) by volume of undissolved (free) water in accordance with ASTM D 3240 (AquaGlo) or by a sustained turbidimeter reading for one minute.

b. Solids. When analyzed (see 4.6.4.2), the average weight of solids in the effluent fuel sample shall be not greater than 0.5 milligrams per liter (mg/l).

c. Fibers. When analyzed (see 4.6.4.3), the effluent fuel shall contain an average of not more than 10 fibers (see 6.4.3) per liter, and the number of fibers in any single sample shall be not greater than 15 fibers per liter.

3.5 Construction.

3.5.1 Materials. Materials shall be as specified herein, shall be of the best quality, and suitable for the purpose intended. All metal parts in contact with the fuel must be free of zinc, cadmium, copper and their alloys. Materials used in the construction of the housing shall be as specified by the contracting activity (see 6.2.1). Sensing lines on the housing may be copper or copper alloys.

3.5.2 Elements. The monitor elements shall be as shown in Figure 1. The open end shall be configured so as to effect a positive, non-leaking seal when seated properly in the monitor housing.

3.5.3 Housing.

3.5.3.1 Configuration. The monitor housing shall be configured to hold the required number of elements shown in Figure 1 to meet the flow rate specified by the contracting activity (see 6.2.1). Adequate provisions to effect a satisfactory sealing arrangement for each element shall be provided for between the inlet and outlet compartments. The interior deckplate shall have the required number of mounting holes for the elements, each hole having a diameter of 1.313 $\pm$0.002 inches.

3.5.3.2 Piping connections. Inlet and outlet connections shall be as specified by the contracting activity (see 6.2.1) and shall be permanently marked.

3.5.3.3 Accessory connections. Pressure taps shall be provided for pressure gage connections, one each for the inlet and outlet compartments. Tapped holes at the highest fuel flow point shall be provided for connecting an air eliminator and a pressure relief valve as specified by the contracting activity (see 6.2.1).

3.5.3.4 Drain valve. The monitor housing shall be equipped with a manual drain valve (or valves) to provide for complete drainage of each compartment.

3.5.3.5 Pressure gage. A pressure gage shall be provided to measure the pressure drop between the inlet and outlet compartments of the housing. The gage shall be either a direct reading differential pressure gage, or a pressure gage with a selector valve for separate readings of the inlet and outlet pressures.

3.5.3.6 Pressure rating. The monitor housing shall have a design pressure rating equal to or greater than the higher of the following: the maximum working pressure of the fuel system, 150 psig, or as specified by the contracting activity (see 6.2.1). The unit shall be constructed and labeled in accordance with Section VIII of the ASME Code for Unfired Pressure Vessels.

3.5.3.7 Hydrostatic test pressure. The monitor housing shall withstand a hydrostatic pressure of 1-1/2 times the design pressure for a period of five minutes. The interior deckplate shall withstand a hydrostatic pressure equal to the design pressure, applied to the inlet side with all element mounting holes sealed.

3.5.3.8 Identification. A stainless steel or non-ferrous metal identification plate, prepared in accordance with MIL-P-15024, shall be securely attached to the monitor housing. The identification plate shall contain the following information:

a. Name of unit

b. MIL-M-81380C(AS)

c. Name and address of manufacturer

d. Manufacturer's serial number

e. Inspection block (to be stamped by a government inspector)

f. Contract or order number

g. Flow rate and type of fuel

h. Weight, wet/dry

i. Working pressure

j. Test pressure

k. Element model number and quantity installed

l. Recommended element change differential pressure

3.6 Performance.

3.6.1 Differential pressure. With the element installed in a monitor housing (single element or full scale), the differential pressure (see 6.4.1) across the element shall be not greater than eight psi at rated flow, when tested in accordance with 4.6.3.1.

3.6.2 Rated flow. The monitor element shall have a rated flow of one gallon per minute (gpm) per inch of nominal length.

3.6.3 Media migration. The media migration from the element shall not be greater than 10 fibers per liter when tested in accordance with 4.6.3.1.

3.6.4 Mechanical integrity. The monitor element shall withstand a three foot drop without structural failure when tested in accordance with 4.6.3.1. It shall withstand a pressure differential of 150 psi without collapse when tested in accordance with 4.6.3.2.

