

MIL-S-52028C  
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SUPERSEDING  
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## MILITARY SPECIFICATION

SWITCH, VEHICULAR IGNITION: WATERPROOF,  
STARTER AND MAGNETO, WITH DEGASSER CONTROL

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

### 1. SCOPE

1.1 Scope. This specification covers ignition switches for controlling magnetos and auxiliary equipment on engines in military vehicles.

### 2. APPLICABLE DOCUMENTS

#### 2.1 Government documents.

\* 2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48397-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

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SPECIFICATIONS  
FEDERAL

- QQ-A-591 - Aluminum Alloy Die Castings.
- QQ-S-571 - Solder, Tin Alloy: Tin-Lead Alloy; and Lead Alloy.

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- MIL-M-14 - Molding Plastics and Molded Plastic Parts, Thermosetting.
- MIL-F-13927 - Fungus Resistance Test; Automotive Components.
- MIL-C-46168 - Coating, Aliphatic Polyurethane, Chemical Agent Resistant.
- MIL-C-53039 - Coating, Aliphatic Polyurethane, Single Component, Chemical Agent Resistant.

STANDARDS  
FEDERAL

- FED-STD-H28 - Screw-Thread Standards for Federal Services.

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-130 - Identification Marking of US Military Property.
- MIL-STD-193 - Painting Procedures and Marking for Vehicles, Construction Equipment and Material Handling Equipment.
- MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
- MIL-STD-1184 - Electrical Components for Automotive Vehicles; Waterproofness Tests.
- MIL-STD-45662 - Calibration Systems Requirements.
- MS24570 - Switch, Vehicular Ignition: Waterproof, Starter and Magneto, with Degasser Control.

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

\* 2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for the MS standard), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

\* 3.1 First article. Unless otherwise specified (see 6.2), the contractor shall furnish switches which shall be subjected to first article inspection (see 4.5). First article inspection samples, properly marked with identifying information, shall be representative of the units to be furnished to the Government. All subsequent switches delivered to the Government shall conform to these samples in all of their pertinent physical and performance attributes.

3.2 Materials. Materials shall be as specified herein, in applicable specifications, and on applicable drawings (see 4.8.1).

3.2.1 Dissimilar metals. Except where necessary to complete an electrical circuit, contact between dissimilar metals, which would encourage galvanic action, shall be avoided. Separation of dissimilar metals shall be accomplished by providing insulation between mating surfaces (see 4.8.1).

\* 3.2.2 Aluminum castings. Aluminum castings shall conform to alloy A380.0 or 413.0 of QQ-A-591 (see 4.8.1).

3.2.3 Molded plastic insulating material. Molded plastic insulating material shall conform to type MFE of MIL-M-14 (see 4.8.1).

3.2.4 Solder. Solder shall conform to composition Sn50 or Sn60 of QQ-S-571. A rosin flux shall be used (see 4.8.1).

\* 3.2.5 Recycled, virgin and reclaimed materials. There are no requirements for the exclusive use of virgin materials. The use of recycled or reclaimed (recovered) materials is acceptable provided that all other requirements of this specification are met (see 6.3.1).

3.3 Design and construction. Unless otherwise specified (see 6.2), the switch shall conform to MS24570 (see 4.8.1 and 4.8.2).

3.3.1 Standard parts. Military standard parts shall be incorporated wherever applicable. Commercial standard parts may be used provided they are interchangeable with military standard parts without modification, and the equivalent military standard part is identified by the manufacturer (see 4.8.1).

3.3.2 Locking devices. Lockwashers, self-locking nuts, or other approved locking devices shall be incorporated where specified or where required to prevent loosening of components (see 4.8.1).

3.3.3 Springs. Springs shall not be used to transmit current (see 4.8.1).

3.3.4 Threaded parts. Screw threads shall conform to FED-STD-H28 (see 4.8.1).

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3.3.5 Weight. The weight of the switch shall be as specified on the applicable military standard (see 4.8.3).

