

W-S-506B
June 15, 1977
SUPERSEDING
W-S-506A
6 June 1963

FEDERAL SPECIFICATION

SPARK PLUG

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers spark plugs used on non-aircraft internal combustion engines requiring electric-spark ignition systems (see 6.1).

1.2 Classification.

1.2.1 Types, classes. Spark plugs shall be of the following types, and classes, as specified (see 6.2).

Type I.--Shielded (zero gas leakage through insulator).
Class A.--Suppressed.
Class B.--Nonsuppressed.

Type II.--Shielded.
Class A.--Suppressed.
Class B.--Nonsuppressed.

Type III.--Unshielded.
Class A.--Suppressed.
Class B.--Nonsuppressed.

1.2.2 Style. Electrode tip style shall be as specified when required (see 3.3.1 and 6.2).

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

Federal Specification:

TT-N-97 - Naphtha; Aromatic.

Federal Standard:

Fed. Std. No. 123 - Marking for Shipment. (Civilian agencies)

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles, Philadelphia, PA, Houston, TX, and Seattle, WA.

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(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Specifications

MIL-L-2104	-	Lubricating Oil, Internal Combustion Engine (Heavy Duty)
MIL-C-6529	-	Corrosion Preventive, Aircraft Engine
MIL-E-17555	-	Electronic and Electrical Equipment, Accessories, and Repair Parts; Packaging and Packing of
MIL-G-46015	-	Gasoline, Automotive, Combat (Referee Grade)

Military Standards

MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	-	Marking for Shipment and Storage
MIL-STD-130	-	Identification Marking of US Military Property
MIL-STD-461	-	Electromagnetic Interference Characteristics Requirements for Equipment
MIL-STD-462	-	Electromagnetic Interference Characteristics, Measurement of
MIL-STD-810	-	Environmental Test Methods
MS35910	-	Gasket, Spark Plug: Nonaircraft

(Copies of Military Specifications and Standards required by suppliers in connection with specific procurement functions should be obtained from the procuring 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. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

Society of Automotive Engineers, Inc., (SAE) Standards.

J548	-	Spark Plugs
J549	-	Preignition Rating of Spark Plugs

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

3. REQUIREMENTS

3.1 Qualification. The spark plugs furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.2 and 6.3).

3.2 Materials. Materials shall be as specified herein, on applicable drawings, and in applicable specifications. Current-carrying spring members shall be of a corrosion-resistant material.

3.3 Design and construction. Spark plug design and construction shall conform to the applicable Military Standard or drawing (see 6.2). Type III spark plugs shall conform to current SAE J548.

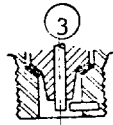
3.3.1 Electrode tip style. Electrode tip style shall be as indicated on applicable drawings and standards, or as specified in Figure 1 (see 6.2). When a style is not specified, the style tip provided shall conform with the style tip of the commercial products identified in the procurement description.



1
FLAT SHELL
SINGLE GROUND
(SEE STYLE 4)



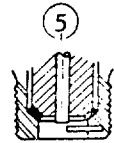
2
SINGLE SAWED GAP
GROUND ELECTRODE



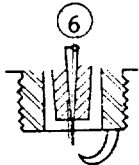
3
PUSH SHELL
SINGLE GROUND



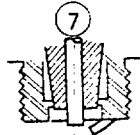
4
FLAT SHELL
SINGLE GROUND
(SEE STYLE 1 & 17)



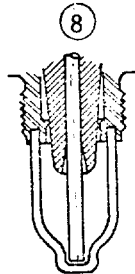
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PUSH SHELL
SINGLE GROUND
(SEE STYLE 3)



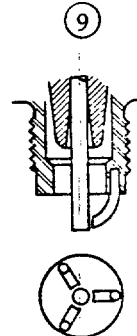
6
POINTED GAP
SINGLE GROUND



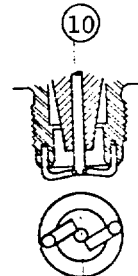
7
SLANTED GAP
SINGLE GROUND



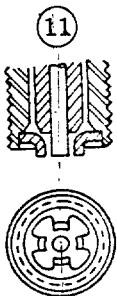
8
"U" TYPE GROUND
(SEE STYLE 16)



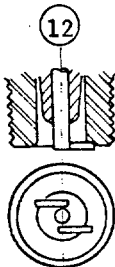
9
THREE ROUND GROUND
ELECTRODES
(SEE STYLE 15)



