

METRIC

MIL-DTL-81248C  
31 March 2006  
SUPERSEDING  
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30 June 1980

DETAIL SPECIFICATION  
DETECTOR PAD, FREE WATER

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

## 1. SCOPE

1.1 Scope. This specification establishes the formulation and manufacturing requirements for a free water detector pad. This uranine coated paper disc is used with the Model Number MK II Free Water Detector, MIL-D-81227; the Type III, Detector, Contaminated Fuel, MIL-D-22612; and the ASTM-D3240 Test Pad Rater.

1.2 Classification. The free water detector pads covered by this specification are of the following sizes (see 6.2):

Size 1 - 37 mm  
Size 2 - 47 mm  
Size 3 - 25 mm

## 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 meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Comments, suggestions, or questions on this document should be addressed to Naval Air Systems Command AIR-4.4.5, Fuels and Lubricants Division, 22229 Elmer Road, Patuxent River MD 20670-1534 or emailed to [John.Krizovensky@navy.mil](mailto:John.Krizovensky@navy.mil). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil>.

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### 2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

#### DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-117	-	Bags, Heat-Sealable
MIL-DTL-5624	-	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-D-22612	-	Detector, Contaminated Fuel
MIL-D-81227	-	Detector Kit, Water, Automotive-Aviation Fuel
MIL-DTL-83133	-	Turbine Fuels, Aviation, Kerosene Types, NATO F-34(JP-8), NATO F-35, AND JP-8 + 100

#### DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-129	-	Military Marking for Shipment and Storage
MIL-STD-1916	-	DoD Preferred Methods for Acceptance of Product

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or <http://assist.daps.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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 these documents are those cited in the contract or solicitation.

#### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) INTERNATIONAL

ASTM-D1655	-	Standard Specification for Aviation Turbine Fuels (DoD adopted)
ASTM-D5452	-	Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration
ASTM-E308	-	Standard Practice for Computing the Colors of Objects by Using the CIE System (DoD adopted)

(Copies of these documents are available from [www.astm.org](http://www.astm.org) or ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

#### TECHNICAL ASSOCIATION FOR THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI-T403	-	Bursting Strength Paper
TAPPI-T410	-	Grammage of Paper and Paperboard (weight per unit area)
TAPPI-T431	-	Ink Absorbency of Bibulous Paper

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(Copies of these documents are available from <http://www.tappi.org> or TAPPI, 15 Technology Parkway South, Norcross, GA 30092.)

## UNITED STATES PHARMACOPEIA (USP)

USP-NF - Edition XVIII or current edition

2.4 Order of Precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

## 3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Materials. The materials shall conform to the applicable specifications, standards, and requirements herein. The detector pad shall consist of a blotting paper disc that has been surface coated on one side with uranine. The detector pad shall be made from such materials and such processes to meet the requirements of this specification.

3.2.1 Blotting paper disc. The blotting paper shall conform to the requirements specified in table I.

TABLE I. Blotting paper disc requirements.

Properties	Requirements
Material	Made from fibrous, cellulosic material which may include reclaimed fiber
Color	White
Texture	Smooth
<u>1/</u> Basis weight in accordance with TAPPI-T410 19 X 24-1000	200 pounds $\pm$ 5percent
<u>1/</u> Burst in accordance with TAPPI-T403	average not less than 25 pounds per square inch(psi)
<u>1/</u> Absorption of 1 milliliter inks in accordance with TAPPI-T431	not more than 50 seconds
Moisture	The blotting paper shall be sufficiently free of moisture to ensure conformance to 3.3.
Porosity	The blotting paper shall allow aviation fuel to pass freely through when subjected to the filterability/flow test specified in 4.5.5.

1/ Unless an alternate method is authorized by the procuring activity.