3.4 Physical requirements.

3.4.1 Lever torque. The torque required to move each lever to its operating position, at temperatures of -65 degrees Fahrenheit (°F) to 165°F, shall be 3 to 6 pound-inches for the MAGNETOS lever and 7 to 11 pound-inches for the START and BOOST levers. Each lever, when in its operating position, shall withstand a torque of not less than 3 pound-feet without damage at temperatures of -65 to 165°F. The switch shall subsequently meet the requirements of 3.5.1 (see 4.8.4.1).

3.4.2 Plunger force. The force required to depress the DEGASSER plunger to its operating position, at temperatures of -65 to 165°F, shall be  $7 \pm 3$  pounds. The plunger shall have positive spring return and shall turn radially in either direction without drag or binding (see 4.8.4.2).

3.4.3 Vibration. When tested as specified in 4.8.4.3, the switch shall show no evidence of intermittent or accidental circuit operation and shall subsequently meet the requirements of 3.5.1 and 3.5.3.

3.4.4 Shock. When tested as specified in 4.8.4.4, the switch shall show no evidence of intermittent or accidental circuit operation and shall subsequently meet the requirements of 3.5.1 and 3.5.3.

3.5 Electrical requirements.

3.5.1 Circuit continuity. Circuits shall provide continuity through the switch at the various positions of the levers as specified on the applicable military standard (see 4.8.5.1).

3.5.2 Circuit voltage drop. The voltage drop across each circuit, at a load of 10 amperes, shall be 500 millivolts (see 4.8.5.1).

3.5.3 Dielectric strength. When tested as specified in 4.8.5.2, the switch shall show no evidence of burning, charring, loosening, arcing, or other damage to the insulation.

3.5.4 Endurance. When tested as specified in 4.8.5.3, the switch shall show no evidence of electrical or mechanical failure and shall subsequently meet the requirements of 3.5.1 and 3.5.3.

3.6 Environmental requirements.

\* 3.6.1 Waterproofness. The switch shall show no evidence of leakage and shall be electrically and mechanically operable during and subsequent to submersion when tested as specified in MIL-STD-1184 for type II, class 2 components (see 4.8.6.1).

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3.6.2 Corrosion. When tested as specified in 4.8.6.2, the switch shall show no evidence of corrosion affecting operation and shall subsequently meet the requirements of 3.5.1 and 3.5.3.

3.6.3 Fungus. When tested as specified in 4.8.6.3, the switch shall show no evidence of fungus growth affecting operation and shall subsequently meet the requirements of 3.5.1 and 3.5.3.

3.7 Finish. Cleaning, pretreatment, and priming shall conform to MIL-STD-193 (see 4.8.1).

\* 3.7.1 Painting. Unless otherwise specified (see 6.2), the switch shall be painted with paint conforming to MIL-C-46168 or MIL-C-53039, color forest green (see 4.8.2).

3.8 Marking.

3.8.1 Identification marking. Identification marking shall conform to MIL-STD-130 and as a minimum shall include the following (see 4.8.2):

Military part number  
Manufacturer's identification (see 6.2)  
Manufacturer's serial number  
Date of manufacture (month, year, e.g., JUN 85)  
US

3.8.2 Operational marking. Operational marking shall be permanent and shall conform to MIL-STD-130 and the applicable military standard (see 4.8.2).

3.9 Workmanship. Workmanship shall be such as to assure a product free of sharp edges, burrs, chips, scratches, and rust (see 4.8.2).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2), the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform or witness any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

\* 4.1.1 Responsibility for compliance. All items must 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 system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of

assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Inspection equipment. Unless otherwise specified in the contract (see 6.2), the contractor is responsible for the provision and maintenance of all inspection equipment necessary to assure that supplies and services conform to contract requirements. Inspection equipment must be capable of repetitive measurements to an accuracy of 10 percent of the measurement tolerance. Calibration of inspection equipment shall be in accordance with MIL-STD-45662. Records of calibration of inspection equipment shall be made available to the Government.

4.2.1 Standard measuring instruments. Standard measuring instruments shall be accurate within the tolerances specified in table I.

TABLE I. Measuring instrument accuracy.