3.6.5 Reaction to solids. The monitor element shall allow a maximum of 0.5 mg/l of solids in the effluent fuel when tested in accordance with 4.6.3.2. The time to reach a differential pressure of 75 psi shall be not less than 10 minutes at 100 percent of rated flow.

3.6.6 Reaction to water. The monitor element's reaction to water shall be as shown in Table I when tested in accordance with 4.6.3.3. Minimum running time to 25 psi differential pressure shall be as specified in Table I.

TABLE I. Monitor elements reaction to water.

Test Condition	Flow Rate (Percent)	Running Time (Minutes)	Free Water Content (ppm by volume)		Sampling Intervals (Minutes)
			Influent	Effluent	
1	100	15	50	5	2
2	10	100	50	5	10
3	100	2 (max)	1000 (slug)	10	1

3.6.7 Reaction to freezing/thawing. The monitor shall not pass water in excess of 5 ppm when subjected to test condition one of Table I after being frozen and when tested in accordance with 4.6.3.4.

3.6.8 Reaction to surfactants. The monitor element shall not pass water in excess of 5 ppm when subjected to test condition one of Table I with inhibited fuel (4.5.2.3) and when tested in accordance with 4.6.3.5.

3.6.9 Environmental conditions.

3.6.9.1 Operating temperature. The aviation fuel monitor housing and elements shall permit rated flow when operating in ambient temperatures ranging from -25°F to +125°F.

3.6.9.2 Storage temperature. The aviation fuel monitor housing and elements shall withstand storage in temperatures ranging from -50°F to +160°F without deterioration, after which they shall operate as specified in 3.6.9.1.

3.6.9.3 Fuel immersion. The monitor element shall show no evidence of swelling, corrosion, separation of components, dissolving of adhesives, or deformation which could cause failure during operation after being immersed in fuel for 100 hours.

3.6.10 Post environmental. The monitor elements subjected to the conditions in 3.6.9 shall operate without failure when subjected to test condition one of Table I.

3.6.11 Reaction to surge. The monitor element shall not pass water in excess of 5 ppm or be otherwise adversely affected by a surge of fuel.

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 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 assure supplies and services conform to prescribed requirements.

4.1.1 Acceptance testing. Acceptance testing shall be accomplished by the contractor. Records of the tests shall be kept complete and available to the Government as specified in the contract or purchase order.

4.2 Classification of inspections

a. Qualification inspection (see 4.3)

b. Quality conformance inspection (see 4.4)

4.3 Qualification inspection. Qualification inspection of monitor elements and housings shall be performed in accordance with the test conditions specified herein and shall be performed at a laboratory acceptable to the Government (see 6.3) on the number of samples specified herein, produced with equipment and procedures normally used in production.

4.3.1 Samples.

a. Monitor element. Test samples shall consist of 40 elements with a nominal length of 20 inches. Five elements of each of the other nominal lengths (10, 15, 25, or 30 inches) the manufacturer desires to have included on the Qualified Products List (QPL) shall also be submitted for qualification testing. Drawings, part numbers, and generic description of the materials of all monitor components are to be included with the test samples.

b. Monitor housing. Sample of monitor housing shall consist of one complete monitor housing assembly with three complete sets of elements. A certified drawing of the monitor housing shall be furnished. Samples, descriptive material, and drawings shall be identified as required and forwarded to the designated test activity.

4.3.2 Qualification testing. Qualification tests contained in this specification shall be run using elements with a nominal length of 20 inches. Two elements of each of the remaining sizes shall be tested for conformance to 3.6.1 and test condition one of Table I. Only those sizes of elements submitted and tested will be listed on the QPL.

4.3.3 Retention of qualification. Retention of qualification for the monitor elements on the QPL shall be dependent on periodic verification, by means of test data, of continued compliance with the requirements of this specification. This periodic verification will normally be every two years from the date of inclusion on the QPL.

4.4 Quality conformance inspections

4.4.1 Monitor element. Elements submitted for quality conformance inspections and acceptance shall be subjected to the inspection test (see 4.6.1). Random samples of the monitor elements shall be selected from each lot in accordance with MIL-STD-105. The Acceptable Quality Level (AQL) shall be 0.15, Inspection Level III. Random sampling shall be utilized in selecting samples for acceptance testing.