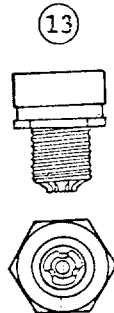
10
TWO ROUND GROUND
ELECTRODES



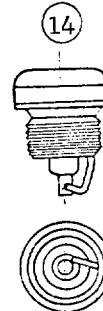
11
FOUR GAP GROUND
ELECTRODES



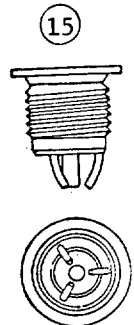
12
TWO FLAT GROUND
ELECTRODES



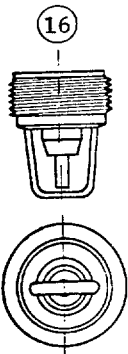
13
TRIPLE GAP GROUND
ELECTRODES



14
SINGLE ROUND GROUND
ELECTRODE



15
THREE ROUND
GROUND ELECTRODES
(SEE STYLE 9)



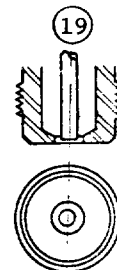
16
SINGLE "U" TYPE GROUND
ELECTRODE (SEE ALSO STYLE 8)



17
SINGLE GROUND ELECTRODE
(SEE STYLE 4)



18
SINGLE GROUND
EXTENDED TIP
(SEE STYLE 1)



19
SURFACE GAP FIRING END DESIGN
WITH INTERNAL AUXILIARY GAP

FIGURE 1 Electrode Tip Styles

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3.3.2 Terminals. Unless otherwise specified (see 6.2), type III spark plug terminals may be removable or nonremovable at the option of the contractor. Terminal configuration shall conform to current SAE J548.

3.3.3 Ceramic Insulator. The exterior of the ceramic of type III spark plugs and the inner barrel of the ceramic of types I and II spark plugs shall be glazed.

3.3.4 Threads. Unless otherwise specified on drawings or standards, thread dimensions for all types of spark plugs shall conform to SAE J548.

3.3.5 Resistors. Resistors used to suppress types I, II and III, class A plugs, shall be an internal type and shall not be removable with common tools without damaging the plug or seal.

3.3.6 Gaskets. Gaskets shall be provided when required and shall conform to MS35910 or to SAE J548 when applicable. Conical seat spark plugs shall be furnished without gaskets.

3.4 Performance.

3.4.1 Torque resistance.

3.4.1.1 Spark plug. When tested in accordance with 4.5.1.1, with dry threads, spark plugs shall withstand the torque values specified in table I, when applied to the hex without damage to the threads or other portions of the plug. There shall be no change or distortion to the threads or other portions of the plug. There shall be no change or distortion to the gap setting. The plugs shall subsequently conform to 3.4.3. Marking of conical seat during torque test is acceptable.

TABLE I. Torque requirements

Type	Size	Torque*	
		N·m	lb.-ft.
Flat Seat	10 mm.	20	15
Flat Seat	12 mm.	27	20
Flat Seat	14 mm.	60	45
Flat Seat	18 mm.	80	60
Flat Seat	7/8 in.	100	75
Conical Seat	14 mm.	20	15
Conical Seat	18 mm.	27	20

*These torque values are for test purposes only. Proper installation torques are specified in SAE J548.

3.4.1.2 Terminal end. When tested in accordance with 4.5.1.2, types I and II spark plugs shall withstand a 25 pound-foot (34 N·m) torque applied at the lead terminal end to the nut and ferrule specified on the applicable lead and conduit assembly military design standard. There shall be no damage to the threads, gap setting, or other portions of the plug which would impair installation or operation. Plug shall subsequently conform to 3.4.3.

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3.4.2 Electrical resistance. Unless otherwise specified on the Military standard or drawing, the suppressor resistor rating of types I and II, class A spark plugs shall be no greater than 15,000 ohms or no less than 7,500 ohms when tested in accordance with 4.5.2. An additional tolerance of plus or minus 2,500 ohms shall be allowed when tested at $450^{\circ} \pm 50^{\circ}\text{F}$ ($232^{\circ} \pm 28^{\circ}\text{C}$) and after the endurance test.

Class A, type III, and all class B spark plugs shall be tested in accordance with 4.5.2.3. All type III, class A suppressors shall have a resistance rating no greater than 15,000 ohms nor less than 2,500 ohms. Class B spark plugs shall not exceed 2,500 ohms.

3.4.3 Gas leakage.

3.4.3.1 Type I. When tested as specified in 4.5.3, there shall be zero gas leakage through the insulator into the terminal area of the spark plug, and the total leakage at all other points shall be not more than five cubic centimeters (cc) per minute.

3.4.3.2 Types II and III. When tested as specified in 4.5.3, the total gas leakage occurring at all points, shall be not more than five cubic centimeters (cc) per minute.

3.4.4 Pre-ignition rating. When determined as specified in SAE J549 (see 4.5.4), the average IMEP (indicated mean effective pressure) rating (psi) of the spark plugs tested shall be within plus or minus five percent of the IMEP rating specified on the applicable Military standard or drawing or as specified in the procurement document (see 6.2). The spark plugs shall then pass the subsequent tests specified in tables II and III.

3.4.5 High voltage. When tested as specified in 4.5.5, the spark plug insulator shall evidence no cracking, charring, or flashover.

3.4.6 Insulator resistance. When tested as specified in 4.5.6, the minimum electrical resistance of the spark plug insulator shall be one megohm (one million ohms).