Measuring instrument	Tolerance
Voltmeter dc <u>1/</u>	$\pm 0.50$ percent
Millivoltmeter dc	$\pm 0.50$ percent
Ammeter dc (multi-range)	$\pm 0.50$ percent

1/ dc = direct current

4.2.2 Apparatus. In addition to standard measuring instruments (see table I), test apparatus shall include a submersion tank and a chamber capable of maintaining air temperatures of -65 to 165°F. Air movement in the chamber shall be held to a minimum to prevent a temperature gradient within the chamber and any cooling resulting from excess air motion.

\* 4.3 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be conducted under the following conditions:

- a. Air temperature  $73 \pm 18^\circ\text{F}$ .
- b. Barometric pressure 28.5 (+2, -3) inches mercury.
- c. Relative humidity  $50 \pm 30$  percent.

Unless otherwise specified herein, test samples shall be temperature stabilized for 1 hour before being subjected to the tests. When specified herein, mounting shall be in the manner as in intended use.

\* 4.4 Classification of inspections:

- a. First article inspection (see 4.5).
- b. Quality conformance inspections (see 4.6).
  - (1) Examination (see 4.6.2).
  - (2) Tests (see 4.6.3).
- c. Control tests (see 4.7).

\* 4.5 First article inspection. Unless otherwise specified (see 6.2), the Government shall select four switches produced under the production contract for first article inspection. First article samples shall be examined for the defects specified in table III, and tested as specified in table II in the order listed. Approval of first article samples by the Government shall not relieve the contractor of his obligation to supply switches that are fully representative of those inspected as first article samples. Any changes or deviation of the production units from the first article samples shall be subject to the approval of the contracting officer.

\* 4.5.1. First article inspection failure. Deficiencies found during, or as a result of, first article inspection shall be cause for rejection of the first article sample until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiency. Any deficiency found during, or as a result of, first article inspection shall be evidence that all items already produced prior to completion of first article inspection are similarly deficient unless contrary evidence satisfactory to the contracting officer is furnished by the contractor. Such deficiencies on all items shall be corrected by the contractor. The Government will not accept products until first article inspection is completed to the satisfaction of the Government.

TABLE II. Order of first article tests.

Sample number	Paragraph	Title
1	4.8.5.1	Circuits
	4.8.4.2	Plunger force
	4.8.4.3	Vibration
	4.8.6.3	Fungus
	4.8.5.1	Circuits
2	4.8.5.1	Circuits
	4.8.5.3	Endurance
	4.8.5.1	Circuits
	4.8.6.2	Corrosion

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TABLE II. Order of first article tests - Continued.

Sample number	Paragraph	Title
3	4.8.5.1	Circuits
	4.8.4.1	Lever torque
	4.8.4.4	Shock
	4.8.5.1	Circuits
	4.8.5.2	Dielectric strength
4	4.8.5.1	Circuits
	4.8.6.1	Watrproofness
	4.8.5.2	Dielectric strength

4.6 Quality conformance inspections.

4.6.1 Sampling.

4.6.1.1 Lot formation. An inspection lot shall consist of all the switches manufactured during an identifiable production period, from one manufacturer, submitted at one time for acceptance.

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

4.6.1.3 Sampling for tests. Samples for quality conformance tests shall be selected in accordance with level S-3 of MIL-STD-105 from each lot that has passed the examination specified in 4.6.2.2.

4.6.2 Examination.

4.6.2.1 Acceptable quality level. Each sample selected in accordance with 4.5.1.2 shall be examined to determine conformance to the following acceptable quality levels (AQL) on the basis of percent defective:

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

\* 4.6.2.2 Classification of defects. For examination purposes, defects shall be classified as listed in table III.

TABLE III. Classification of defects.

Category	Defect	Method of examination
Critical	None	
<u>Major</u>	<u>AQL 1.0% Defective</u>	
101	Dimensions affecting interchangeability, out of tolerance (see 3.3).	SIE <u>1/</u>
102	Faulty workmanship affecting performance (see 3.9).	Visual
<u>Minor</u>	<u>AQL 2.5% Defective</u>	
201	Dimensions not affecting interchangeability, out of tolerance (see 3.3).	SIE
202	Improper color (see 3.7.1).	Visual
203	Improper marking (see 3.8).	Visual
204	Faulty workmanship affecting appearance (see 3.9).	Visual

1/ SIE = Standard Inspection Equipment.

