

METRIC

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## DETAIL SPECIFICATION

### SPECTROMETRIC OIL STANDARDS

Reinstated after 12 August 2013 and may be used for new and existing designs and acquisitions.

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

#### 1. SCOPE

1.1 Scope. This specification covers the requirements for blended spectrometric oil standards for use in calibrating or verifying the calibration of spectrometers used in spectrometric analysis of metallic elements found in oils and other fluids.

1.2 Classification. The blended spectrometric oil standards are of the following types:

Type	Description of the Spectrometric Oil Standards Type
D19-0	Spectrometric oil standards (SOS) with 0 elements
D19-XXX <sup>1</sup>	Series of Spectrometric oil standards (SOS) with 19 elements (Aluminum, Chromium, Copper, Iron, Lead, Magnesium, Nickel, Silicon, Silver, Sodium, Tin, Titanium, Boron, Molybdenum, Zinc, Barium, Cadmium, Manganese, Vanadium).
D12-XXX <sup>1</sup>	Spectrometric oil standards (SOS) with 12 elements (Aluminum, Chromium, Copper, Iron, Lead, Magnesium, Nickel, Silicon, Silver, Sodium, Tin, Titanium)
D3-100	Spectrometric oil standards (SOS) with 3 elements (Boron, Molybdenum, Zinc)
D21-XXX <sup>1</sup>	Spectrometric oil standards (SOS) with 21 elements (Aluminum, Chromium, Copper, Iron, Lead, Magnesium, Nickel, Silicon, Silver, Sodium, Tin, Titanium, Boron, Molybdenum, Zinc, Barium, Cadmium, Manganese, Vanadium, Calcium, Phosphorus)

**Note:** <sup>1</sup> The “XXX” is replaced by the corresponding concentration of the elements in the applicable standard. For example D19-005 contains 5 parts per million (ppm) of the 19 elements listed in the description. The D19 and D21 series of standards are produced in the nominal concentrations of 5, 10, 30, 50, 80, 100, 120, 300, 500, 700, and 900 ppm. The D12 series of standards are produced in the nominal concentrations of 5, 10, 30, 50, 100, and 300 ppm.

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Air Warfare Center, Aircraft Division, Code 4L8000B120-3, Highway 547, Lakehurst, NJ 08733-5100 or emailed to [michael.sikora@navy.mil](mailto:michael.sikora@navy.mil). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

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## 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 cited in sections 3 and 4 of this specification, whether or not they are listed.

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 these documents are those cited in the solicitation or contract.

## ASTM INTERNATIONAL

- ASTM D92 - Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
- ASTM D97 - Standard Test Method for Pour Point of Petroleum Products
- ASTM D445 - Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- ASTM D2270 - Standard Practice for Calculating Viscosity Index from Kinematic Viscosity at 40 and 100° C
- ASTM D2273 - Standard Test Method for Trace Sediment in Lubricating Oils
- ASTM D4052 - Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
- ASTM D4057 - Standard Practice for Manual Sampling of Petroleum and Petroleum Products
- ASTM D4177 - Standard Practice for Automatic Sampling of Petroleum and Petroleum Products
- ASTM D5185 - Standard Test Method for Determination of Additive Elements, Wear Metals, and Contaminants in Used Lubricating Oils and Determination of Selected Elements in Base Oils by Inductively Coupled Plasma Atomic Emission Spectrometry
- ASTM D6595 - Standard Test Method for Determination of Wear Metals and Contaminants in Used Lubricating Oils or Used Hydraulic Fluids by Rotating Disc Electrode Atomic Emission Spectrometry

(Copies of these documents are available online at [www.astm.org](http://www.astm.org) or from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959.)

## AMERICAN SOCIETY FOR QUALITY (ASQ)

ASQ-Z1.4 - Sampling Procedures and Tables for Inspection by Attributes.

(Copies of this document are available online at [www.asq.org](http://www.asq.org) or from the American Society for Quality, P.O. Box 3005, 611 East Wisconsin Avenue, Milwaukee, WI 53201-4606.)