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3.2.1.1 Dimensions. The thickness of the paper disc shall be  $0.610 \pm 0.076$  millimeter (mm) (0.024 to 0.003 inch). The diameter shall be:

Size 1 -  $37.0 \pm 0.5$  mm ( $1.46 \pm 0.02$  inches)

Size 2 -  $47.0 \pm 0.5$  mm ( $1.85 \pm 0.02$  inches)

Size 3 -  $25.0 \pm 0.5$  mm ( $0.98 \pm 0.02$  inch)

3.2.2 Uranine coating. Each blotting paper disc (3.2.1) shall be surface coated on one side with a solution of uranine, (fluorescein, sodium) with a minimum dye content of 98.5 percent (equivalent to USP grade) in any of the following denatured ethyl alcohol formulations: 1, 2A, 2B, 3A, 12A, 28A, and 30. The requirements of USP-NF XVIII may be used as a basis for acceptance as an alternate for the current edition of the USP-NF. When tested as specified in 4.5.1 there shall be:

37 mm disc -  $0.56 \pm 0.06$  milligrams of uranine per disc

47 mm disc -  $0.9 \pm 0.1$  milligrams of uranine per disc

25 mm disc -  $0.26 \pm 0.03$  milligrams of uranine per disc

3.3 Heat-sealed unit pack. The test pads shall be individually packaged (unit pack) in a heat-sealed watervaporproof bag conforming to MIL-DTL-117, Type I, Class E, style 1. When subjected to the test specified in 4.5.2, the sealed watervaporproof bag shall show no sign of leakage. There shall be no evidence of water in the sealed bag after exposure to 90 to 95 percent relative humidity and at a temperature of 38 °C (100 °F) for 16 hours.

3.4 Visual detector pad color. The detector pad, immediately after removal from its watervaporproof bag, shall be subjected to a visual test as specified in 4.5.3. The detector pads shall have a uniform orange color over the dyed surface. An acceptable pad shall yield a color approximately equal to the ASTM-E308 color specified by CIE  $L^*a^*b^*$  values  $L^* = 73.7$ ,  $a^* = 36.3$ ,  $b^* = 59.7$  (CIE Illuminant D65 and CIE 2 Degree Standard Observer). An unacceptable pad shall yield a color approximately equal to the color specified by CIE  $L^*a^*b^*$  values  $L^* = 75.5$ ,  $a^* = 34.1$ ,  $b^* = 63.2$  (CIE Illuminant D65 and CIE 2 Degree Standard Observer). Any discoloration, inconsistency in color, or fading (orange to yellow coloration) shall be cause for rejection.

3.5 Contamination by water. When tested under ultraviolet light as specified in 4.5.4, the detector pad, immediately after removal from its sealed watervaporproof bag, shall show none of the characteristic fluorescence resulting from the presence of free water (indicated by a discoloration of the pad, yellowing or yellow spots).

3.6 Filterability/flow. The detector pad, immediately after removal from its watervaporproof bag, shall be subjected to the fuel flow test specified in 4.5.5. Five hundred milliliters of aviation turbine fuel conforming to either MIL-DTL-5624, MIL-DTL-83133, or ASTM-D1655 shall be

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filtered through the detector pad in 37.5 to 50 seconds (indicating a fuel flow rate of 600 to 800 mL/min).

3.7 Marking. Each unit pack shall be marked in accordance with MIL-STD-129.

3.7.1 Additional marking. Each unit pack shall be marked with the following:

- a. Lot number
- b. Date of manufacture
- c. CAUTION: The enclosed detector pad is highly sensitive to water and water vapor. Do not open envelope until seconds prior to use. Remove and handle the enclosed detector pad with tweezers. Do not touch with fingers.

3.8 Workmanship. When visually examined, the detector pad shall be evenly coated and free from foreign matter, holes, tears, cuts, creases, wrinkles, printing, and other imperfections that render the pad unusable for its intended use.

#### 4. VERIFICATION

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

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

4.2 First article inspection. First article inspection shall be performed on one complete package containing a free water detector pad when a first article sample is specified (see 3.1). The sample shall be representative of the production item and shall be taken from a production lot (see 6.5.1). First article inspection shall consist of all tests and examination specified in this specification.

4.3 Conformance inspection. Conformance inspection shall consist of the examinations and tests specified in table II for each production run. A sample (see 4.3.1) that does not conform to all the applicable conformance requirements shall be cause for rejection.

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Table II. Conformance inspection.

Inspection	Requirement	Test Method
Dimensions	3.2.1.1	Industry Standards
Uranine coating	3.2.2	4.5.1
Heat-seal	3.3	4.5.2
Color	3.4	4.5.3
Contamination	3.5	4.5.4
Filterability/Flow	3.6	4.5.5
Workmanship	3.7	Visual examination
Marking	3.7 and 3.7.1	Visual examination

4.3.1 Conformance samples. Unless otherwise specified, conformance samples for the inspections shall be selected at random in accordance with MIL-STD-1916 and table III below.