4.4.2 Monitor housing. Each monitor housing submitted for acceptance shall be subjected to the following tests:

a. Inspection (4.6.1)

b. Hydrostatic pressure (4.6.2)

4.5 Test conditions

4.5.1 Equipment. Equipment used for the testing specified herein shall be of laboratory precision type or equivalent insofar as practicable, and shall be calibrated at intervals properly spaced to assure laboratory accuracy. Figure 2 is a schematic of the test system.

4.5.1.1 Main circulating pump. The main circulating pump(s) shall be a centrifugal or vane pump capable of emulsifying the fuel and water mixture.

4.5.1.2 Flowmeter, fuel. A flowmeter shall be provided to measure the fuel flow with an accuracy of one percent at the specified fuel flow rate.

4.5.1.3 Sampling devices. Upstream facing, probe type sampling devices shall be provided; one immediately before and one immediately after the test unit, for extracting in-line samples.

4.5.1.4 Differential pressure reading device. Differential pressure across the test unit shall be measured with an accuracy of two percent of the scale reading of the device used, such as a differential pressure gage, selector valve and gage, etc.

4.5.1.5 Pressure relief valve. An adjustable pressure relief valve shall be installed before the test unit for system protection.

4.5.1.6 Water injection system. A suitable system shall be provided to inject water into the fuel prior to the main pumping unit. The accuracy of the water injection system shall be within five percent of the specified water addition rate.

4.5.1.7 Solids addition system. A continuous solids addition system shall be provided to uniformly feed test dust at a rate of 10 $\pm$1 mg/l into the fuel upstream of the test unit.

4.5.1.8 Turbidimeter. The test system shall incorporate a turbidimeter installed to monitor the effluent fuel from the test unit. The monitor shall be a Keene Corporation Model 861-F (totamitor) or equal. A strip chart recorder or other suitable means shall be provided to produce a continuous record of turbidity readings.

4.5.1.9 Test system pressure. The pressure in the test system shall not be less than 20 psi at the start of all tests when measured at the sampler immediately downstream of the test unit.

4.5.2 Test fluid. Unless otherwise specified, the test fluid shall be JP-5 aviation turbine fuel conforming to MIL-T-5624, shall be clean fuel (see 6.4.2), and shall be tested for conformance as follows:

4.5.2.1 Preliminary testing. Prior to the start of qualification testing, the fuel shall be tested for conformance to the applicable requirements of MIL-T-5624, Table I, as listed below.

a. Aromatics
b. Viscosity
c. Sulfur
d. Existent gum
e. Particulate matter
f. Copper strip corrosion
g. Freezing point
h. Olefins
i. Flash point
j. Specific gravity
k. Distillation temperature

Manufacturer's data sheet may be included showing conformance of the fuel to MIL-T-5624.

4.5.2.2 Uninhibited fuel. All tests, with the exceptions listed below, shall be run using uninhibited fuel. The fuel shall be subjected to clay treatment until a Microseparometer (MSEP) or Minisonic Separometer (MSS) Surfactants value of 96 or greater is obtained when tested in accordance with ASTM D 3948 or ASTM D 3602.

4.5.2.3 Inhibited fuel. Inhibited fuel shall be used for the Reaction to Surfactant test and Fuel Immersion test. Unless otherwise specified, the uninhibited fuel from 4.5.2.2 shall be inhibited with corrosion inhibitor in accordance with MIL-I-25017 at a concentration of 16 pounds, inhibitor per 1000 barrels of fuel and fuel system icing inhibitor (FSII) in accordance with MIL-I-85470 at a concentration of 0.15 to 0.20 percent by volume. Inhibitors shall be added to the fuel in accordance with Appendix B.

4.5.2.4 Test fuel volume. The test fuel volume shall be not less than 10 times the gallon per minute rating of the test unit.

4.5.2.5 Fuel temperature. The fuel temperatures shall be maintained between 70°F and 90°F during the testing specified herein, and shall be kept within ±5°F of the temperature at the start of a test.

4.5.3 Test contaminants. The following fresh water, solids, and inhibitor test contaminants shall be used.

4.5.3.1 Fresh water. Fresh water containing less than one mg/l of solids and having a surface tension of not less than 65 dynes per centimeter at 75°F when tested in accordance with ASTM D 1331, Method A. The pH value shall be between six and eight.