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## SAE INTERNATIONAL

SAE J1966 – Lubricating Oils, Aircraft Piston Engine (Non-Dispersant Mineral Oil)

(Copies of this document are available from <http://www.sae.org> or from the SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

2.3 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, 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 Qualification. The spectrometric oil standards furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3).

3.2 Material. The standards shall be prepared from metallo-organic concentrates and base oil.

3.2.1 Metallo-organic concentrates. The metallo-organic concentrates shall consist of metallo-organic or organic oil-miscible liquid compounds or solutions and a fully compatible preservative, stabilizing additive. The compounds shall be fully soluble/miscible in the base oil.

3.2.2 Base oil. The base oil for blending the standards shall be an SAE 50 mineral oil that meets the requirements of Table I, which is analogous to an SAE J1966 non-additive mineral aircraft engine lubricating oil. The base oil shall be tested to verify that no trace metals exceed 1 part per million (ppm), milligrams per kilogram.

3.3 Spectrometric oil standards (SOS). The spectrometric oil standards shall be prepared using materials specified in 3.2 to the concentration specified in the contract. Nominal concentrations are 5 ppm, 10 ppm, 30 ppm, 50 ppm, 80 ppm, 100 ppm, 120 ppm, 300 ppm, 500 ppm, 700 ppm, and 900 ppm for types D19-XXX and D21-XXX; 5 ppm, 10 ppm, 30 ppm, 50 ppm, 100 ppm, and 300 ppm for type D12-XXX; 100 ppm for type D3-100; 0 ppm for type D19-0.

3.3.1 Type D19-0. Type D19-0 shall be a 0 standard that meets the requirements specified in Table I and does not exceed the elemental requirements in Table II.

3.3.2 Type D19-XXX. Type D19-XXX spectrometric oil standard (SOS) shall meet the requirements specified in Table I and contain the elements at the appropriate concentrations as listed for Type D19 standards in Table II. Nominal concentrations for D19 standards are 5 ppm,

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10 ppm, 30 ppm, 50 ppm, 80 ppm, 100 ppm, 120 ppm, 300 ppm, 500 ppm, 700 ppm, and 900 ppm.

3.3.3 Type D12-XXX. Type D12-XXX spectrometric oil standard (SOS) shall meet the requirements specified in Table I and contain the elements at the appropriate concentrations as listed for Type D12 standards in Table II. Nominal concentrations for D19 standards are 5 ppm, 10 ppm, 30 ppm, 50 ppm, 100 ppm, and 300 ppm.

3.3.4 Type D3-100. Type D3-100 spectrometric oil standard (SOS) shall meet the requirements specified in Table I and contain the elements at the concentration of 100 ppm as listed for Type D3 standards in Table II.

3.3.5 Type D21-XXX. Type D21-XXX spectrometric oil standard (SOS) shall meet the requirements specified in Table I and contain the elements at the appropriate concentrations as listed for Type D21 in Table II. Nominal concentrations for D21 standards are 5 ppm, 10 ppm, 30 ppm, 50 ppm, 80 ppm, 100 ppm, 120 ppm, 300 ppm, 500 ppm, 700 ppm, and 900 ppm.

3.4 Homogeneity. All blended spectrometric oil standards shall be homogeneous, free of sediment or precipitate and shall not indicate any mirroring or silvering appearance from the silver element.

3.5 Spectrometric oil standards stability. The spectrometric oil standards shall have a shelf life stability of not less than 30 months for Types D12-XXX and D19-0 and not less than 12 months for Types D19-XXX, D21-XXX, and D3-100. Shelf life beyond the above limits shall be established on laboratory test data (see 6.3).

3.6 Toxicity. The spectrometric oil standards shall have no adverse effect on the health of personnel when used for its intended purpose in accordance with the safety standards issued by the Occupational Safety and Health Administration (OSHA) (see 6.5 and 6.6).

