

INCH-POUND

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SUPERSEDING

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## PERFORMANCE SPECIFICATION

### SWITCH, VEHICULAR LIGHTS: 28 VOLT DC

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

#### 1. SCOPE

1.1 Scope. This specification covers master lighting switches for controlling service and blackout drive, marker, stop and tail, parking, and instrument panel lights on military motor vehicles (see 6.1).

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

##### 2.2 Government document.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

Comments, suggestions, or questions on this document should be addressed to Tank-automotive and Armaments Command, 6501 E. 11 Mile Road, Warren, MI 48397-5000 or emailed to [standardization@tacom.army.mil](mailto:standardization@tacom.army.mil). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil>.

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### DEPARTMENT OF DEFENSE SPECIFICATIONS

- MIL-PRF-26 - Resistors, Fixed, Wire Wound (Power Type) General Specification For

### DEPARTMENT OF DEFENSE STANDARDS

- MIL-STD-130 - Identification Marking of U.S. Military Property.  
MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.  
MIL-STD-461 - Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment.  
MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests.  
MIL-STD-1275 - Characteristics of 28 Volt DC Electrical Systems in Military Vehicles.  
MIL-DTL-13486 - Cables, Special Purpose, Electrical: Low-Tension, Heavy-Duty, Single Conductor and Multiple Conductor, Shielded and Unshielded, General Specification For

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

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

### DRAWINGS

#### ARMY

- 7723494 - Electrical Connectors, Waterproof.  
12369007 - Paint System for Aluminum Interior Surfaces, Light Green.  
12480561 - Waterproofness Requirement for Automotive Electrical Components.

(Copies of these drawings are available from US Army RDECOM, AMSRD-TAR-E/ACQ MS 268, 6501 E 11 Mile Rd, Warren, MI 48397.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation.

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Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

### SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)

- SAE J1113-2 - Electromagnetic Compatibility Measurement Procedures and Limits for Vehicle Components (Except Aircraft) Conducted Immunity, 15 Hz to 250 kHz All Leads
- SAE J1113-13 - Electromagnetic Compatibility Measurements Procedure for Vehicle Components – Part 13: Immunity to Electrostatic Discharge.
- SAE AMS4235 - Aluminum Alloy Castings, 4.6Cu - 0.35Mn - 0.25Mg - 0.22Ti (A206.0-T71) Solution and Precipitation Heat Treated-UNS A12060.
- SAE AS478 - Identification Marking Methods.

(Copies of these documents are available from the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096 or website: [www.sae.org](http://www.sae.org))

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

- ASTM B32 - Standard Specification for Solder Metal.

(Copies of this document are available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or website: [www.astm.org](http://www.astm.org)).

### AMERICAN SOCIETY FOR QUALITY (ASQ)

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

(Copies of this document are available from the American Society for Quality, 600 North Plankinton, Milwaukee, WI 53203 or website: [www.asq.org](http://www.asq.org)).

### INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

- ISO 10012 - Measurement Management Systems – Requirements for Measurement Processes and Measuring Equipment

(Copies of this document are available from the International Organization for Standardization (ISO), 1, rue de Varembé, Case postale 56, CH-1211 Geneva 20, Switzerland or website: [www.iso.com](http://www.iso.com)).

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

### 3. REQUIREMENTS

3.1 First article. Unless otherwise specified (see 6.2), the contractor shall furnish vehicular switch assemblies, which shall be subjected to first article inspection (see 4 and 6). First article inspection samples, properly marked with identifying information shall be representative of the units to be furnished to the Government. All subsequent switch assemblies 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 and on applicable referenced standards, drawings, or specifications. Materials shall be uniform and free from imperfections or defects, which adversely affect performance or serviceability of the finish products. All non-metallic materials shall be inherently fungus resistant or treated to resist fungus growth. All metallic parts shall be made from corrosion resistant steels or treated with corrosion-resistant materials. Materials shall be suitable for a switch operating in an ambient temperature range from -65°F to 180°F (-53.9°C to +82.2°C). Asbestos and cadmium materials shall not be used in any form in any part of the switch. No item, part, or assembly shall contain radioactive materials in which the specific activity is greater than 0.002 microcuries per gram or activity per item equals or exceeds 0.01 microcuries (see 4.1.2).