3.4.7 Endurance. When tested as specified in 4.5.7, the spark plugs shall not crack, chip, char, burn, or cause pre-ignition. During the 50-hour fouling portion of the test, the power output of the test engine at the end of each of the two minute check points shall be more than 70 percent of the power observed with the reference check plugs installed. After the test, the total gap growth of the electrode of class A plugs shall be less than 0.004 inch (0.101mm) and the materials from which the plugs are made shall be examined for evidence of deterioration. If evidence of material deterioration is noted, the second 50-hour portion of the 100-hour test shall be repeated. The total gap growth of class A plugs after 150 hours of testing shall be less than 0.010 inch (0.254mm).

3.4.8 Salt fog (corrosion). When types I and II spark plugs are tested as specified in 4.5.8, the resultant corrosion on the plugs shall not impair their ability to pass the subsequent tests specified in table II.

3.4.9 Electromagnetic interference. When tested as specified in 4.5.9, all Class A Types I and II spark plugs shall meet the electromagnetic interference requirements of MIL-STD-461 for Class IIC equipment.

3.4.10 Ground electrode bending. When tested in accordance with 4.5.10, ground electrodes of spark plugs conforming to styles 1, 2, 4, 9, 14, 17, and 18 of figure 1 shall not break or crack.

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3.5 Dimensions. The dimensions for all spark plugs shall be as specified on applicable Military standards or drawings. For plugs not covered by drawings or standards, the mounting thread size and reach, and any other essential data, shall be as specified in procurement documents (see 6.2). General configuration shall conform to SAE J548.

3.6 Identification marking.

3.6.1 Military agencies. Identification marking shall be in accordance with MIL-STD-130 and shall be legible after completion of the corrosion test and, as a minimum shall include the following:

Government part number (types I and II only.) (See 6.2).
Manufacturer's name or identification.

3.6.2 Civil agencies. Each spark plug shall be stamped, etched, rolled or otherwise permanently and legibly marked on the body of the plug with the manufacturer's part number, name, and trademark of such known character that the source of manufacture may be readily identified.

3.7 Workmanship. Workmanship shall be such as to assure a useable product free of burrs, rust, cracks, and sharp edges.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facility 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 that supplies and services conform to prescribed requirements.

4.2 Qualification testing. A qualification sample of 40 spark plugs of each type, class, and IMEP rating to be tested, shall be submitted for qualification testing including one spark plug without an internal resistor with each lot of class A (see 4.5.10). The samples shall be representative of the units proposed to be furnished under the contract. Qualification testing shall be conducted by the Government or at a place acceptable to the Government and shall consist of examination for the defects specified in 4.3.2.2 and testing as specified in table II or III in the order listed.

TABLE II. Order of qualification testing of Types I and II

<u>Specimens</u>	<u>Paragraph</u>	<u>Test sequence</u>
(a) 10 plugs	4.5.4	Pre-ignition rating
	4.5.1	Torque
	4.5.2	Electrical resistance
	4.5.2	Electrical resistance (77°F/ 25°C only)
	4.5.5	High voltage
	4.5.6	Insulator resistance
(b) 10 plugs	4.5.9	Electromagnetic interference
	4.5.7	Endurance
	4.5.1	Torque
	4.5.2	Electrical resistance
	4.5.3	Gas leakage

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TABLE II (Cont)

<u>Specimens</u>	<u>Paragraph</u>	<u>Test sequence</u>
(b) 10 plugs	4.5.10	Ground electrode bending
	4.5.5	High voltage
	4.5.6	Insulator resistance
	4.5.9	Electromagnetic interference
(c) 6 plugs	4.5.8	Salt fog (corrosion)
	4.5.1	Torque
	4.5.9	Electromagnetic interference

TABLE III. Order of qualification testing of Type III

<u>Specimens</u>	<u>Paragraph</u>	<u>Test sequence</u>
(a) 10 plugs	4.5.4	Pre-ignition rating
	4.5.1	Torque
	4.5.2	Electrical resistance (77°F/ 25°C only)
	4.5.3	Gas leakage
	4.5.5	High voltage
	4.5.6	Insulator resistance
(b) 10 plugs	4.5.7	Endurance
	4.5.10	Ground electrode bending
	4.5.2	Electrical resistance
	4.5.3	Gas leakage
	4.5.5	High voltage
	4.5.6	Insulator resistance

4.2.1 Failure. Failure of any specimen to pass any examination or test specified herein may be cause, at the option of the Government, for refusal to conduct additional testing until the faults revealed by the test have been corrected.

4.3 Quality conformance inspection.

4.3.1 Sampling.

4.3.1.1 Lot formation. A lot shall consist of all spark plugs of one type, class, style, IMEP rating, and one part number, from an identifiable production period, from one manufacturer, submitted at one time for acceptance.