3.7 Properties. Spectrometric oil standards shall meet all of the requirements of this specification when tested as specified in Table I and 4.4.1 through 4.4.2.

3.8 Unit pack. Spectrometric oil standards shall meet all of the unit pack requirements of this specification as specified in 3.8.1 through 3.8.3.

3.8.1 Containers. Natural high-density polyethylene cylinder bottles with 24/410 neck finish, 8 ounce capacity, shall be used. The bottles shall have a 24/410 white polypropylene unlined flip top cap and a 24/410 natural unlined low-density polyethylene Yorker cap with red tip.

3.8.2 Packing. The natural high-density polyethylene cylinder bottles shall be packed in Kraft mailing tubes with end caps (2.5" x 7" x 0.060").

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3.8.3 Labeling. All containers and mailing tubes shall be labeled in accordance with the applicable federal, state, and municipal laws, statutes, regulations, and ordinances. In addition to the labeling, the following shall appear on each container.

Shelf Life/Expiration Date

National Stock Number (NSN)

“Keep closed when not in use”

“Store at 50-80 °F”

“Protect from bright light, humidity, and water”

TABLE I. Chemical and physical property requirements and test methods.

Physical property	Requirement	Test Method
Density at 60 °F	report	ASTM D4052
Viscosity (mm <sup>2</sup> /s at 100 °C)	16.3 min., 21.9 max.	ASTM D445
Viscosity Index, Min	85	ASTM D2270
Trace Sediment	0.005 ml/100 mL Oil max.	ASTM D2273
Pour point	-12 °C max.	ASTM D97
Flash point, minimum (COC)	243 °C	ASTM D92
Metal Elements (Rotrode-AES)	See Table IV	ASTM D6595
Metal Elements (ICP-AES)	See Table V	ASTM D5185

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TABLE II. List of elements and formulations by type.

Element (chemical symbol)	Spectrometric Oil Standards Types				
	D19-0	D21-XXX	D19-XXX	D12-XXX	D3-100
Aluminum (Al)	<1 ppm	1.00 X	1.00 X	1.00 X	
Chromium (Cr)	<1 ppm	1.00 X	1.00 X	1.00 X	
Copper (Cu)	<1 ppm	1.00 X	1.00 X	1.00 X	
Iron (Fe)	<1 ppm	1.00 X	1.00 X	1.00 X	
Lead (Pb)	<1 ppm	1.00 X	1.00 X	1.00 X	
Magnesium (Mg)	<1 ppm	1.00 X	1.00 X	1.00 X	
Nickel (Ni)	<1 ppm	1.00 X	1.00 X	1.00 X	
Silicon (Si)	<1 ppm	1.00 X	1.00 X	1.00 X	
Silver (Ag)	<1 ppm	1.00 X	1.00 X	1.00 X	
Sodium (Na)	<1 ppm	1.00 X	1.00 X	1.00 X	
Tin (Sn)	<1 ppm	1.00 X	1.00 X	1.00 X	
Titanium (Ti)	<1 ppm	1.00 X	1.00 X	0.92 X	
Boron (B)	<1 ppm	1.00 X	1.00 X		1.15 X
Molybdenum (Mo)	<1 ppm	1.00 X	1.00 X		0.85 X
Zinc (Zn)	<1 ppm	1.00 X	1.00 X		1.00 X
Barium (Ba)	<1 ppm	1.00 X	1.00 X		
Cadmium (Cd)	<1 ppm	1.00 X	1.00 X		
Manganese (Mn)	<1 ppm	1.00 X	1.00 X		
Vanadium (V)	<1 ppm	1.00 X	1.00 X		
Calcium (Ca)	<1 ppm	1.00 X			
Phosphorus (P)	<1 ppm	1.00 X			

Where X = nominal concentration of spectrometric oil standard in ppm

#### 4. VERIFICATION

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

- a. Qualification inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 Qualification inspection. Qualification inspection shall consist of testing to all the tests specified in Table I and 4.4 through 4.4.3. The extended storage stability test (see 4.4.3) shall be performed after the candidate product has passed all other qualification tests. Tentative qualification approval may be granted to products undergoing the extended storage stability tests. Upon successful completion of the extended storage stability test, full qualification approval may be granted. Failure to pass the extended storage stability test is cause for withdrawal of qualification approval.