4.6.3 Tests. Samples selected in accordance with 4.6.1.3 shall be subjected to the tests specified in table IV in the order listed, using an AQL of 6.5 on the basis of percent defective.

TABLE IV. Order of quality conformance tests.

Paragraph	Title
4.8.5.1	Circuits
4.8.4.1	Lever torque

4.6.4 Quality conformance inspection failure. Failure of any sample to pass any quality conformance examination or test specified herein may be cause, at the option of the Government, for refusal to accept subsequent lots until the faults revealed have been corrected.

4.7 Control tests. Control tests shall be conducted on 5 from each 500 switches consecutively produced, or fraction thereof, except that not more than 10 nor less than 5 shall be selected in any 30-day period. The samples shall be identified as to production period, examined for the defects specified in table III, and subjected to the tests specified in table V in the order listed.

TABLE V. Order of control tests.

Paragraph	Title
4.8.5.3	Endurance
4.8.4.2	Plunger force
4.8.4.3	Vibration

4.7.1 Control test failure. Failure of any sample to pass any control test specified herein shall be cause for the Government to refuse acceptance of the production quantity represented, until action taken by the contractor to correct defects and prevent recurrence has been approved by the Government.

#### 4.8 Methods of inspection.

\* 4.8.1 Materials and construction. Conformance to 3.2 thru 3.3.4, 3.7, and 3.7.1 shall be determined by inspection of contractor records providing proof or certification that design, construction, processing, and materials conform to requirements. Applicable records shall include drawings, specifications, design data, receiving inspection records, processing and quality control standards, vendor catalogs and certifications, industry standards, test reports, and rating data.

\* 4.8.2 Defects. Conformance to 3.3 and 3.7.1 thru 3.9 shall be determined by examination for the defects listed in table III. Examination shall be visual, tactile, or by measurement with SIE.

\* 4.8.3 Weight. To determine conformance to 3.3.5, the switch shall be weighed.

#### 4.8.4 Physical tests.

4.8.4.1 Lever torque. To determine conformance to 3.4.1, the switch shall be installed in a test fixture and torque shall be applied gradually to the MAGNETOS, BOOST, and START levers to cause movement to their operating positions. While in these positions, a torque of 3 pound-feet shall be applied to the levers. These tests shall be conducted in ambient temperatures of  $77 \pm 15^{\circ}\text{F}$ ,  $165 \pm 5^{\circ}\text{F}$ , and  $-65 \pm 5^{\circ}\text{F}$  after the switch has been stabilized at these temperatures for 24 hours, except when specified for quality conformance testing, in which only the  $77 \pm 15^{\circ}\text{F}$  shall apply. The switch shall subsequently be tested as specified in 4.8.5.1.

4.8.4.2 Plunger force. To determine conformance to 3.4.2, the switch shall be installed in a test fixture and force shall be applied gradually to the DEGASSER plunger to cause movement to its operating position. This test shall be conducted in ambient temperatures of  $77 \pm 15^{\circ}\text{F}$ ,  $165 \pm 5^{\circ}\text{F}$ , and  $-65 \pm 5^{\circ}\text{F}$  after the switch has been stabilized at these temperatures for 24 hours.

4.8.4.3 Vibration. To determine conformance to 3.4.3, the switch shall be mounted and connected in a circuit with a nominal 28-volt potential and 28-volt indicating lamps, and tested as specified in MIL-STD-202, method 201. During the test, observation shall be made for evidence of intermittent or accidental circuit operation. The switch shall subsequently be tested as specified in 4.8.5.1 and 4.8.5.2.

\* 4.8.4.4 Shock. To determine conformance to 3.4.4, the switch shall be mounted and connected in a circuit with a nominal 28-volt potential and 28-volt indicating lamps, and tested as specified in MIL-STD-202, method 213, test condition G. An acceleration force of 50 gravity units shall be applied in the direction of each of the three major axes of the switch. During the test, observation shall be made for intermittent or accidental circuit operation. The switch shall subsequently be tested as specified in 4.8.5.1 and 4.8.5.2.