4.3.1.2 Sampling for examination. Samples for quality conformance shall be selected in accordance with MIL-STD-105.

4.3.1.3 Sampling for testing. A representative sample shall be selected in accordance with level S-3 of MIL-STD-105 from each lot that has passed the inspection specified in 4.3.2.2.

4.3.2 Examination.

4.3.2.1 Acceptable quality level. Each spark plug selected in accordance with 4.3.1.2 shall be examined for conformance to the following acceptable quality levels (AQL) on the percent defective basis:

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<u>Classification</u>	<u>AQL</u>
Major	1.0
Minor	2.5

4.3.2.2 Classification of defects. For examination purposes, defects shall be classified as specified in table IV.

TABLE IV. Classification of defects

<u>Categories</u>	<u>Defects</u>	<u>Method of inspection</u>
<u>Major</u>		
101	Terminals (See 3.3.2)	Visual
102	Ceramic glaze (See 3.3.3)	Visual
103	Threads (See 3.3.4)	Visual - Gage
104	Resistors (See 3.3.5)	Visual
105	Dimensions affecting gasket seating (See 3.5)	Gage
<u>Minor</u>		
201	Spark-gap dimensions (See 3.5)	Gage
202	Gasket size, finish, and appearance (See 3.3.6)	Visual
203	Hex dimensions (See 3.5)	Gage
204	Identification marking (See 3.6)	Visual
205	Workmanship (See 3.7)	Visual

4.3.3 Testing.

4.3.3.1 Quality conformance test. Samples selected in accordance with 4.3.1.3 shall be subjected to the tests specified in table V using an AQL of 6.5 on the percent defective basis.

TABLE V. Order of quality conformance testing

<u>Paragraph</u>	<u>Test</u>
4.5.1	Torque
4.5.3	Gas linkage
4.5.5	High voltage

4.4 Control test.

4.4.1 Sampling for control test. Five spark plugs of each type, class and style to be furnished shall be selected at the start of a contract. This control test sample shall be identified as to production period and, after having been examined for the defects specified in 4.3.2.2, they shall be subjected to the test specified in 4.5.4. Samples shall then be selected periodically throughout the duration of the contract for a total sample of one percent of the contract, but not to exceed 20 spark plugs of one type, class, and style for testing in accordance with 4.5.4. The five spark plugs initially tested shall be used as calibration spark plugs to establish the average IMEP rating (psi) (see 3.4.4) and rejection or acceptance of the spark plugs subsequently tested shall be based on that average.

4.4.2 Failure. Failure of any control test sample to pass any examination or test specified herein may be cause, at the option of the Government, for refusal to accept subsequent lots until the faults revealed by the test have been corrected.

4.5 Test procedures.

4.5.1 Torque.

4.5.1.1 Spark plug. To determine conformance to 3.4.1.1, the electrode end of the specimens shall be screwed without thread lubricant into a clean and dry test fixture. The specified torque shall be applied with a torque wrench. The specimens shall then be removed and examined for conformance to 3.4.1.1.

4.5.1.2 Terminal end. To determine conformance to 3.4.1.2, the electrode end of the specimens shall be screwed without thread lubricant, into a clean and dry, test fixture, except that the 10mm spark plugs shall be clamped at the hex in a vise. The specified torque shall be applied with a torque wrench. The specimens shall then be removed and examined for conformance to 3.4.1.2.

4.5.2 Electrical resistance. To determine conformance to 3.4.2; Types I and II spark plugs with Class A resistor shall be tested according to 4.5.2.1 and 4.5.2.2. Types I and II, Class B and Type III spark plugs shall be tested according to 4.5.2.3.

4.5.2.1 Test conditions. The spark plug shall be stabilized at $77^{\circ} \pm 15^{\circ}\text{F}$ ($25^{\circ} \pm 8^{\circ}\text{C}$) and the resistance measured at high voltage according to 4.5.2.2. The specimens shall then be placed in the ambient air temperature of $450^{\circ} \pm 50^{\circ}\text{F}$ ($232^{\circ} \pm 28^{\circ}\text{C}$) for 16 hours, and while still at this temperature the resistance shall again be measured at high voltage according to 4.5.2.2.

4.5.2.2 High voltage test for Class A spark plugs. Test equipment shall be used to produce short duration high peak voltage pulses across the plug resistor with the following parameters:

Pulse Repetition Rate	1 to 5 pulses/sec.
Pulse Duration	100 micro seconds (max.).
Pulse Peak Voltage.	5000 ± 25 volts
Pulse Rise Time15 micro seconds (max.).

An oscilloscope or other suitable device shall be used to determine true resistance value under these test conditions.

4.5.2.3 Low voltage test for Class A type III and all Class B spark plugs. The spark plugs shall be stabilized at $77^{\circ} \pm 15^{\circ}\text{F}$ ($25^{\circ} \pm 8^{\circ}\text{C}$) and the resistance at low voltage (not to exceed 12 volts) shall be checked with a general purpose ohmeter having a two (2) percent accuracy tolerance.