4.5.3.2 Solids. Siliceous dust, obtainable from the AC Spark Plug Company, Flint, MI, identified as standardized fine air-cleaner (AC) test dust, package No. 1543094, and having a particle size distribution as shown in Table II.

TABLE II. Particle size distribution.

Size Microns	Weight, Percent
0 to 5	39 ±2
5 to 10	18 ±3
10 to 20	16 ±3
20 to 40	18 ±3
Over 40	9 ±3

4.5.3.3 Inhibitors. Corrosion inhibitor conforming to MIL-I-25017 and Fuel System Icing Inhibitor (FSII-DiEGME) conforming to MIL-I-85470 shall be used to inhibit the fuel.

4.6 Test methods and procedures

4.6.1 Inspection. Each item submitted shall be examined visually for damage, derangement, and to verify conformance with the details specified herein and the manufacturer's specifications, including drawings and any other data or details that are considered applicable by the Government inspector. Inspection of the items shall be made both before and after performance testing. Results of these inspections shall be recorded and made a part of the test record.

4.6.2 Hydrostatic pressure. The hydrostatic pressure specified in 3.5.3.7 shall be applied to the complete monitor housing without internal components, as prescribed in the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. The test shall verify the tightness of all joints and the body material. Each compartment shall be tested individually to the hydrostatic pressures specified in 3.5.3.7.

4.6.3 Performance tests. The following tests shall be conducted on randomly selected elements to determine compliance with the performance requirements specified herein.

4.6.3.1 Media migration and drop test. Three elements to be tested shall be dropped from a distance of three feet above a concrete surface, with the element in a vertical position, open end down. Visual inspection shall be performed on the elements to identify cracking of the material or other structural defects. The elements shall be installed in turn in a single element test facility as shown in Figure 2. Test fluid conforming to 4.5.2 shall be pumped through the test unit for a period of 15 minutes, using the flow schedule shown in Table III. Three samples shall be taken from the inlet and three from the outlet samplers. Samples shall be taken immediately after starting at rated flow; during the transition from rated flow to 10 percent of the rated flow; and during the transition back to 100 percent rated flow. A fiber count of the samples for media migration shall be conducted as per 4.6.4.3. The differential pressure across the element shall be recorded at the start and finish of each phase of Table III.

TABLE III. Flow schedule.

Phase	Elapsed Time (Minutes)	Flow Rate (Percent)
1	0-5	100
2	5-10	10
3	10-15	100

4.6.3.2 Solids reaction. Using the three elements from 4.6.3.1, each element in turn shall be run in the single element test vessel at 100 percent of rated fuel flow. Contaminant conforming to 4.5.3.2 shall be injected at a rate of 10 +1 mg/l of the fuel flow. The test dust shall be continuously and uniformly added to the fuel influent stream as close as practicable to the test unit. The test shall be continued until the differential pressure across the element reaches 150 psi, and then held at 150 psi for five minutes. Continuous samples shall be taken at the inlet and outlet samplers, and analyzed for solids content in accordance with 4.6.4.2. Sample filters may be replaced as they become loaded with solid contaminants. The average particulate concentration shall consist of the combined tare weights of the sample filters divided by the total volume of fuel passed through the samplers. The differential pressure shall be recorded every five minutes. Sample results shall be recorded on the test data sheet.

4.6.3.3 Water reaction. Using a new element for each test, conduct nine separate single element tests (three tests for each of the three test conditions) in accordance with Table I. Water conforming to 4.5.3.1 shall be injected into the fuel on the inlet side of the main pump at the rates shown in Table I. When the differential pressure reaches 15 psi, the fuel flow shall be momentarily stopped and restarted by closing and, within five seconds, opening the downstream valve. The main pump shall be kept running during the cycling of the valves to provide a surge of fuel. Repeat the surge of fuel when the differential pressure reaches 20 psi. The surge test is not required for test condition three of Table I (slug test). The test shall be continued to a differential pressure of 25 psi. Turbidimeter readings shall be recorded continuously by a chart recorder or other suitable means. Differential pressure shall be recorded every five minutes and when the pressure drop reaches 25 psi. Samples shall be taken at the intervals specified in Table I and analyzed in accordance with 4.6.4.1. Sample results shall be recorded on the test data sheet.