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4.2.1 Requalification. Requalification shall be required when any reformulation or change is made in the source of manufacture, purity, or composition of the base oil or organo-metallic concentrates. A minor change in the oil formulation may be made without requalification testing, but only after notification to, and approval by, the qualification activity (see 6.3).

4.2.2 Sampling. Qualification samples shall consist of six 8 ounce bottles of each type D21-XXX and D19-XXX in nominal concentrations of 5 ppm, 10 ppm, 30 ppm, 50 ppm, 80 ppm, 100 ppm, 120 ppm, 300 ppm, 500 ppm, 700 ppm, and 900 ppm; six 8 ounce bottles of type D12-XXX in nominal concentrations of 5 ppm, 10 ppm, 30 ppm, 50 ppm, 100 ppm, and 300 ppm; six bottles of Type D3-100 and six bottles of Type D19-0 (see 6.3.1 and 6.3.2).

4.3 Conformance inspection. Conformance inspection shall consist of the tests specified in Table III. Failure to pass any conformance test shall be cause for rejection.

TABLE III. Conformance tests.

Physical property	Requirement	Test Method
Viscosity (mm <sup>2</sup> /s at 100 °C)	16.3 min., 21.9 max.	ASTM D445
Metal Elements (ICP-AES)	See Table V	ASTM D5185

4.3.1 Sampling and inspection. Each bulk lot (see 6.4) of material for conformance inspection shall be sampled at random in accordance with ASTM D4057 or ASTM D4177. A sample of two 8 ounce bottles of every production lot supplied to the procuring activity shall be forwarded to the Naval Air Station Receiving Officer, HAZMART Bldg. 2385, Sample (AIR-4.4.6.1), 22680 Hammond Road, Patuxent River, MD 20670.

4.3.2 Examination of filled containers. A random sample of filled containers from each lot (see 6.4), taken in accordance with ASQ-Z1.4 shall be examined with regard to fill, closure, sealing and leakage. Reject any container having one or more defects or for being under the required fill.

4.3.3 Conformance test inspection report. The conformance inspection report (see 6.2) on each lot of oil produced for U.S. Government use shall be approved by the qualification activity (see 6.3).

4.3.4 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the applicable paragraphs of this specification.

4.4 Test methods. All tests shall be performed in accordance with Table I and 4.4.1 through 4.4.2. Failure to pass any test shall be cause for rejection.

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4.4.1 Rotrode qualification testing. Testing of spectrometric oil standards shall be done as a statistical analysis and performed on the data generated by the spectrometric analysis to provide an accuracy index (AI) and repeatability index (RI) for each element involved.

4.4.1.1 Test method. The qualification testing of spectrometric oil standards shall consist of ten replicates of each standard. The results shall be obtained with a Spectroil M/N spectrometer or equivalent direct reading, rotating disk electrode, atomic emission spectrometer approved by the Joint Oil Analysis Program-Coordinating Group (JOAP-CG).

4.4.1.1.1 Accuracy index (AI). The accuracy index (AI) of spectrometric oil standards shall meet the requirements specified in Table IV for the appropriate ppm concentration level. If the spectrometric oil standard does not meet the specified accuracy index then the spectrometric oil standard shall be rejected.

The accuracy index is as follows:

$$AI = |Y - \bar{X}|$$

Where Y = nominal value of the SOS in ppm

$\bar{X}$  = average measured value of the SOS in ppm

4.4.1.1.2 Repeatability index (RI). The repeatability index (RI) of the spectrometric oil standards shall meet the requirements specified in Table IV for the appropriate ppm concentration level. If the results are not satisfactory for the spectrometric oil standards, then the spectrometric oil standard shall be rejected.