3.2.1 Dissimilar metals. Separation of dissimilar metals shall be done by insulation between mating surfaces. Except where necessary to complete an electrical circuit, contact between dissimilar metals that would encourage galvanic action shall be avoided (see 4.1.2).

3.2.2 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs (6.3.3).

3.2.3 Process requirements. If the following processes are used to fabricate the switch, conformance to the cited specifications is required.

3.2.3.1 Solder. Solder shall meet the applicable electrical and electronic device solder requirements of ASTM B32 (see 4.1.2).

3.2.3.2 Cast parts. Cast parts shall conform to composition of SAE AMS4235 (see 4.1.2).

3.3 Design and construction. Design and construction shall conform to all of the applicable requirements, standards, and drawings herein that include operational, environmental,

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mechanical, and electrical interface requirements. Dimensions of the switch assembly and switches are shown in Figure A1.

3.3.1 Springs. Mechanical springs shall not be used to transmit current (see 4.1.3).

3.3.2 Connector. Connectors shall conform to Drawing 7723494 contact arrangement 28-51. The shell may be integral with its mounting surface (see 4.1.3). The pin configuration and assignments are shown in Figure A1.

3.3.3 Cables. Cables shall conform to MIL-DTL-13486 (see 4.1.2). Internal wires shall be 14 gauge conductors (AWG).

3.3.4 Mechanical interlock. The switch assembly shall incorporate a mechanical interlock to prevent the inadvertent energizing of any part of the light system except the blackout marker lights. To energize the blackout drive lights, the operator must first switch to the blackout marker position, then deactivate the mechanical interlock in order to switch to the blackout drive light position of the switch. To energize the stop/turn lights or service drive lights, the operator must switch clockwise from the "OFF" position while deactivating the mechanical interlock in order to switch to the desired position (see 4.1.3).

3.3.5 Index marking. Index marks and their identification shall be made by etching, engraving, embossing, casting, or other approved permanent marking method (see 4.1.3).

3.3.5.1 Identification and color of marking. Index positions shall be identified as specified in Figure A1 and applicable drawings (see 4.4.2). Color of the markings shall be base metal or white (see 4.1.2 and 4.1.3).

3.3.6 Resistor. The panel lamp circuit shall be connected in series with a 30 ohm  $\pm$  5 percent (%), five-watt resistor conforming to MIL-PRF-26 (see 4.1.2 and 4.1.3). The dimming resistor is intended to only limit the current for the vehicle instrument panel lamps. The resistor shall be mounted with sufficient spacing or insulation from the internal switch materials to prevent damage from heat dissipated while operated at maximum load conditions for an indefinite period of time.

3.3.7 Circuit breaker. The switch assembly shall be equipped with an internal nominal 20 ampere circuit breaker in the battery feed line, pin F. All of the current passing through the switch assembly, except the circuits fed by pins C, K, and N, shall pass through the circuit breaker (see 3.4.3 through 3.4.11, and 4.1.3).

### 3.4 Performance.

3.4.1 Electrical continuity. The switch assembly shall close appropriate circuits when main and auxiliary levers are in indexed positions. All other circuits shall remain open. Mechanical interlock shall function as designed, in accordance with 3.3.4 (see 4.6.1).

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3.4.2 Voltage drop. When a current load of 10 amperes is applied to each circuit except the panel lamp dim circuit, the voltage drop shall be not more than 320 millivolts (mV). The voltage drop through the panel lamp dim circuit shall be 12 volts  $\pm$  10% at 0.40 amperes (see 4.6.2).