4.5.3 Gas leakage. To determine conformance to 3.4.3, for type I (zero gas leakage), types II and III spark plugs, tests shall be conducted with spark plugs stabilized at a temperature of $77^{\circ} \pm 15^{\circ}\text{F}$ ($25^{\circ} \pm 8^{\circ}\text{C}$). The amount of gas leakage shall be determined by a liquid displacement method using a pressure bomb and nitrogen gas (see figure 2 Gas Leakage Test Apparatus). After removal from the liquid, spark plug shall be cleaned with petroleum naphtha. When tested for acceptance, an alternate procedure, that has been approved by the Government may be used.

4.5.3.1 System check. Leakage in the system shall be detected by depressurizing the reservoir so that 25 inches (63.5 cm) of water vacuum is applied to the plug body with no pressure applied to the firing end. Any variance in burette (vacuum test gage) readings under these conditions is due to system leakage and should be corrected before proceeding with the test.

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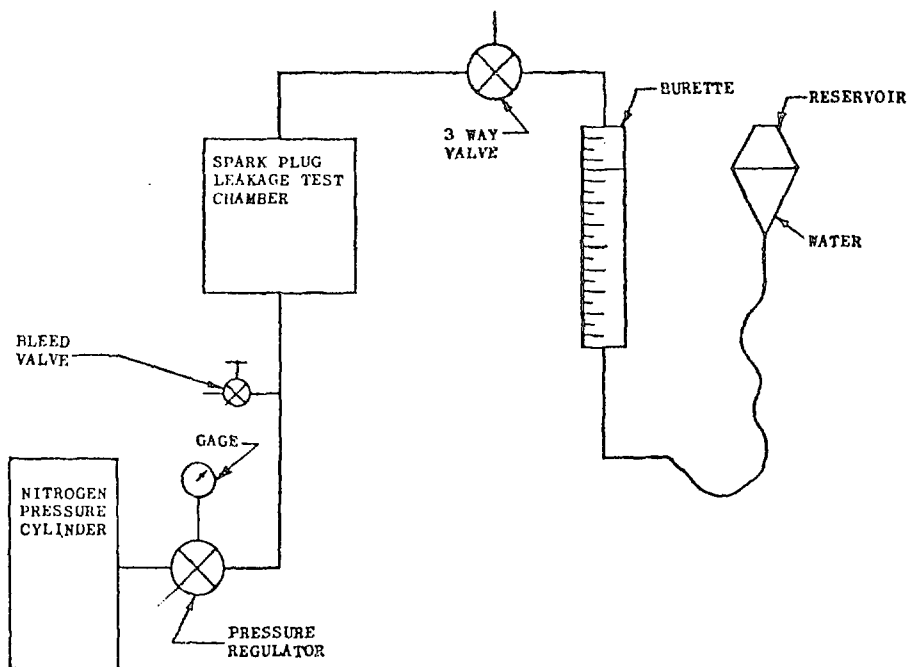


FIGURE 2 Typical Gas Leakage Test Apparatus

4.5.3.2 Test procedures. Spark plug threads shall be lubricated with a coating of grade 10 oil conforming to MIL-L-2104 or compound conforming to MIL-C-6529. An approved spark plug gasket shall be used (when applicable) and the test performed at $77^{\circ} \pm 15^{\circ}\text{F}$ ($25^{\circ} \pm 8^{\circ}\text{C}$). Seat leakage shall be observed by placing a small amount of liquid around the gasket and observing any bubbles with 800 pounds per square inch (psi) (5516 kilopascals (kPa)) pressure applied to the firing end. Leakage through the plug shall be determined by the difference in liquid levels in the burette (liquid level test gage) over a five minute period during which the top of the plug is sealed and vented only to the burette and 800 psi (5516 kPa) applied at the firing end of the plug. Readings shall be taken with the liquid level in the burette and reservoir the same, and with the system sealed from the atmosphere.

4.5.4 Pre-ignition rating. The pre-ignition rating of spark plugs shall be conducted in accordance with current SAE J549, and the IMEP rating (psi) shall be calculated to determine conformance to 3.4.4.

4.5.5 High voltage. The shell electrode shall be removed or turned away from the center electrode (if necessary to prevent sparking) and the firing end of each spark plug insulated with gas pressure or by an insulating liquid. An alternating, 60-cycle voltage shall be applied between the center electrode and the spark plug shell and gradually increase to 9000 volts root mean square (rms). This voltage shall be maintained for one minute. Any evidence of failure of the spark plug insulator showing cracking, charring or flashover, shall be recorded to determine conformance to 3.4.5.

4.5.6 Insulator resistance. Each spark plug shall be placed in a heating chamber and heated to $900^{\circ} \pm 25^{\circ}\text{F}$ ($482^{\circ} \pm 14^{\circ}\text{C}$). While at the temperature, the electrical resistance of the insulator shall be measured from the firing end of the spark plug, using 500 volts direct current (DC), to determine conformance to 3.4.6.