4.6.3.4. Freeze/thaw. Using a new element for each test, conduct two separate tests in accordance with the following. Install an element in the single element test vessel and run test condition one of Table I to a differential pressure of 15 psi. Remove the element and place it in a bath of fuel. Lower the temperature of the bath and maintain at -25°F for 24 hours. The element shall then be reinstalled in the test vessel and subjected to the remainder of test condition one of Table I as in 4.6.3.3.

4.6.3.5 Surfactant test. Using a new element for each test, conduct three separate single element tests using inhibited fuel as specified in 4.5.2.3. The inhibited fuel shall be circulated through the element at 100 percent rated flow for 24 hours, bypassing all clean-up units. After the conditioning period, run test condition one of Table I in accordance with 4.6.3.3. Maintain the MSEP or MSS rating of the inhibited fuel (tested at least every four hours using ASTM D 3948 or ASTM D 3602) at a value of 70 or below by adding corrosion inhibitor or FSII as necessary.

4.6.3.6 Environmental tests. Using two new elements, conduct the environmental tests as specified in 4.6.3.6.1 through 4.6.3.7.

4.6.3.6.1 Storage, high temperature. Test the elements in accordance with MIL-STD-810, Method 501, procedure I, steps 1, 2, 3, and 6. Examine for defects.

4.6.3.6.2 Storage, low temperature. Test the elements in accordance with MIL-STD-810, Method 502, procedure I, steps 1, 2, 3, and 6, using a temperature of -50°F for 24 hours. Examine for defects.

4.6.3.6.3 Resistance to fuel. Immerse the elements in fuel conforming to 4.5.2.3 for 100 hours at a temperature of 77°±5°F. Remove the elements and examine for evidence of swelling, corrosion, separation of components, dissolving of adhesives, or deformation which could cause failure during operation.

4.6.3.7 Post environmental water reaction test. After successful completion of the tests specified in 4.6.3, install the same two elements in turn in the test vessel and conduct a water reaction test in accordance with 4.6.3.3, using test condition one of Table I.

4.6.4 Analysis of test samples. Samples shall be analyzed for contaminants as specified in 4.6.4.1 through 4.6.4.3.

4.6.4.1 Water contamination. Free water detection shall be made using the turbidimeter specified in 4.5.1.8. Calibration of the turbidimeter shall be in accordance with the manufacturer's standard practice. In-line samples shall be taken and analyzed in accordance with ASTM D 3240 (AquaGlo).

4.6.4.2 Solids contamination. Analytical procedures shall be in accordance with ASTM D 2276.

4.6.4.3 Media migration (fibers). Analytical procedures shall be in accordance with Appendix A.

5. PACKAGING

5.1 Monitor Elements. The monitor elements shall be packaged separately, one each in a sealed, moisture-proof plastic bag. The elements shall then be inserted in a suitable cardboard box or cylindrical container to protect it in storage and handling. The cardboard containers shall be packed in suitable cartons so as to insure carrier acceptance and safe delivery at destination, complying with carrier rules and regulations applicable to the mode of transportation.

5.2 Monitor housing.

5.2.1 Preservation and packaging.

5.2.1.1 Level A. The monitor housing shall be preserved and packaged without the elements installed. Dust caps and plugs shall be assembled with their respective fittings. The fittings shall be wrapped with barrier material in accordance with MIL-B-121, Type I, Grade C, secured in place with pressure sensitive tape in accordance with PPP-T-60, Type II, Class C.

5.2.1.2 Level C. The monitor housing shall be preserved and packaged in accordance with the manufacturers standard practice to insure adequate protection against deterioration and damage.

5.2.2 Packing.

5.2.2.1 Level A. The monitor housing shall be packed in a wooden crate in accordance with PPP-B-601, or PPP-B-621, Class 2 or 4. Blocking, bracing, and securing of the unit within the crate shall be in accordance with MIL-C-104.

5.2.2.2 Level C. The monitor housing shall be packed to insure carrier acceptance and safe delivery at the destination in a container complying with carrier rules and regulations applicable to the mode of transportation.