3.4.3 Circuit breaker continuous current capacity and ultimate trip current. At each ambient air temperature specified in TABLE III, the switch assembly circuit breaker shall carry the continuous current specified for that temperature without tripping or causing other current interruption. Subsequent to carrying the continuous currents and while at the specified temperatures, the ultimate current load shall be applied and the circuit breaker shall open in not more than 60 minutes (see 4.6.3).

3.4.4 Circuit breaker high temperature reclosing. When the switch assembly is conditioned at a temperature of  $180^{\circ}\text{F} \pm 5^{\circ}\text{F}$ , a 60 ampere current shall be passed through the switch assembly circuit breaker until tripping occurs. Subsequent to tripping, the contacts shall reclose in not more than 30 minutes (see 4.6.4).

3.4.5 Circuit breaker no-current trip temperature. When carrying no current, the switch assembly circuit breaker shall not trip at temperatures below  $265^{\circ}\text{F}$  ( $129^{\circ}\text{C}$ ) (see 4.6.5).

3.4.6 Circuit breaker speed of operation. At specified overload currents, the switch assembly circuit breaker shall meet the minimum and maximum opening time requirements specified in TABLE I (see 4.6.6). The switch assembly circuit breaker must not reset sooner than 30 seconds for each of the specified overload currents.

3.4.7 Circuit breaker overload characteristics. With the switch assembly connected as shown in Figure A2, and demand-currents of 26, 30, 50, 120, and 200 amperes applied to the switch assembly circuit breaker, the effective current shall be from 15 to 26 amperes (see 4.6.7).

3.4.8 Overload. Each switch circuit shall withstand  $575 \pm 25$  amperes of current applied five times with the circuit breaker opening and resetting each time. The switch shall subsequently meet the requirements of 3.4.1 and 3.4.2 (see 4.6.8).

3.4.9 Circuit breaker resistance to short circuit. After meeting the requirements of 3.4.8, the switch assembly shall be further tested as specified. During testing, the tested circuit shall permanently open or after testing, the switch assembly circuit breaker shall have a continuous current capacity of 21.0 amps and an ultimate trip current of 29.0 amps (see 4.6.9).

3.4.10 Circuit breaker endurance. The switch assembly circuit breaker shall meet the opening time requirement of 3.4.6 when being subject to a 40 amp current for not less than 2,000 cycles. Upon completion of cycling, the switch assembly's circuit breaker shall meet the requirements of 3.4.3 for any ambient temperature of  $77 \pm 5^{\circ}\text{F}$  ( $25 \pm 3^{\circ}\text{C}$ ) (see 4.6.10).

3.4.11 Conditions after rupture. Each of the switch assembly circuits shall be subjected to a rupture current of up to 2000 amps and 100 VDC (except for the circuit with the series wired

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resistor) until the circuit opens. There shall be no electrical contact with the switch assembly case (see 4.6.11).

3.4.12 Switch lever torque. The torque required to operate the switch levers shall be  $0.70 \pm 0.15$  pound-force foot (lbf-ft) ( $0.95 \pm 0.20$  N-m) (see 4.6.12).

3.4.13 Interlock strength. The main switch lever with the mechanical interlock in the lock position shall withstand 3.0 lbf-ft (4.1 N-m) of torque without operating the switch (i.e., only the circuits specified for the tested index position shall have power delivered to them) or damage to the switch assembly (see 4.6.13).

3.4.14 Interlock effort. While  $0.70 \pm 0.15$  lbf-ft of torque is applied to the switch assembly's interlock lever, the application of the same amount of torque to the main switch lever shall cause the main switch lever to rotate (see 4.6.14).

3.4.15 Endurance. The switch assembly shall show no evidence of mechanical or electrical failure during or following 50,000 cycles of operation while connected to each of the circuits energized as specified in TABLE IV. Switch contacts and sockets shall withstand current loads during switching and breaking sequences. The values of the parameters measured after endurance testing shall not differ by more than 20% from those measured prior to beginning the test (see 4.6.15). Subsequently, the switch assemblies shall comply with 3.4.1, 3.4.2, 3.4.13, and 3.5.1. Any deviation from normal operation, even an intermittent anomaly, such that the switch eventually returns to normal operation, shall be recognized as a failure and shall be cause for rejection.