4.5.7 Endurance. Fuel used for this test shall conform to grade 1 of MIL-G-46015. Engine oil shall conform to MIL-L-2104. "Reference Check Plugs" as referred to shall be selected from the group of plugs submitted for test (test plugs), however, the reference check plugs shall be used only at check points.

4.5.7.1 Test procedure.

4.5.7.1.1 Engine selection. The engine selected must be one that would normally use the spark plug to be tested. The engine must be in good operating condition. The engine power output (observed) when checked with the reference check plugs at the specified check periods shall be within three percent of the initial check value. If the power output is outside these limits, the engine shall be checked carefully and the deficiencies corrected.

4.5.7.1.2 Engine preparation. Before testing each new set of test plugs, the engine cylinder head shall be removed and all combustion chambers cleaned. Engine inspection checks before and after each test plug fouling and high load endurance test shall include the following:

- Cylinder compression pressures.
- Valve rocker clearance.
- Distributor and breaker point condition and setting (if used).
- Ignition harness system.
- Ignition timing.
- Inspection for engine oil and water leaks, fan belt, and dynamometer couplings.

With the installation of new test plugs the following shall be conducted:

- Spark plug gap adjusted to engine requirement.
- New gasket used as specified in 3.3.6.
- Plugs torqued to specification value (see SAE J548).

4.5.7.1.3 Engine-power output (observed) reference checks. The engine-power output of the selected engine to be used shall be determined in accordance with table VI before and after the 50 hour fouling test and after the high load endurance test. Reference check plugs shall be used. The table indicates the percentage of the rated maximum engine RPM and the rated BHP performance at the corresponding RPM percentage of the test engine used.

TABLE VI. Percent of engine rated

Rpm	Bhp
45	100
60	100
75	100
90	100
100	100
90	100
75	100
60	100
45	100

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4.5.7.1.4 50-hour fouling test. After the engine is performing satisfactorily in accordance with 4.5.7.1.3 checks, replace the reference check plugs with test plugs and operate the engine for 50 hours to the schedule in table VII under the following conditions:

Coolant temperature $150^{\circ} + 5^{\circ}\text{F}$ ($66^{\circ} + 2^{\circ}\text{C}$).
 Gallery oil temperature not to exceed 225°F (107°C).
 Plugs shall not be removed or rotated.

Record the following during the test:

- (a) All performance data at half-hour intervals except during the brief check periods at wide-open throttle (WOT).
- (b) Only engine load and rpm, and intake manifold pressure at the end of each two minute check period.
- (c) Only engine load and rpm, fuel flow, and intake manifold pressure at the end of each five minute power check period.

If, within the two or five minute check periods, the engine operation is not steady, determine the maximum load at which the engine will operate steady at constant speed. During the test periods, under the above noted conditions, constant observations shall be made for indications of pre-ignition. If pre-ignition is encountered, operate the engine only long enough as is necessary to confirm the pre-ignition condition.

4.5.7.1.5 Spark plug inspection after 50-hour fouling test. Upon completion of the 50-hour fouling test, remove test plugs from engine and inspect visually. Do not clean, adjust gap or service. Measure gap of each test plug.

TABLE VII. Fouling test schedule

Cycle	Period	Percent of rated engine		Test time			
		Rpm	Beam load-lbs.	Each period		Total	
		%	%	Hrs.	Min.	Hrs.	Min.
A 1-hour rated power output and pre-ignition check	1	Idle	0	-	10	-	10
	2	45	100	-	5	-	15
	3	60	100	-	5	-	20
	4	76	100	-	5	-	25
	5	90	100	-	5	-	30
	6	100	100	-	30	1	-
B 14 hours lead fouling	7	45	20	4	-	5	-
	8	45	100	-	2	5	2
	9	Idle	0	-	13	5	15
	10*	Idle	0	-	15	5	30
	11	45	20	4	30	10	-
	12	45	100	-	2	10	2
	13	Idle	0	-	13	10	15
	14*	Idle	0	-	15	10	30
	15	45	20	4	30	15	-
C 1-hour rated power output	16	45	100	-	2	15	2
	17	100	100	-	2	15	4
	18	100	100	-	6	15	10
	19	100	100	-	50	16	-
D 4-hour carbon fouling	20	Idle	0	-	30	16	30
	21*	Idle	0	3	30	20	-
	-	200	-	-	-	-	-

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TABLE VII. Fouling test schedule (cont.)