The repeatability index is as follows:

$$\sqrt{\frac{N(\sum X_i^2) - (\sum X_i)^2}{N(N-1)}}$$

Where N = number of replicates = 10

$X_i$  = individual analysis result

$\Sigma$  = summation of the analytical data

4.4.2 ICP qualification testing. Testing of spectrometric oil standards shall be done as a statistical analysis and performed on the data generated by the spectrometric analysis to provide an accuracy index (AI) for each element involved.

4.4.2.1 Test method. The qualification testing of spectrometric oil standards shall consist of five replicates of each standard. Spectrometric oil standards shall be diluted on a weight-by-weight basis with a suitable ICP solvent. Typically, spectrometric oil standards in concentrations



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5 ppm, 10 ppm, 30 ppm, and 50 ppm shall be diluted tenfold. Spectrometric oil standards in concentrations 80 ppm, 100 ppm, 120 ppm, 300 ppm, 500 ppm, 700 ppm, and 900 ppm shall be diluted to an appropriate concentration for the given calibration curve. The results shall be obtained with an inductively coupled plasma optical emission spectrometer approved by the Joint Oil Analysis Program-Coordinating Group (JOAP-CG).

4.4.2.1.1 Accuracy index (AI). The accuracy index (AI) of spectrometric oil standards shall meet the requirements specified in Table V for the appropriate ppm concentration level. If the spectrometric oil standard does not meet the specified accuracy index, then the spectrometric oil standard shall be rejected.

The accuracy index is as follows:

$$AI = |Y - \bar{X}|$$

Where Y = formulation concentration of the SOS in ppm (see Table II)

$\bar{X}$  = average measured value of the SOS in ppm

4.4.3 Extended storage stability test. Two 8 ounce samples for each type of spectrometric oil standards shall be stored at room temperature maintained at  $25 \pm 5$  °C for the following periods. Type D19-0: 30 months, Type D12-XXX: 30 months, Type D19-XXX: 12 months, Type D3-100: 12 months, and Type D21-XXX: 12 months. At the midpoint and end of these storage periods, the respective sample shall be examined for conformance to the requirements specified in Table III.

TABLE IV. Rotrode accuracy and repeatability limits.