5.3 Marking. Shipments shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. These full-flow fuel contamination monitors are used in aviation fuel dispensing systems.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification

b. Flow rate or element length (see 3.5.3).

c. Whether element materials are to be compatible with other than the fuels and inhibitors listed (see 3.5.1)

d. Monitor housing materials (see 3.5.1)

e. Monitor housing maximum design working pressure required (see 3.5.3)

f. Monitor housing type and size of inlet and outlet connections (see 3.5.3).

g. Monitor housing flow rate (3.5.3)

h. Monitor housing accessory connection (see 3.5.3)

i. Quantity of manuals required

j. Laboratory/test facility (see 6.3).

k. Levels of preservation, packaging and packing (see section 5).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the same time set for opening of bids, qualified for inclusion on the applicable Qualified Products List (QPL) whether or not such products have actually been so listed by that date. The attention of contractors is called to these requirements, 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 purchase orders for the products covered by this specification. The activity responsible for the QPL is the Naval Air Systems Command (Attention: Naval Air Engineering Center (SESD), (Code 93), Lakehurst, NJ 08733-5100) and information pertaining to qualification of products may be obtained from that activity. Qualification testing of monitor elements submitted for inclusion on a QPL will be performed at the Naval Air Propulsion Center, Trenton, NJ 08628-0176. Qualification testing of monitor housings shall be accomplished at a testing facility designated by the Government (this may include testing at an approved manufacturer's test facility).

6.4 Definitions.

6.4.1 Differential pressure. The differential pressure across the aviation fuel contamination monitor is defined as the pressure drop measured from the fuel inlet connection to the fuel outlet connection.

6.4.2 Clean fuel. Clean fuel is defined as fuel containing not more than 0.5 mg/l of solids contamination and 0 ppm undissolved water.

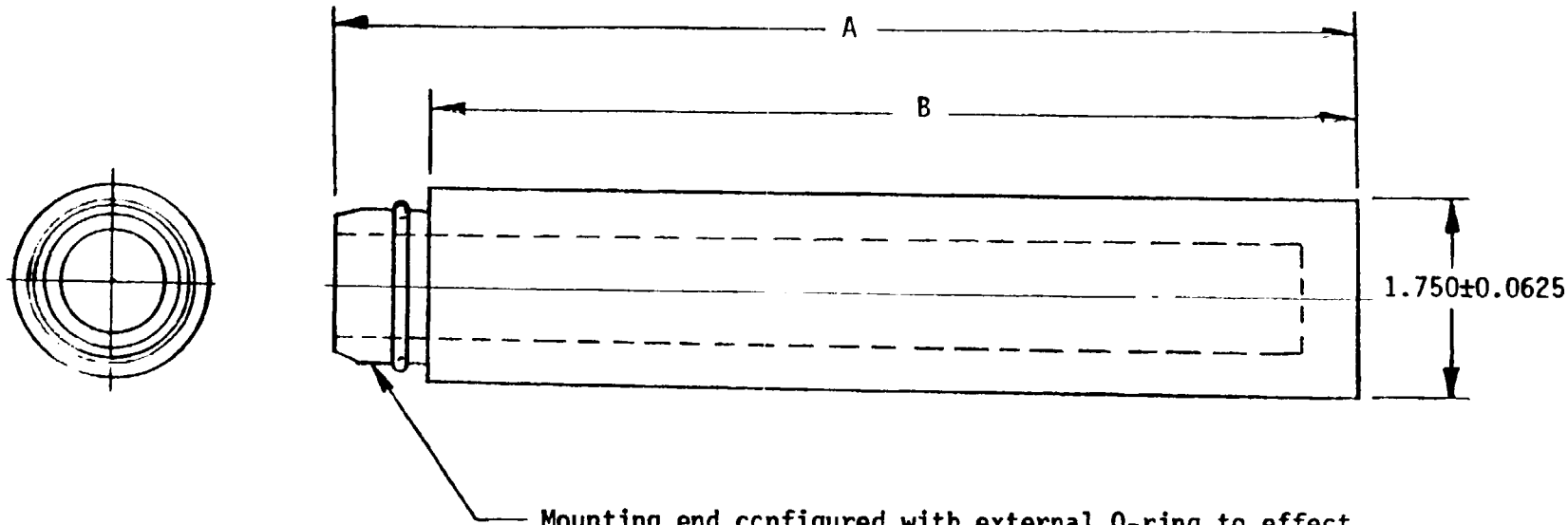
6.4.3 Fiber. A fiber is defined as any particle with a length to diameter ratio of 20 or greater and a minimum length of 20 microns.

