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(see 6.9)

MILITARY SPECIFICATION

FUEL, NAVAL DISTILLATE

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

1. SCOPE

1.1 Scope. This specification covers one grade of Naval distillate fuel (NATO symbol F-76).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 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 those listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation. (see 6.2)

SPECIFICATIONS

MILITARY

DoD-A-24682 - Additive, Fuel Oil Stabilizer.

MIL-T-5624 - Turbine Fuel, Aviation, Grades JP-4 and JP-5

NATO-STANAG-1135 - Interchangeability of Fuels, Lubricants and Associated Products used by the Armed Forces of the North Atlantic Treaty Nations.

NATO-STANAG-1385 - Guide Specification (Minimum Quality Standards) for Fuel, Naval Distillate (F76).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 03R42, 2531 Jefferson Davis Highway, Washington, DC 22342-5160 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 9140

STANDARDS

MILITARY
MIL-STD-290 - Packaging of Petroleum and Related Products.

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

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are indicated as DoD adopted are those listed in the current DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D 86 - Standard Test Method for Distillation of Petroleum Products, (DoD adopted)
D 93 - Standard Test Method for Flash Point by Pensky-Martens Closed Tester, (DoD adopted)
D 97 - Standard Test Method for Pour Point of Petroleum Oils (DoD adopted)
D 129 - Standard Test Method for Sulfur in Petroleum Products (General Bomb Method). (DoD adopted)
D 130 - Standard Method for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test. (DoD adopted)
D 189 - Standard Test Method for Conradson Carbon Residue of Petroleum Products
D 287 - Standard Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method). (DoD adopted)
D 445 - Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquid and the Calculation of Dynamic Viscosity). (DoD adopted)
D 482 - Standard Test Method for Ash from Petroleum Products. (DoD adopted)
D 524 - Standard Test Method for Ramsbottom Carbon Residue of Petroleum Products. (DoD adopted)
D 611 - Standard Test Method for Aniline Point and Mixed Aniline Point of Petroleum Products and Hydrocarbon Solvents. (DoD adopted)
D 613 - Standard Test Method for Ignition Quality of Diesel Fuels by the Cetane Method.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) (Contd)

D 664 - Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration.
D 974 - Standard Test Method for Acid and Base Number by Color-Indicator Titration. (DoD adopted)
D 976 - Standard Test Method for Calculated Cetane Index of Distillate Fuels.
D 1141 - Standard Specification for Substitute Ocean Water
D 1298 - Standard Practice for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method. (DoD adopted)
D 1401 - Standard Test Method for Emulsion Characteristics of Petroleum Oils and Synthetic Fluids.
D 1500 - Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale). (DoD adopted)
D 1552 - Standard Test Method for Sulfur in Petroleum Products (High-Temperature Method). (DoD adopted)
D 2274 - Standard Test Method for Oxidation Stability of Distillate Fuel Oil (Accelerated Method).
D 2500 - Standard Test Method for Cloud Point of Petroleum Oils. (DoD adopted)
D 2622 - Standard Test Method for Sulfur in Petroleum Products (X-Ray Spectrographic Method). (DoD adopted)
D 2709 - Standard Test Method for Water and Sediment in Distillate Fuels by Centrifuge. (DoD adopted)
D 3605 - Standard Test Method for Trace Metals in Gas Turbine Fuels by Atomic Absorption and Flame Emission Spectroscopy.
D 4052 - Standard Test Method for Density and Relative Density by Digital Density Meter
D 4057 - Standard Practice for Manual Sampling of Petroleum and Petroleum Products.
D 4176 - Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels (Clear and Bright Pass/Fail Procedures). (DoD adopted)
D 4177 - Standard Practice for Automatic Sampling of Petroleum and Petroleum Products.
D 4294 - Standard Test Method for Sulfur in Petroleum Products by Energy Dispersive X-Ray Florescence Spectroscopy.
D 4530 - Standard Test Method for Micro Carbon Residue of Petroleum Products
D 4808 - Standard Test Method for Hydrogen Content of Light Distillates, Middle Distillates, Gas Oils, and Residua by Low-Resolution Nuclear Magnetic Resonance Spectroscopy.
D 5304 - Standard Test Method for Assessing Distillate Fuel for Storage Stability by Oxygen Overpressure.
D 5452 - Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) (Contd)