#### 4.8.5 Electrical tests.

4.8.5.1 Circuits. To determine conformance to 3.5.1 and 3.5.2, the voltage drop through each circuit, at a load of 10 amperes, shall be measured at the terminals using a millivoltmeter.

4.8.5.2 Dielectric strength. To determine conformance to 3.5.3, with the MAGNETOS lever in the BOTH position, 1,000 volts root mean square at 60 cycles per second shall be applied to the switch between the magneto terminals. The same voltage shall be applied between all terminals and ground. The voltage shall be applied for 1 minute in each position.

4.8.5.3 Endurance. To determine conformance to 3.5.4, the switch terminals shall be connected to the following electrical loads:

Terminal	Load amperes	Load type
Booster coil	3	Inductive L/R - 0.026
Magneto	1	Inductive L/R - 0.026
Auxiliary	5	Inductive L/R - 0.026
Degasser	2	Inductive L/R - 0.026
Starter	2	Inductive L/R - 0.026
Battery - Power source of 28 $\pm$ 1 volts dc		

The switch shall then be operated for 50,000 cycles at a rate of 20 cycles per minute. Each cycle shall consist of the following: the MAGNETOS lever shall be moved from its OFF position to its BOTH position for 2 seconds; the BOOST and START levers and the DEGASSER plunger shall be moved from their off positions to their operating positions and remain there for 1 second and then return to their off positions. The 50,000 cycles shall be conducted in the following ambient temperatures:

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Number of cycles	Temperature
15,000	165 ± 5°F
20,000	77 ± 15°F
15,000	-65 ± 5°F

Prior to operation in each ambient temperature, the switch shall be stabilized at that temperature for 24 hours.

4.8.6 Environmental tests.

\* 4.8.6.1 Waterproofness. To determine conformance to 3.6.1, the switch shall be tested as specified in MIL-STD-1184 for type II, class 2 components.

4.8.6.2 Corrosion. To determine conformance to 3.6.2, the switch shall be tested as specified in MIL-STD-202, method 101, except that the length of test shall be 200 hours. The switch shall subsequently be tested as specified in 4.8.5.1 and 4.8.5.2.

4.8.6.3 Fungus. To determine conformance to 3.6.3, the switch shall be tested as specified in MIL-F-13927, class 1, method B. The switch shall subsequently be tested as specified in 4.8.5.1 and 4.8.5.2.

5. PACKAGING

5.1 Preservation, packaging, packing, and marking. Preservation, packaging, packing, and marking for the desired level shall be in accordance with the applicable packaging requirements specified by the contracting authority (see 6.2).

6. NOTES

6.1 Intended use. Ignition switches covered by this specification are intended for controlling magnetos and auxilliary equipment on engines in military vehicles.

\* 6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. If first article samples are not required (see 3.1).
- c. If the applicable military standard shall be other than as specified (see 3.3).
- d. If the color shall be other than as specified (see 3.7.1).
- e. Manufacturer's identification (see 3.8.1).
- f. If responsibility for inspection shall be other than as specified (see 4.1).
- g. If responsibility for inspection equipment shall be other than as specified (see 4.2).
- h. If inspection conditions shall be other than as specified (see 4.3).

- i. If first article inspection is not required (see 4.5).
- j. Selection of applicable level, and packaging requirements (see 5.1).

\* 6.3 Definitions.

\* 6.3.1 Recovered materials. "Recovered materials" means materials that have been collected or recovered from solid waste (see 6.3.2).

\* 6.3.2 Solid waste. "Solid waste" means (a) any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility; and (b) other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. It does not include solid or dissolved material in domestic sewage, or solid or dissolved material in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Clean Water Act, (33 U.S.C. 1342 et seq.), or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.) (Source: Federal Acquisition Regulations, section 23.402).

\* 6.4 Subject term (key word) listing.

Degasser-control switch  
Ignition switch  
Magneto switch  
Starter switch  
Switch  
Vehicular ignition

\* 6.5 Changes from previous issue. The margins of this specification are marked with asterisks where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:  
Army - AT  
Air Force - 85

Preparing activity:  
Army - AT

(Project 5930-1369)

Review activities:  
Air Force - 99  
DLA - ES

User activities:  
Army - ME  
Navy - MC