Cycle	Period	Percent of rated engine		Test time			
		Rpm	Beam load-lbs.	Each period		Total	
		%	%	Hrs.	Min.	Hrs.	Min.
E	22	45	100	-	2	20	2
25 hours lead fouling	23	45	20	4	58	25	-
	24	45	100	-	2	25	2
	25	Idle	0	-	13	25	15
	26*	Idle	0	-	15	25	30
	27	45	20	4	30	30	-
	28	45	100	-	2	30	2
	29	Idle	0	-	13	30	15
	30*	Idle	0	-	15	30	30
	31	45	20	4	30	35	-
	32	45	100	-	2	35	2
	33	Idle	0	-	13	35	15
	34*	Idle	0	-	15	35	30
	35	45	20	4	30	40	-
	36	45	100	-	2	40	2
	37	Idle	0	-	13	40	15
	38*	Idle	0	-	15	40	30
	39	45	20	4	33	45	3
F	40	45	100	-	2	45	5
5-hours rated power output and pre-ignition check	41	60	100	-	5	45	10
	42	75	100	-	5	45	15
	43	90	100	-	5	45	20
	44	100	100	4	-	49	20
	45	90	100	-	5	49	25
	46	75	100	-	5	49	30
	47	60	100	-	5	49	35
	48	45	100	-	5	49	40
	49	Idle	0	-	20	50	-

*Check oil level

4.5.7.1.6 50-hour high-load endurance. Install reference check plugs in the engine and determine the power output as specified in 4.5.7.1.3. If there is a loss in engine power greater than three percent, determine cause and eliminate. If the engine power output (observed) checks within three percent of the value determined prior to the 50-hour fouling test (see table VI) replace the reference check plugs with the same test plugs which completed the 50-hour fouling test. Operate the engine for 50 hours in accordance with the cyclic (high-load endurance test schedule) specified in table VIII. The engine test conditions shall be as follows:

- (a) Coolant temperature $180^{\circ} + 5^{\circ}\text{F}$ ($82^{\circ} + 2^{\circ}\text{C}$).
- (b) Oil gallery temperature shall not exceed 225°F (107°C).
- (c) Spark plugs shall not be removed or rotated at any time.
- (d) New gaskets shall be used as specified in 3.3.1.

Record performance data at each one hour period. During the test periods at wide open throttle, continually observe for indications of pre-ignition. Check engine oil level at each five hour period and refill when necessary.

TABLE VIII. High-load endurance test schedule

Period	Time (hours)	Percent engine rated	
		Rpm	Absolute Bhp
One	1	25	25
Two	1	75	75
Three	3	100	100

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4.5.7.1.7 Spark plug inspection after 50-hour high-load endurance test. Upon completion of the 50-hour high-load endurance test, remove test plugs and install reference check plugs. Determine engine-power output (observed) and check with previous power results. Examine test plugs for physical damage and deterioration of materials and measure the electrode gap.

4.5.8 Salt fog (corrosion). To determine conformance to 3.4.8, the spark plugs shall be subjected to the salt fog test specified in method 509 of MIL-STD-810. Preparation shall conform to 3.1.5 of method 509 with the threads protected and the firing end of the plug sealed. The terminal end of the plug shall be sealed using the same connector with which it is intended to be used in service.

4.5.9 Electromagnetic interference test. To determine conformance to 3.4.9, the spark plug shall be tested in accordance with the applicable provisions of MIL-STD-462.

4.5.9.1 Resistor-suppressor. The plug shall be fired by a motor-driven, integrally shielded and suppressed magneto with the plug subjected to 80 psi (552 kPa) air pressure. The RF energy produced by the plug while being fired by the magneto shall be monitored by an RF inductive pickup inserted at an unshielded point in the shielded high-tension lead assembly between the magneto and the plug. The instrumentation used to sense the RF at the inductive pickup shall be Radio Interference Measuring Set An/URM-85 or equivalent. Reference readings of the RF energy produced by a sample shall be obtained over the frequency range of 155 mc to 1000 mc using one of the class A sample plugs without resistor (see 4.4). The remaining test plugs shall then be tested at the same frequencies and the emanating RF energy subsequently monitored shall conform to MIL-STD-461 at all frequencies. The gap setting for all tests shall be 0.025 inch (0.6 mm).

4.5.9.2 Shielding effectiveness. While the specimens are fired in the test jig used to check the resistor-suppressor in 4.5.9.1, the specimen plugs shall be subjected to the applicable RF interference test, for shielding effectiveness, conforming to MIL-STD-461.

4.5.10 Ground electrode bending. To determine conformance to 3.4.10, the spark plug ground electrode shall be adjusted to obtain a gap of 0.050 inch (1.2 mm) above the normal setting, then reset the gap specified for the engine in which the plug is being tested. This procedure shall be performed three times without a break or crack failure.

4.6 Inspection of preparation for delivery. An inspection shall be made to determine compliance with the requirements of section 5. Defects shall be scored in accordance with Table IX. The sample unit shall be one shipping container fully prepared for delivery. The lot size shall be the number of shipping containers offered for acceptance at one time. The inspection level shall be S-4, with an AQL of 4.0 defects per hundred units.

TABLE IX. Classification of defects

Marking	Omitted, incorrect, wrong location
Materials	Packing materials not as specified missing, damaged, or non-serviceable.
Workmanship	Straps not properly tensioned. Containers inadequately closed, poor application of internal packing parts, intermediate packs loose not secured.