Element	Accuracy Index (AI)												Repeatability Index (RI)											
	0	5	10	30	50	80	100	120	300	500	700	900	0	5	10	30	50	80	100	120	300	500	700	900
Al	0.6	0.9	2.1	3.3	4.5	5.7	7.5	9.3	33.0	45.0	57.0	69.0	0.5	0.6	0.7	1.5	2.5	3.5	5.0	8.0	15.0	25.0	35.0	45.0
Cr	0.6	0.9	2.1	3.3	4.5	5.7	7.2	8.7	33.0	45.0	57.0	69.0	0.5	0.6	0.7	1.5	2.5	3.5	5.0	8.0	15.0	25.0	35.0	45.0
Cu	0.8	1.2	2.1	4.5	7.1	9.6	13.7	17.7	45.0	70.0	95.0	120.0	0.5	0.7	1.0	2.7	4.5	6.5	9.0	11.0	27.0	45.0	63.0	81.0
Fe	0.8	1.2	2.1	3.9	6.3	8.7	12.0	15.3	39.0	63.0	87.0	111.0	0.5	0.6	0.9	2.4	4.0	6.0	8.0	10.0	24.0	40.0	56.0	72.0
Pb	1.2	1.5	2.1	3.3	5.0	6.6	9.2	11.7	33.0	50.0	67.0	84.0	0.9	1.0	1.0	2.0	3.1	4.5	6.0	9.0	18.0	30.0	42.0	54.0
Mg	0.8	1.2	2.1	4.5	7.1	9.6	13.7	17.7	45.0	70.0	95.0	120.0	0.5	1.0	1.6	4.8	8.0	8.5	9.0	11.0	27.0	45.0	63.0	81.0
Ni	0.6	0.9	2.1	3.3	4.5	5.7	7.5	9.3	33.0	45.0	57.0	69.0	0.5	0.6	0.7	1.5	2.5	3.5	5.0	8.0	15.0	25.0	35.0	45.0
Si	0.6	0.9	2.1	3.3	4.5	5.7	7.5	9.3	33.0	45.0	57.0	69.0	0.5	0.6	0.7	1.5	2.5	3.5	5.0	8.0	15.0	25.0	35.0	45.0
Ag	1.0	1.8	2.1	3.9	6.3	8.7	12.0	15.3	39.0	63.0	87.0	111.0	0.5	0.6	0.9	2.4	4.0	6.0	8.0	10.0	24.0	40.0	56.0	72.0
Na	0.8	2.0	3.3	8.7	14.1	19.5	28.5	37.5	87.0	140.0	193.0	246.0	0.5	1.0	1.6	4.8	8.0	12.0	16.0	20.0	48.0	80.0	112.0	144.0
Sn	1.2	1.5	2.1	3.3	5.0	6.6	9.2	11.7	33.0	50.0	67.0	84.0	0.5	1.0	1.0	2.0	3.1	4.5	6.0	9.0	18.0	30.0	42.0	54.0
Ti	0.6	0.9	2.1	3.3	4.7	6.0	8.7	11.4	33.0	47.0	61.0	75.0	0.5	0.6	0.7	1.8	3.0	4.3	6.0	9.0	18.0	30.0	42.0	54.0
B	0.6	0.9	2.1	3.3	4.7	6.0	8.7	11.4	33.0	47.0	61.0	75.0	0.5	0.6	0.7	1.8	3.0	4.3	6.0	9.0	18.0	30.0	42.0	54.0
Mo	0.8	1.2	2.1	3.9	6.3	8.7	12.0	15.3	39.0	63.0	87.0	111.0	0.5	0.6	0.9	2.4	4.0	5.5	8.0	10.0	24.0	40.0	56.0	72.0
Zn	0.8	1.5	2.4	6.2	9.9	13.7	19.5	25.4	62.0	99.0	136.0	173.0	0.5	0.8	1.3	3.6	6.0	9.0	12.0	18.0	36.0	60.0	84.0	108.0
Ba	0.8	1.2	2.1	3.9	6.3	8.7	12.0	15.3	39.0	63.0	87.0	111.0	0.5	0.6	0.7	1.8	3.0	4.5	6.0	9.0	18.0	30.0	42.0	54.0
Cd	0.8	1.2	2.1	3.9	6.3	8.7	12.0	15.3	39.0	63.0	87.0	111.0	0.5	0.6	0.7	1.8	3.0	4.5	6.0	9.0	18.0	30.0	42.0	54.0
Mn	0.8	1.2	2.1	3.9	6.3	8.7	12.0	15.3	39.0	63.0	87.0	111.0	0.5	0.6	0.7	1.8	3.0	4.5	6.0	9.0	18.0	30.0	42.0	54.0
V	0.8	1.2	2.1	3.9	6.3	8.7	12.0	15.3	39.0	63.0	87.0	111.0	0.8	0.6	0.9	1.8	3.0	4.5	6.0	9.0	18.0	30.0	42.0	54.0
Ca	0.5	1.2	1.5	3.3	5.5	8.3	10.0	12.6	32.0	53.0	73.9	95.0	0.5	0.6	0.8	1.8	2.8	3.5	3.8	4.1	10.0	20.0	29.8	40.0
P	4.4	6.0	7.5	15.5	18.2	19.4	20.0	21.6	35.0	60.0	82.3	105.0	1.1	1.5	1.9	5.5	7.5	9.3	10.0	12.5	15.0	25.0	32.6	40.0

Note: The column headings, 0, 5, 10, 30, 50, 80, 100, 120, 300, 500, 700 and 900 denote the nominal concentration in parts per million (ppm).