E 29 - Recommended Practice for Indicating Which Places of Figures Are To Be Considered Significant in Specified Limiting Values. (DoD adopted)

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

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

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

3. REQUIREMENTS

3.1 General. Requirements contained herein are not subject to corrections for tolerance of test methods. If multiple determinations are made by the inspecting laboratory, average results will be used except for those test methods where repeatability data are given. In those cases, the average value derived from the individual results that agree within the repeatability limits given may be used at the discretion of the inspection authority, provided an indication is given of the total number or results obtained and the number falling outside the repeatability limits. For purposes of determining conformance with each requirement, an observed value or calculated value shall be rounded off "to the nearest unit" in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding-off procedure given in ASTM E 29.

3.2 Material. The fuel supplied under this specification shall be a refined hydrocarbon distillate fuel and may contain only those additives specified in 3.2.1 unless otherwise stated.

3.2.1 Additives. The additives listed herein may be used singly or in combination in amounts not to exceed those specified. The names and dosages of any additives used in the fuel shall be reported along with the results of testing for compliance with the fuel physical and chemical requirements specified in paragraph 3.3 below.

3.2.1.1 Stabilizer additives. Fuel oil stabilizer additive, conforming to DoD-A-24682 and listed in the current QPL-24682, may

be blended into the distillate fuel at a dosage up to 100 milligrams per liter (37.9 grams/100 gallons (U.S.), or 35 pounds/1,000 barrels) for additional protection against deterioration.

3.2.1.1.1 Stabilizer applications. Distillate fuel stabilizer additive conforming to DoD-A-24682 and listed in the current QPL-24682 is not intended for use in fuel acquired for immediate shipboard use. Stabilizer additives conforming to DoD-A-24682 and listed in the current QPL-24682 may be added to improve the accelerated storage stability of the fuel in order to meet the requirement in Table I. The amount added shall not exceed the maximum allowable concentration listed in 3.2.1.1.

3.2.1.2 Metal deactivator. A metal deactivator, N, N-disalicyclidene-1,2 propanediamine may be blended into the fuel in an amount not to exceed 5.8 milligrams of active ingredient per liter of fuel (2.2 grams/100 gallons (U.S.), or 2 lb/1,000 barrels).

3.2.1.3 Ignition improver. The following additives, to raise the ignition quality of the fuel, may be used as required to conform to this specification:

Amyl nitrate (mixed primary nitrates).
Hexyl nitrate (N-hexyl nitrate).
Cyclohexyl nitrate.
N-octyl nitrate.

3.3 Physical and chemical requirements. The Naval Distillate Fuel shall conform to the physical and chemical requirements specified in Table I. Where more than one test method is allowed for a specific requirement, Table I lists the referee test method first and follows it with the notation "(R)" (see 6.3 and 6.7).

TABLE I. Physical and Chemical Requirements.