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

Review activity:
Navy - MC

Preparing activity:
Navy - AS

(Project No. 4930-N250)



Nominal Length (Inches)	Flow Rating (GPM) (Max)	A (Inches)	B (Inches)
30	30	30.8125 ±0.0625	30.250 ±0.0625
25	25	25.8125 ±0.0625	25.250 ±0.0625
20	20	20.8125 ±0.0625	20.250 ±0.0625
15	15	15.8125 ±0.0625	15.250 ±0.0625
10	10	10.8125 ±0.0625	10.250 ±0.0625

All materials used in construction must be compatible with all aviation fuels. Direction of flow shall be from outside to inside of element.

FIGURE I. Element.

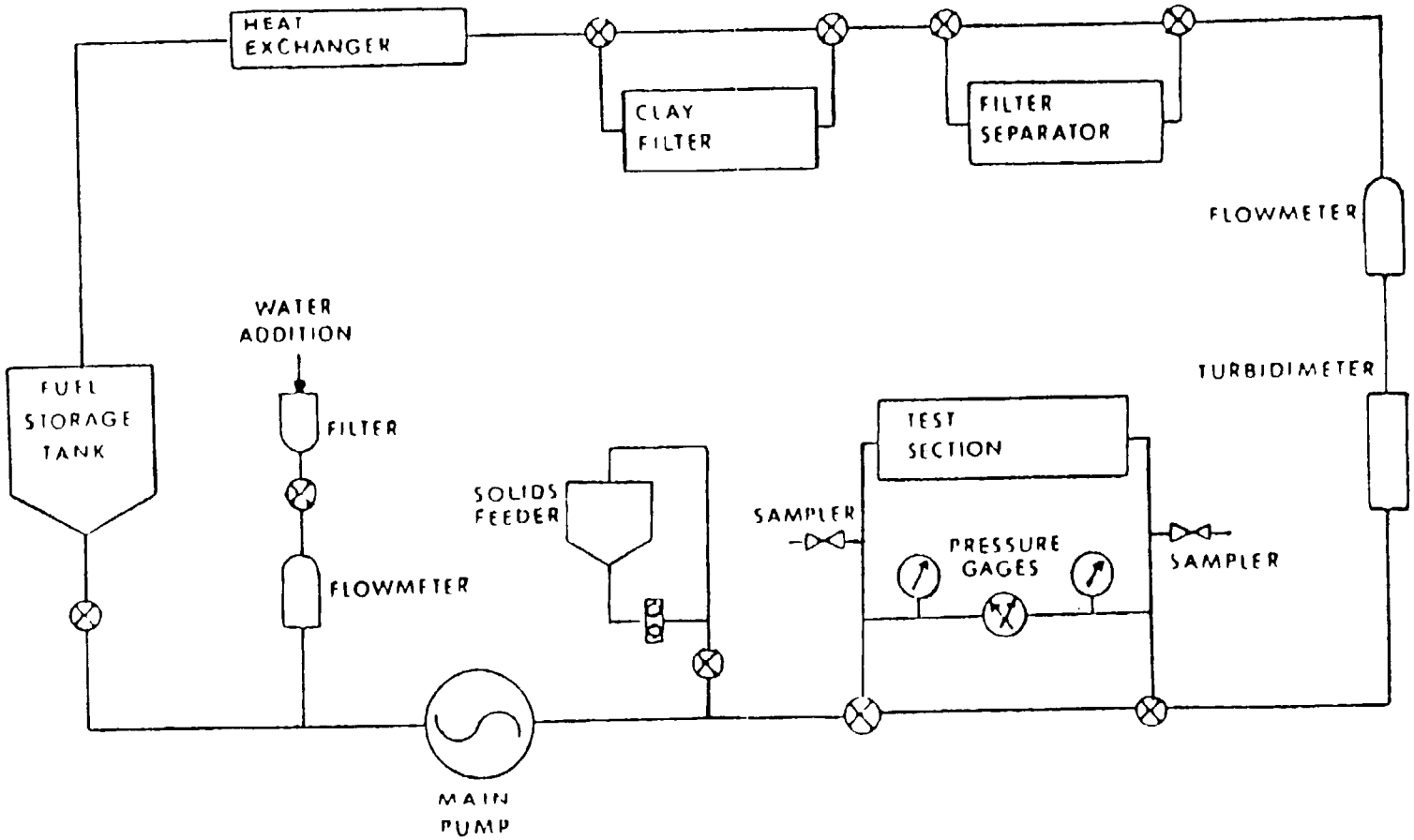


FIGURE 2. Schematic of test system.