TABLE V. ICP accuracy limits.

	Type D19-0	Type D19-XXX and D21-XXX											Type D12-XXX						Type D3-100
Element	0	5	10	30	50	80	100	120	300	500	700	900	5	10	30	50	100	300	100
Al	1.0	1.4	1.8	2.9	3.5	4.3	4.7	5.1	7.4	9.1	10.4	11.5	1.4	1.8	2.9	3.5	4.7	7.4	-----
Cr	1.0	0.6	1.0	2.2	3.2	4.5	5.4	6.2	12.3	18.0	23.1	27.9	0.6	1.0	2.2	3.2	5.4	12.3	-----
Cu	1.0	0.5	1.0	2.7	4.2	6.5	7.9	9.4	21.5	34.3	46.6	58.6	0.5	1.0	2.7	4.2	7.9	21.5	-----
Fe	1.0	0.5	0.8	2.0	3.0	4.3	5.2	6.0	12.5	18.8	24.5	30.0	0.5	0.8	2.0	3.0	5.2	12.5	-----
Pb	1.0	2.7	3.3	4.8	5.6	6.5	7.0	7.4	9.9	11.7	13.0	14.1	2.7	3.3	4.8	5.6	7.0	9.9	-----
Mg	1.0	0.6	1.2	3.0	4.6	6.9	8.4	9.8	21.6	33.5	44.8	55.6	0.6	1.2	3.0	4.6	8.4	21.6	-----
Ni	1.0	1.1	1.6	2.8	3.5	4.5	5.0	5.4	8.5	10.9	12.9	14.6	1.1	1.6	2.8	3.5	5.0	8.5	-----
Si	1.0	2.0	2.4	3.1	3.6	4.1	4.3	4.5	5.7	6.5	7.1	7.6	2.0	2.4	3.1	3.6	4.3	5.7	-----
Ag	1.0	0.6	1.0	2.5	3.9	5.7	6.9	8.0	17.1	26.1	34.5	42.5	0.6	1.0	2.5	3.9	6.9	17.1	-----
Na	1.0	1.4	2.2	4.6	6.5	8.8	10.2	11.5	21.1	29.6	37.0	43.7	1.4	2.2	4.6	6.5	10.2	21.1	-----
Sn	1.0	3.2	3.5	4.3	4.7	5.1	5.3	5.4	6.3	6.9	7.3	7.6	3.2	3.5	4.3	4.7	5.3	6.3	-----
Ti	1.0	1.0	1.3	1.9	2.3	2.7	3.0	3.2	4.5	5.4	6.1	6.7	0.9 <sup>A</sup>	1.2 <sup>A</sup>	1.8 <sup>A</sup>	2.2 <sup>A</sup>	2.9 <sup>A</sup>	4.3 <sup>A</sup>	-----
B	1.0	1.3	2.6	7.8	13.0	20.8	26.0	31.2	78.0	130.0	182.0	234.0	-----	-----	-----	-----	-----	-----	29.9 <sup>B</sup>
Mo	1.0	0.9	1.5	3.1	4.5	6.2	7.3	8.3	15.7	22.5	28.4	33.9	-----	-----	-----	-----	-----	-----	6.5 <sup>C</sup>
Zn	1.0	0.6	1.1	3.0	4.7	7.1	8.6	10.1	22.7	35.6	47.8	59.7	-----	-----	-----	-----	-----	-----	8.6
Ba	1.0	0.7	1.1	2.3	3.2	4.3	5.0	5.7	10.4	14.5	18.1	21.4	-----	-----	-----	-----	-----	-----	-----
Cd	1.0	0.8	1.5	4.5	7.5	12.0	15.0	18.0	45.0	75.0	105.0	135.0	-----	-----	-----	-----	-----	-----	-----
Mn	1.0	0.5	1.0	3.0	5.0	3.0	10.0	5.0	30.0	50.0	50.0	90.0	-----	-----	-----	-----	-----	-----	-----
V	1.0	0.3	0.6	1.8	3.1	4.9	6.1	7.3	18.3	30.5	42.7	54.9	-----	-----	-----	-----	-----	-----	-----
Ca	1.0	0.5	1.0	3.0	5.0	8.0	10.0	12.0	30.0	50.0	19.2	90.0	-----	-----	-----	-----	-----	-----	-----
P	1.0	3.3	4.9	9.3	12.6	16.5	18.8	20.9	35.5	47.8	58.1	67.2	-----	-----	-----	-----	-----	-----	-----