Characteristic	Requirement	Test Method
PHYSICAL REQUIREMENTS		
Appearance, @ 25°C or ambient temperature whichever is higher	Clear, bright and free of visible particulates	D 4176 1/
Demulsification, @ 25°C, minutes (max)	10	D 1401 2/
Density, @ 15°C, kg/m^3 (max)	876	D 1298 (R), D 4052 D 287
Distillation, 10 % point, °C 50 % point, °C 90 % point, °C, (max) end point, °C, (max) Residue + Loss, % vol.,(max)	 Record Record 357°C 385°C 3.0	D 86 3/
Cloud Point, °C, (max)	-1°C	D 2500
Color, (max)	3	D 1500
Flash Point, °C, (min)	60°C	D 93 4/
Particulate Contamination, mg/liter, (max)	10	D 5452 5/
Pour Point, °C, (max)	-6°C	D 97
Viscosity, @ 40°C, mm^2/second	1 7 - 4.3	D 445
CHEMICAL REQUIREMENTS		
Accelerated Storage Stability, total insolubles, mg/100ml, (max)	1 5	D 5304 (R), D 2274 6/
Acid Number, mg KOH/100ml, (max)	0.30	D 974 (R), D 664
Aniline Point, °C, (min)	60°C	D 611
Ash, % wt., (max)	0.005	D 482
Carbon Residue, on 10% bottoms, % wt., (max)	0.20	D 524 (R), D 4530, D 189 7/
Corrosion, @ 100°C, (max)	No. 1 ASTM	D 130
Hydrogen Content, % wt., (min)	12.5	D 4808
Ignition Quality, Cetane Number, (min) Cetane Index, (min)	42 43	D 613 (R), 8/ D 976
Sulfur Content, % wt. (max)	1.0	D 4294 (R), D 129, D 1552, D 2622
Trace Metals, ppm, (max) Calcium Lead Sodium plus Potassium Vanadium	 1.0 0.5 1.0 0.5	D 3605 9/
Additive Names and Dosages	Record	

1/ If the sample fails ASTM D 4176 because a slight haze was observed, the product must meet the requirement of ASTM D 2709,

0.05 percent volume maximum. A slight haze is acceptable if the water and sediment (ASTM D 2709) does not exceed 0.05 percent volume. If the sample fails ASTM D 4176 because it contains visible sediment or particulate matter, but meets the requirement of 10 mg/l (max) (ASTM D 5452), the fuel is considered acceptable, provided all other requirements are met.

2/ The demulsification test shall be conducted in accordance with the following exceptions:

(a) Synthetic sea water prepared in accordance with ASTM D 1141 shall be used as the emulsifying fluid.
(b) The test temperature shall be 25°C.
(c) The demulsification time shall be that required for separation into two layers with no cuff at the interface. A lacy emulsion which does not form a band or cuff on the wall of the cylinder shall be disregarded. The fuel, water and emulsion layer volumes shall be recorded at one minute intervals and the demulsification time reported shall be to the nearest minute.

3/ As the end point of the distillation is approached, if either a thermometer reading of 385°C or a decomposition point is observed, discontinue the heating and resume the procedure as directed in ASTM D 86.

4/ The flash point value is absolute and no value less than 60°C is permissible.

5/ A one-liter minimum sample shall be used.

6/ ASTM D 2274 may be used as an alternate method for testing storage stability provided the test time is extended from 16 hours to 40 hours.

7/ When the finished fuel contains a cetane improver, the carbon residue requirement specified in Table I shall apply to the base fuel without the cetane improver.

8/ Either cetane number (ASTM D 613) or cetane index (ASTM D 976) shall be reported. The cetane index requirement specified in Table I shall apply to the base fuel without cetane improving additives. Where cetane index is reported, the value shall be reported as the cetane index.

9/ Any quantitative spectroscopic method may be employed if correlation to ASTM D 3605 is demonstrated to the satisfaction of the inspection authority.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to the prescribed requirements.

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

4.2 Lot.

4.2.1 Bulk lot. Bulk lot shall be considered an indefinite quantity of a homogenous mixture of material offered for acceptance in a single isolated container.

4.2.2 Packaged lot. Packaged lot shall be considered an indefinite number of 208-liter (55-gallon) drums or smaller unit containers of identical size and type, offered for acceptance, and filled with a homogenous mixture of material from one isolated container; or filled with a homogenous mixture of material manufactured in a single plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient material.

4.3 Sampling.

4.3.1 Sampling for bulk tests. Bulk samples for tests shall be taken in accordance with ASTM D 4057 for manual sampling and ASTM D 4177 for automatic sampling. Samples shall be tested in accordance with Table I (see 6.3 and 6.7).