3.4.16 Dielectric strength. The insulation shall resist the application of 1000 volts root mean square (RMS) at 60 cycles per second (cps) without charring, cracking, arcing, rupturing, or other damage (see 4.6.16).

3.4.17 Switch lever position. When the switch levers are indexed as specified (see 3.3.6 and 3.4.10) at each of the switch index positions, the switch levers shall align within 5 degrees of the index mark (see 4.6.17).

3.4.18 Switch lever indexing. The switch assembly levers shall positively index themselves when rotated through all the specified positions. Upon application of  $0.10 \pm 0.01$  lbf-ft ( $0.14 \pm 0.014$  N-m) of torque, the switch lever shall not move more than 5 degrees and the switch assembly shall meet the requirements of 3.4.1 and 3.4.2 (see 4.6.18).

3.4.19 Crimp terminations. Crimp terminations used internally within the switch assembly, as applicable, shall meet the performance requirements specified by 3.4.19.1 through 3.4.19.5 (see 4.6.19).

3.4.19.1 Voltage drop. The crimp termination voltage drop shall be less than 6 mV before the test, and shall be less than 11 mV after the test, as specified in TABLE II (see 4.6.19.1) for 14 AWG conductors.



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3.4.19.2 Current rating. The terminal barrel temperature shall not exceed by more than 9°F (5°C) the temperature of the attached conductor stranding when testing as specified (see 4.6.19.2).

3.4.19.3 Current overload. The terminal barrel temperature shall not exceed by more than 18°F (10°C) the temperature of the attached conductor stranding when tested as specified. The value recorded in the subsequent voltage drop test shall meet the “after test” requirements specified in TABLE II (see 4.6.19.3).

3.4.19.4 Mechanical strength. The crimp terminations shall withstand the minimal mechanical strength requirements of TABLE II for 14 AWG conductors without breaking or becoming distorted to the extent that they are unfit for further use (see 4.6.19.4).

3.4.19.5 Vibration. The crimp terminations, subsequent to testing as specified, shall show no evidence of mechanical or electrical damage and meet the requirements of 3.4.19.2 and 3.4.19.4 (see 4.6.19.5).

3.4.20 Operating voltage range. The switch shall operate normally within the given voltage range, and shall function properly when subjected to vehicle electrical starting disturbances (see 4.6.20).

3.4.21 Voltage spikes. The switch assembly shall withstand imported voltage spikes and shall not exceed the limitation of exported spikes into the vehicle electrical system (see 4.6.21).

3.4.22 Voltage surges. The switch assembly shall withstand imported voltage surges (see 4.6.22).

3.4.23 Ripple voltage. The switch assembly shall function properly when ripple voltage is applied to pin F of the switch. The switch shall not exceed the limitation of exported ripple voltage into the vehicle electrical system (see 4.6.23).

3.4.24 Electromagnetic interference. The switch assembly shall meet the military ground platform requirements for conducted and radiated radio frequency emissions and susceptibility (see 4.6.24).

3.4.25 Electrostatic discharge. The switch assembly and its components shall meet the requirements for electrostatic discharge (see 4.6.25).

3.4.26 Function test. The switch assembly shall show no evidence of mechanical or electrical failure during or following 1,000 cycles of operation while connected to each of the circuits energized as specified in tables 4 and 5. Switch contacts and sockets shall withstand current loads during switching and breaking sequences. Total amperage must be considered if switch contacts and sockets share current loads in the same circuit. The values of the parameters measured after endurance testing shall not differ by more than 20% from those measured prior to beginning the test (see 4.6.26). Subsequently, the switch assemblies shall comply with 3.4.1, 3.4.2, 3.4.13, and 3.5.1. Any deviation from normal operation, even an intermittent anomaly,



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such that the switch eventually returns to normal operation, shall be recognized as a failure and shall be cause for rejection.