TABLE III. Conformance sampling.

Inspection <u>1/</u>	Verification Level	Sampling Unit
Dimensions	IV	Detector pad before packaging
Uranine coating	IV	Detector pad before packaging
Heat-seal	IV	Unit pack
Color	IV	Detector pad before packaging
Contamination	IV	Immediate container
Filterability/Flow	IV	Immediate container
Workmanship	II	Detector pad before packaging
Marking	I	Unit pack.

1/ The lot size (see 6.5.1) shall be the number of unit packs for all inspections.

4.4 Inspection conditions. Unless otherwise specified in the detailed test methods specified herein, the physical tests contained in this specification shall be performed with an atmosphere having a relative humidity of  $50 \pm 10$  percent and a temperature ranging from 18 to 27 °C (65 to 80 °F).

4.5 Examinations and tests.4.5.1 Uranine content.

4.5.1.1 Apparatus. The apparatus shall consist of a fluorometer or spectrophotometer with fluorometric attachment with a sensitivity capable of detecting 0.02 micrograms of uranine per milliliter of water and standard laboratory glass volumetric flasks (1000 mL and 100 mL capacity).

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4.5.1.2 Standards. Weigh exactly 0.20 grams of uranine that has been previously dried in an oven at 110 °C for 0.5 hour and dissolve in 1 liter of distilled water. Label this solution "A". Pipette 10 mL of solution "A" and dilute to 1 liter with distilled water. Label this solution "B". Measure 1, 2, 3, 4 and 5 mL of the "B" solution respectively from a 5 mL buret and dilute to 100 mL using 100 mL volumetric flasks. These 5 solutions will contain 0.02, 0.04, 0.06, 0.08, and 0.10 micrograms of uranine per mL, respectively. Determine the fluorometer readings versus uranine concentration in micrograms per milliliter on linear graph paper. This plot is the standard against which unknown concentrations are determined.

4.5.1.3 Procedure. Random samples shall be selected as specified in 4.3.1 and analyzed for uranine concentration according to the following procedure. The pad selected shall be placed coated-side down in a Buchner funnel. A Buchner funnel with a plate diameter of 56 mm for the 47 mm pads, a plate diameter of 43 mm for the 37 mm pads, and a plate diameter of 30 mm for the 25 mm pads shall be used. Alternate funnels and plates may be substituted as long as suitable washing results are obtained. The pad shall be washed with distilled water until the pad has turned completely white. After appropriate water rinses, the filtrate shall be transferred to a 1 liter volumetric flask and diluted to 1 liter. Pipette 10 mL of this solution into a 100 mL volumetric flask and dilute to the mark. Determine the fluorometer reading, and calculate the uranine content from the standard graph determined in 4.5.1.2.

4.5.2 Heat-seal integrity. All samples shall be conditioned at room temperature for at least 4 hours prior to the testing. The filled and sealed watervaporproof bags shall then be placed in a humidity cabinet. Condition the samples for 16 hours at  $38 \pm 1$  °C ( $100 \pm 2$  °F) and a relative humidity of 90 to 95 percent. There shall be no moisture condensation on the test specimens. The air circulation over the test specimens shall be negligible. After the conditioning period, each bag shall be opened and examined for the presence of water. If moisture is not readily apparent in the bag, immediately remove the detector pad and test for the presence of free water as specified in 4.5.3 and 4.5.4.

4.5.3 Visual test for detector pad color. Immediately after opening the sealed watervaporproof bag, the detector pad shall be visually inspected under normal lighting conditions for color, uniformity of color, and fading. The pad shall have a uniform/even orange color over the entire dyed surface. Under normal lighting, compare the pad to the standards specified in paragraph 3.4. The pad orange color shall appear approximately equal to the standard color. The pad shall be examined to ensure that fading of the pad has not occurred.

4.5.4 Contamination by water. Immediately after opening the sealed watervaporproof bag, the detector pad shall be placed coated side up, under an ultraviolet lamp (equivalent to specification MIL-D-81227 or MIL-D-22612 free water detectors). The detector pad shall be visually examined under the fluorescent light for fluorescence that is characteristic of water contamination. (Utilization of either specification MIL-D-81227 or MIL-D-22612 free water

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detectors helps facilitate the comparison, since, an unaffected detector pad appears identical to the 0 ppm water standard contained in the detectors.)