4.3.2 Sampling for examination of packaged lots. A random sample of packaged containers shall be taken from each lot in accordance with Table II. The sample shall be examined in accordance with 4.4.

TABLE II. Sampling for Examination of Packaged Lots.

LOT SIZE	SAMPLE SIZE
1-13	All
14-150	13
151-250	32
251-500	50
501-1,200	80
1,201-3,200	125
3,201-10,000	200
10,001-35,000	315
35,001 and over	500

4.4 Examination of the preparation for delivery. Samples taken in accordance with 4.3.2 shall be examined for compliance with MIL-STD-290 with regard to fill, closure, sealing, leakage, packaging, packing, and marking requirements. Any container having one or more defects, or under the required fill shall be rejected. (see 6.6)

4.5 Inspection of packaging. Sample packages and packs, and the inspection of the preservation, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packing requirements specified herein apply only for direct Government acquisition.)

5.1 Preservation, packing, and marking. Preservation, packing, and marking shall be in accordance with MIL-STD-290. The level of preservation, packing, type and size and quantity of unit containers shall be as specified in the acquisition documents (see 6.2).

6. NOTES

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

6.1 Intended use. Naval Distillate Fuel is intended for use in all shipboard boilers, gas turbines, and diesel engines at ambient temperatures above -1.1°C. Other uses may be specified according to the needs of the Department of Defense. The use of a fuel stabilizer additive conforming to DoD-A-24682 and listed in the current version of QPL-24682 may be used. When gas turbines and diesel engines are exposed to ambient temperatures that consistently fall below -1.1°C, JP-5 in accordance with MIL-T-5624 should be used instead of Naval Distillate Fuel.

6.2 Acquisition requirements. Acquisition documents should specify the following:

(a) Title, number, and date of this specification.
(b) Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2)
(c) Applicable level of preservation and packing required (see 5.1).
(d) Unit container type, size and quantity (see 5.1).

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Description (DID) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirement List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
3.3 & 4.3.1	DI-NDTI-80809	Test and Inspection Reports	----

The above DID's were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.4 International interest. Certain provisions of this specification are the subject of international standardization agreement, NATO STANAG-1135. When amendment, revision, or cancellation of this specification is proposed which will modify the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization offices to change the agreement or make other appropriate accommodations. In addition, this specification complies with NATO-STANAG-1385, guide specification for Naval Distillate Fuel.

6.5 NAVSEA approval and direction. Deviation from specified materials, procedures and requirements and selection of specific alternative materials and procedures require NAVSEA approval or direction. Requests should include supporting documentation.

6.6 Examination lot acceptance/rejection criteria. If as a result of the examination of the preparation for delivery (see 4.4), the number of defective or under-filled containers exceeds the Reject Limit number of Table III, the lot represented by the sample should be rejected.

TABLE III. Lot Acceptance/Rejection Criteria. 1/2/3/

LOT SIZE	SAMPLE SIZE	REJECT LIMIT
1-13	All	Any
14-150	13	1
151-250	32	2
251-500	50	3
501-1,200	80	4
1,201-3,200	125	6
3,201-10,000	200	11
10,001-35,000	315	15
35,001 and over	500	22

1/ All defective items must be replaced with acceptable items prior to lot acceptance.
2/ Inspect sample size until reject criteria is reached
3/ Rejected lots may be screened and resubmitted for inspection and retest.

6.7 Order of reporting test results. The results of testing for compliance with the requirements of Table I shall be listed in test reports in the order in which the physical and chemical requirements are presented in Table I.

6.8 Subject term (Key word Listing).

Diesel
Distillate Fuel
Ignition improver
Marine diesel
Marine gas oil
Metal deactivator
Refined hydrocarbon distillate fuel
Stabilizer Additive

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

Custodians:
Army - ME
Navy - SH
Air Force - 68

Review activities:
Navy - YD, SA, MC, CG
DLA - PS, GS

Preparing activity:
Navy - SH
(Project 9140-0125)