3.5. Environmental and physical.

3.5.1 Waterproofness. The switch assembly shall be waterproofed (see 4.7.1).

3.5.2 Corrosion. The switch assembly shall resist corrosion (see 4.7.2).

3.5.3 Fungus. The switch shall resist fungus and microbial growth on the exterior and interior surfaces (see 4.7.3).

3.5.4 Drop test. The switch assembly shall withstand the drop test (see 4.7.4).

3.5.5 Thermal shock. The switch assembly shall withstand thermal shock (see 4.7.5).

3.5.6 Water jet spray. The switch assembly shall withstand water jet spray (see 4.7.6).

3.5.7 Vibration. When subjected to the vibration test as specified in 4.6.3, the current specified in TABLE III, tested at each switch position, shall not deviate from the set current by more than 5% for periods greater than 0.01 second. Subsequent to vibration testing, the switch assembly shall show no evidence of bending, cracking or other physical damage and shall meet the requirements for 3.5.1 (see 4.7.7).

3.5.8 Shock. The switch assembly and switch levers, after being subjected to the shock test, shall show no evidence of bending, cracking, or other physical damage and the switch levers shall not be displaced more than 3 degrees. During shock testing, the terminal currents shall meet the requirements of 3.5.7 (see 4.6.4 through 4.7.8).

3.6 Protective finishes. All frontal exterior metal surfaces shall be painted with CARC paint. The index marks and their identification shall be base metal or white. Surfaces shall be cleaned, conditioned, primed and painted in accordance with Drawing 12369007. The color of paint shall be green #383 (see 4.5.2).

3.7 Marking. Identification and switch function markings shall be in accordance with SAE AS478 or MIL-STD-130. The switch assembly shall be marked with the part number MS51113-1. At the manufacturer's option, the information may be cast as an integral part of the switch, clearly and legibly, in a visible location and shall include the following information (see 4.5.2).

- a. National stock number (NSN).
- b. Serial number.
- c. Manufacturer's name or identification code (CAGE).
- d. Contractor or order number.
- e. Date of manufacture.
- f. Lot number.
- g. Part number.

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3.8 Workmanship. Workmanship shall be in accordance with the manufacture of a high quality switch. This shall be evidenced by the absence of faults which are detrimental to the appearance, serviceability, and durability of the switch, and free from burrs, chips, dirt, sharp edges, scratches, unauthorized use of used or reworked parts, and improper preparation and assembly of the switch (see 4.5.2).

## 4. VERIFICATIONS

4.1 Inspection equipment. Unless otherwise specified in the contract, the supplier is responsible for the provision and maintenance of all inspection equipment necessary to assure that supplies and services conform to contract requirements. Commercial, modified commercial, or supplier designed inspection equipment or measuring set-ups must be capable of repetitive measurements to an accuracy of 10 percent of the component tolerance. Calibration of inspection equipment shall be in accordance with ISO 10012. Voltage (voltmeter, DC) and current (ammeter, DC) measuring instrument tolerances shall have a maximum error of 1 percent.

4.1.2 Materials and construction. Conformance to 3.2 through 3.3.7, inspection, and material certification records shall be maintained by the contractor. Records shall be subject to review by the Government and shall include the date, part, characteristic identification, inspection results, and disposition of lot (accepted or rejected). Corrective action taken on noted defects shall be subject to approval by the Government.

4.1.3 Physical characteristics. Conformance to 3.2 through 3.3.7 shall be determined by visual and tactile examination, and measurement with standard inspection equipment.

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

- a. First article inspection (see 4.4).
- b. Quality conformance inspections (see 4.5).
  1. Examination (see 4.5.2).
  2. Acceptance tests (see 4.5.3.1).
  3. Control tests (4.5.3.2).