5. PREPARATION FOR DELIVERY

5.1 Cleaning, drying, preservation, packaging, packing and marking. Cleaning, drying, preservation, packaging, packing and marking for the desired level of protection shall be in accordance with the applicable packaging standard or packaging data sheet specified by the procuring activity (see 6.2). When no detailed instructions are provided cleaning, drying, preservation, packaging, and marking shall be in accordance with the applicable level of MIL-E-17555. Packaging and packing shall be as specified in the Item Purchase Description for civil agencies.

5.2 Marking. Each unit package shall be marked with commercial markings which may include the National Stock Number. In addition to any special marking required by the contract or order, (see 6.2), each intermediate package and shipping container shall be marked in accordance with Federal Standard Number 123 for Civil agencies and with MIL-STD-129 for Military activities as applicable.

6. NOTES.

6.1 Intended use. Spark plugs covered by this specification are intended for use in commercial and military internal combustion engines requiring electric-spark ignition.

6.2 Ordering data. Purchasers should select the preferred options permitted herein, and include the following information in procurement documents:

- (a) Title, number, and date of this specification.
- (b) Type, class, and when applicable, style of spark plug required (see 1.2.1 and 3.3.1).
- (c) Applicable Military standard or drawing (see 3.3).
- (d) When a specific type of terminal nut is required (see 3.3.2).
- (e) Shield thread size, if different (see 3.3.4).
- (f) Pre-ignition rating for spark plugs not covered by Military standards or drawings (see 3.4.4).
- (g) Applicable required dimensions for spark plugs not covered by Military standards or drawings (must include reach and mounting thread size) (see 3.5).
- (h) Government part number to be marked on spark plug (types I and II only, see 3.6.1).
- (i) Selection of applicable packaging standard of packaging data sheet (see 5.1).
- (j) Any special marking requirements (see 5.2).

6.3 Qualification. When qualification of a product is a requirement of the specification, information concerning such qualification shall apply as follows: With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, 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. The activity responsible for the Qualified Products Lists should be contacted for information pertaining to qualification of products.

6.3.1 Manufacturer's samples for qualification. At the discretion of the qualifying activity, qualification of one type and class of spark plug may establish qualification of another type and class in accordance with table X.

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TABLE X. Qualification of one plug by another

Type and class tested	Type I		Qualification established for			
	A	B	Type II		Type III	
			A	B	A	B
Type I, Class A	X	X			X	X
Type I, Class B		X				X
Type II, Class A			X	X	X	X
Type II, Class B		X		X		X
Type III, Class A					X	X
Type III, Class B						X

6.4 Cleaning. Petroleum naphtha as covered by TT-N-97, has been found satisfactory for spark-plug cleaning.

6.5 Pre-ignition-rating test engine. The engine shall be as specified in SAE J549 or an equivalent method used to determine IMEP rating of the spark plug.

6.6 High peak voltage test generator. Equipment to produce the high peak voltage necessary to calculate electrical resistance, as specified in 4.5.2, may be of any design producing the required parameters. Information pertaining to approved equipment and test methods may be obtained from the U.S. Army Tank-Automotive Materiel Readiness Command, Warren, MI 48090.

6.7 International standardization agreement. Certain provisions of this specification are the subject of international standardization agreement NATO-STANG 2602. When amendment, revision, or cancellation of this specification is proposed which will affect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization offices, if required.

Custodians:

Army - AT
Navy - YD
Air Force - 82

Preparing activity:

Army - AT

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Review activities:

Army - EL
Air Force - 85
DSA - CS

User activities:

Army - AV, GL, MI, MU
Navy - MC, SH

International Agreement
(see Section 6)

Civil Agency Coordinating Activity

GSA - FSS

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SPECIFICATION COMMENT SHEET

29-R0175

INSTRUCTIONS

This form provides a way for users of this specification to inform the originator of problems encountered in its use. It is not to be used to request changes to accommodate proprietary features. All comments will be considered and appreciated, but please do not expect a reply. To comment, detach, complete, fold, staple, and mail to GSA-FSS-FYS, CMBg 4, Rm. 903, Washington, DC 20406

NOTE: Comments on this form do not constitute or imply authorization to waive any part of the document or serve to amend contractual requirements.

1. SPECIFICATION

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Spark Plug

2. CONTRACT NO. (If any)

3. QUANTITY ON CONTRACT (Optional)

4. DOLLAR VALUE (Optional)

5. GENERAL NATURE OF PROBLEM (e.g., inspection difficulties, manufacturers unable to meet tolerances, containers collapse under normal warehousing conditions, etc.)

6. SPECIFIC REQUIREMENTS AFFECTED (Include paragraph number and lines of wording)

7. SPECIFIC PROBLEMS (e.g., tests in 4.2.2 will not assure that the battery will last required time; temperature ranges in table 2 do not conform to commercially available items.)

8. RECOMMENDATIONS

9. NAME OF MANUFACTURER, ASSOCIATION, GOVT., AGENCY, ETC.

10. ADDRESS (Number, Street, City, State and Zip Code)

11. NAME AND TITLE OF SUBMITTER

12. DATE