APPENDIX A

FIBER DETERMINATION METHOD
(Media Migration)

10. SCOPE

10.1 Scope. This appendix details the method to be used for determining the number of fibers present in a 1000 milliliter (ml) sample of test fuel. The number of fibers present needs to be known in order to determine if a test item is functioning with the limits of this specification. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

30. EQUIPMENT

30.1 The following equipment is required:

a. Millipore Fluid Sample Kit, Cat. No. XX64 037 00 or equal

b. Millipore Field Monitors, Particle Size Analysis, Cat. No. MAWG037P0 or equal

c. Vacuum pump

d. Oven for obtaining 90°C

e. Calibrated microscope capable of examining fibers

40. PROCEDURE

40.1 Withdraw a 1000 ml sample through a pre-counted monitor (see 40.1.1) in accordance with fluid sampling kit operating instructions. Sample shall be taken at the sampling site immediately after the solid feeder pump and shall be called the upstream monitor sample. Withdraw another 1000 ml sample through a pre-counted monitor at the sampling site immediately after the test vessel. This sample shall be called the downstream monitor sample (see Figure 2 of this specification).

40.1.1 Pre-count monitor to obtain a background fiber count blank. Subtract background fiber count blank from each monitor used. If Millipore monitors are used, average background counts are indicated on each carton of assembled Contamination Analysis Monitors. Pre-counting can be eliminated by using the average background fiber count as a blank.

40.2 Remove excess fuel from monitors with a vacuum pump. Dry monitors intact in an oven for one hour (avoid heat above 90°C) with the inlet/outlet plugs removed. Cool monitors.

40.3 Count fibers on each monitor filter pad with a calibrated microscope, capable of examining fibers. Subtract upstream monitor sample from downstream monitor sample to obtain a net fiber count.

APPENDIX B

METHOD FOR ADDING FUEL INHIBITORS TO THE TEST FUEL

10. SCOPE

10.1 Scope. This appendix details the method to be used for adding corrosion inhibitor and icing inhibitor to the test fuel. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

20.1 Government documents.

20.1.1 Specifications. The following document forms a part of this appendix to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-I-25017	Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble (Metric)
MIL-I-85470	Inhibitor, Icing, Fuel System, High Flash

30. PROCEDURE

30.1 The test fuel shall be clay filtered until a Microseparometer (MSEP) Surfactants value of 95 or greater is obtained when tested in accordance with ASTM D 3948. Bypass all filtration equipment before adding the inhibitors.

30.2 The inhibitors shall be injected separately into the main pump suction line, through the contamination injection equipment or at the fuel tank opening. The two inhibitors shall not be premixed or injected simultaneously. The inhibitors may be individually prediluted with the test fuel to achieve the required injection rate or to facilitate mixing.

30.3 Inject corrosion inhibitor conforming to MIL-I-25017 at a rate equal to 16 pounds of inhibitor to 1000 barrels of fuel.

30.4 Inject fuel system icing inhibitor (FSII) conforming to MIL-I-85470 at a rate to obtain 0.15 to 0.20 percent by volume. Follow manufacturer's recommended procedure for addition to fuel.

30.5 Circulate the test fuel, bypassing all filtration equipment, until at least two system turnovers have been completed.

40. CAUTION

40.1 Refer to manufacturer's safety data sheets for precautions to be taken while handling fuel inhibitors.

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1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-M-81380C(AS)	MONITOR, CONTAMINATION, AVIATION FUEL DISPENSING SYSTEM

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR ☐ USER ☐ MANUFACTURER ☐ OTHER *(Specify)*: _____
b. ADDRESS *(Street, City, State, ZIP Code)*	

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b. Recommended Wording:

c. Reason/Rationale for Recommendation:

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