#### 4.5.5 Filterability/flow test.

4.5.5.1 Procedure. Random samples shall be selected as specified in 4.3.2 and tested for fuel filterability according to the following procedure. This test specifies the procedure to verify that the detector pad allows a sufficient quantity of fuel to pass through within a specified time range under vacuum filtration. Five hundred mL of aviation fuel shall be filtered through the detector pad and the time required to filter this volume shall be determined. The test apparatus specified in ASTM-D5452 (or equivalent) shall be used to conduct this test. The apparatus consists of a funnel and funnel base with a filter support such that the detector pad can be securely locked or clamped between the sealing surfaces of the funnel and its base. The funnel and funnel base shall be of stainless steel or glass construction.

- a. Immediately after opening the sealed watervaporproof bag, the detector pad shall be placed, coated side up in a filtration apparatus of the type shown in ASTM-D5452.
- b. Turn on the vacuum and immediately pour 500 mL of (clean and dry) fuel into the funnel. Start recording the time. A vacuum system that develops in excess of 67.5 kPa (20 in. of mercury) vacuum shall be used. Throughout filtration, maintain a sufficient quantity of fuel in the funnel so the membrane filter is always covered.
- c. After the fuel has completely filtered, turn off the vacuum, and record the time (in seconds). If the fuel has not completely filtered through the detector pad in 50 seconds, the pad has failed the fuel flow requirement of 3.5. The test should be stopped and the result recorded as ">50 seconds."

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. 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.



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## 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 detector pads covered by this specification are intended for use with the Model No. MK II Free Water Detector, MIL-D-81227; the Detector, Contaminated Fuel, Type III, MIL-D-22612; and, the ASTM-D3240 Test Pad Rater (Aqua-Glo) (25 mm pads only). When aviation turbine fuel is filtered through the free water detector pad, the free water in the fuel reacts with the uranine dye on the pad. If free water is present in the fuel, the detector pad will fluoresce under ultra violet light, indicating the quantity of water contaminant in aircraft fuel.

6.2. Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of the specification
- b. Quantity of detector pads
- c. Size (see 1.2)
- d. Submission of a first article sample if required (see 3.1)
- e. Packaging requirements (see 5.1)

6.3 Inspection. Inspection should be performed in accordance with method 9601 of FED-STD-791.

6.4 Material Safety Data Sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

6.5 Definitions.

6.5.1 Lot. A lot consists of all the detector pads that have been manufactured and unit packed from the same batch of paper and coated with the same batch of uranine solution.

6.5.2 Batch. A batch is defined as the end product of all raw materials blended or processed in a single operation.

6.6 Metric conversion factors. Units of measure have been converted to the International System of Units (SI) (Metric) in accordance with ASTM SI 10. If test results are obtained in units other than Metric or there is a requirement to report dual units, ASTM SI 10 should be used to convert the units.

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6.7 Subject term (key word) listing.

Contamination  
 Denatured alcohol  
 Jet fuel  
 Sodium fluorescein  
 Undissolved water

6.8 International standardization agreement implementation. This specification implements ASCC Air Std 15/6, "GUIDE SPECIFICATION (MINIMUM QUALITY STANDARDS) FOR AVIATION FUELS: NATO F-34, F-35, F-40, AND F-44", ASCC Air Std 15/9 , "INTERCHANGEABILITY CHART OF STANDARDIZED AVIATION FUELS, LUBRICANTS AND ALLIED PRODUCTS", NATO STANAG-135, "INTERCHANGEABILITY OF FUELS, LUBRICANTS AND ASSOCIATED PRODUCTS USED BY THE ARMED FORCES OF THE NORTH ATLANTIC TREATY NATIONS", and NATO STANAG-3747, "GUIDE SPECIFICATIONS (MINIMUM QUALITY STANDARDS) FOR AVIATION TURBINE FUELS (F-34, F-35, F-40 AND F-44)". When amendment, revision, or cancellation of this specification is proposed, the preparing activity must coordinate the action with the U.S. National Point of Contact for the international standardization agreement, as identified in the ASSIST database at <http://assist.daps.dla.mil>.

6.9 Identification of changes. Marginal notations are not used in this revision to identify changes with respect to the previous issue, due to the extent of the changes.

Custodians:  
 Army – AT  
 Navy – AS  
 Air Force – 99

Preparing activity:  
 Navy – AS

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Review Activities:  
 Army – AV, AR  
 Air Force – 68, 84  
 DLA – MA, PS

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