Note: The column headings, 0, 5, 10, 30, 50, 80, 100, 120, 300, 500, 700, and 900 denote the nominal concentration in parts per million (ppm).

<sup>A</sup> - Ti concentration = 0.92X, where X = nominal concentration of spectrometric oil standard in ppm.

<sup>B</sup> - B concentration = 1.15X, where X = nominal concentration of spectrometric oil standard in ppm.

<sup>C</sup> - Mo concentration = 0.85X, where X = nominal concentration of spectrometric oil standard in ppm.

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## 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 requisite 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.

## 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 spectrometric oil standards covered by this specification are intended for use in calibration and standardization of spectrometers used in spectrometric analysis for metallic elements found in oils and other fluids.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification
- b. Type required (see 1.2)
- c. Concentration required
- d. Quantity desired
- e. Submittal of conformance test results (see 4.3.3)
- f. Packaging requirements (see 5.1)
- g. FAR clause 52.223-3.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in the applicable Qualified Products List, QPL-85694, whether or not such products have actually been so listed by that date. The attention of the 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 orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from the Navy Oil Analysis Program, 22229 Elmer Road, Building 2360, Patuxent River, MD 20670. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.dla.mil/>.

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6.3.1 Data. To initiate the qualification process, forward a written request, including general information on the proposed candidate material, to the address in 6.3. Written response to this will be a "letter of authorization," which will provide detailed instructions for the submission of product samples and test data.

6.3.2 Sample. The typical minimum qualification test sample consists of six 8 ounce bottles of the complete series of D19-XXX and D12-XXX standards and six 8 ounce bottles of D19-0 and D3-100 standards. The D21-XXX series of standards may also be submitted at the same time but is not required. Samples must be submitted to the Naval Air Station Receiving Officer, HAZMART Bldg. 2385, Sample (AIR-4.4.6.1), 22680 Hammond Road, Patuxent River, MD 20670. Each sample bottle is to be identified by a securely attached, durable tag or label marked with the following information:

QUALIFICATION INSPECTION SAMPLE  
SPECTROMETERIC OIL STANDARD  
MIL-DTL-85694

Type: \_\_\_\_\_  
Name of Manufacturer: \_\_\_\_\_  
Batch Number: \_\_\_\_\_  
Date of manufacture: \_\_\_\_\_

6.4 Definition. Bulk lot - A bulk lot is defined as an indefinite quantity of homogeneous mixture of material offered for acceptance in a single isolated container or manufactured by a single plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient material.

6.5 Submission of Material Safety Data Sheets (MSDS). The contractor must furnish to the contracting activity the toxicological data and formulations required to evaluate the safety of the material for the proposed use through the submission of the MSDS detailed in FED-STD-313.

6.6 Toxicity questions. Questions pertinent to the adverse effect on the health of personnel should be referred by the contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency (see 6.5).

6.7 Subject term (key word) listing.

Calibration  
Metal content in oil and other fluids  
Metallo-organic concentrates  
Spectrometer calibration  
Wear detection

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

### CONCLUDING MATERIAL

Custodians:

Army – CR4  
Navy – AS  
Air Force – 68  
DLA – GS

Preparing activity:

Navy – AS  
(Project 9150-2013-006)

Review activities:

Army – AM, AV  
Air Force – 11

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 the ASSIST Online database at <https://assist.dla.mil>.