4.3 Inspection conditions. Except where otherwise specified herein, tests shall be performed in ambient still air temperatures of  $80 \pm 5^{\circ}\text{F}$  and a test voltage of  $28 \pm 2$  VDC. Test currents shall be maintained automatically or manually at specified values. The resistance  $R_{\text{Equiv}}$  (from Figures 2 and 3) shall be adjusted to equal the resistance  $R_{\text{CB}} \pm 5\%$ . Where possible, the circuit shall be adjusted after switching in the switch assembly to yield the instrument readings specified in the applicable test. Current conducting cables shall conform to MIL-DTL-13486 and shall be exposed to the same ambient air temperatures as specified for the switch assembly. Test cables shall be 5 feet long and contain size 14 gauge conductors. The test cables shall be attached to a connector conforming to 7723494 to form a cable assembly. No more insulation than necessary to form electrical contact shall be removed from the cables. The switch assembly shall be engaged to the specified cable assembly using only the normal locking means of the connector. All tests shall be conducted on the intact switch assembly. Power shall be applied to,

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and specified parameters measured at, the source end of the cable attached to pin F of the mating connector. The cable end from socket K shall be connected to the cable end of socket A. The measurement of the angular position of the switch assembly levers shall be performed on a rotating inspection fixture. The axis of rotation of the switch lever shall be co-axial with the axis of rotation of the fixture. The center of the lever is the plane, which bisects the lever and is parallel to the axis of the rotation of the lever.

4.4 First article inspection. The first article sample shall consist of fifteen switches, and if applicable, two samples of each crimp termination. Each crimp termination sample shall be representative with regards to the terminal barrel size and gauge of the attached wire of the terminations used in the switch assembly. The specimens, properly marked with identifying information, shall be representative of the units proposed to be furnished to the Government. First article inspection shall consist of examination for the defects specified in TABLE VII and testing as specified in TABLE V.

4.4.1 First article test sequence. First article tests shall be conducted on the sample in accordance with the test sequence specified in TABLE V.

4.4.2 First article inspection failure. Failure of any first article specimen to pass any specified examination or test shall be cause for Government refusal to conduct additional testing until the faults revealed have been corrected.

4.5 Quality conformance inspection. Noncompliance with any of the specified requirements in section 3 and tests in section 4 shall be cause for rejection of the sample and the inspection lot.

4.5.1 Sampling.

4.5.1.1 Lot formation. An inspection lot shall consist of all the switch assemblies of a single type and part identification number (PIN), from an identifiable production period, from one manufacturer, from one manufacturing location, submitted at the same time for acceptance.

4.5.1.2 Sampling for examination. Samples for quality conformance examination shall be selected in accordance with general inspection level II of ASQ Z1.4.

4.5.2 Quality conformance examinations.

4.5.2.1 Acceptable quality level. Each sample selected in accordance with 4.4.1.2 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

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4.5.2.2 Classification of defects. For examination purposes, defects shall be classified as listed in TABLE VII.

4.5.3 Quality conformance test.

4.5.3.1 Acceptance test.

4.5.3.1.1 Sampling for acceptance tests. Sampling for acceptance tests shall be in accordance with inspection level S-3 of ASQ Z1.4

4.5.3.1.2 Acceptance testing. Switch samples selected in accordance with 4.4.3.1.1 shall be subjected to the tests specified in TABLE VIII, in accordance with inspection level S-3 of ASQ Z1.4, using an AQL of 6.5 based on percent defective and in the sequence specified in TABLE VIII.

4.5.3.2 Control tests. Control tests shall be conducted on three switch assemblies from each lot of 500 units produced, except that not more than six nor less than three units shall be tested in any 30 day period. Samples selected shall be examined for the defects specified in 4.4.2.2. The three samples selected shall be identified with the numbers 1, 2, and 3 and shall be tested in the sequence specified in TABLE VI.

4.5.3.3 Crimp termination. Control test samples of each crimp termination, representative with regards to the terminal barrel size and gauge of attached wire, shall be periodically selected at the rate of 5 of each 500 crimp terminations produced. Not more than 50 or less than 15 crimp terminations shall be selected in any 30-day period. Samples selected shall be examined for the defects specified in 4.4.3.2 and shall be tested in the sequence specified in TABLE VI.

4.5.4 Failure. Failure of any switch assembly or crimp termination sample to pass any of the specified inspections 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.

4.6 Performance test.

4.6.1 Electrical continuity test. To determine conformance to 3.4.1, the electrical continuity shall be measured at each of the specified switch positions between pin F or pin K, as required, and the remaining pins to complete the specified circuits on Figure A1.

4.6.2 Voltage drop test. To determine conformance to 3.4.2, the voltage drop shall be measured at a minimum current of 10 amperes (0.40 ampere for the panel dim circuit) across the circuits as specified in 4.6.1.

4.6.3 Circuit breaker continuous current capacity and ultimate trip current test. To determine conformance to 3.4.3, each switch assembly shall be conditioned at each of the ambient temperatures specified in TABLE III for a minimum of 5 hours. After conditioning, and

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while still at the temperature, the switch assembly shall be subjected to the continuous current tests as specified in TABLE III for not less than 60 minutes. The switch assembly shall subsequently be subjected to the ultimate trip currents for not more than 60 minutes.

4.6.4 Circuit breaker high temperature reclosing test. To determine conformance to 3.4.4, the switch assembly shall be conditioned for 5 hours at  $180 \pm 5^\circ\text{F}$  and, while still in ambient air at that temperature, a 60 ampere current shall be passed through the circuit breaker until it trips. The switch assembly shall be allowed to stand in ambient air at the same temperature until contacts reclose or 30 minutes have passed. If the contacts do not close within the 30 minutes, the switch assembly has failed the test.

4.6.5 Circuit breaker no-current trip temperature test. To determine conformance to 3.4.5, the switch assembly shall be placed in a temperature-controlled oven provided with means of determining whether contacts are open or closed. The oven shall be maintained at  $265 \pm 5^\circ\text{F}$  for a minimum of 5 hours, after which a determination of contact position shall be made. The circuit breaker shall not trip during this test.

4.6.6 Circuit breaker speed of operation test. To determine conformance to 3.4.6, the switch assembly shall be connected in the circuit shown in Figure A2 and the circuit calibrated for each value of current employed. Calibration shall consist of opening switch S2, closing switch S1, and varying the load resistance ( $R_2$ ) until the desired value of current is registered on the ammeter. Subsequently, the S1 switch shall be opened, the S2 switch closed, and the time required for the circuit breaker to trip and reset shall be recorded for each of the current overloads specified in TABLE I.

#### 4.6.7 Circuit breaker overload test.

4.6.7.1 Apparatus. Test apparatus shall include timers with resolution to one millisecond, a controllable load resistance for adjusting the demand current, switches, wiring, components, and fixtures necessary to conduct the test.

4.6.7.2 Test procedures. The switch assembly shall be connected as shown in Figure A2, and the circuit calibrated as specified in 4.6.6. Closure of switch S2 shall initiate the test. The first five cycles are pre-conditioning, and the times shall not be recorded. Upon starting the sixth cycle, two timers shall be used and both timers shall be started simultaneously. Timer 1 shall measure accumulated conduction time for cycles six through ten. Timer 2 shall measure the total time from the start of the sixth cycle to the end of the tenth cycle. A cycle consists of the time interval from the start of conduction to the re-initiation of conduction after tripping. The test shall be conducted with demand-currents of 26, 30, 50, 120, and 200 amperes. Tolerance on demand currents is  $\pm 5\%$  of specified value. Effective current values shall be calculated by means of the following equation to determine conformance to 3.4.7:

$$I = i\sqrt{t/T}$$

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Where:

I = Effective current in amperes.

i = Demand current in amperes.

t = Accumulated circuit breaker conduction time (last five cycles only).

T = Total on time (last five cycles only).

4.6.8 Overload test. To determine conformance to 3.4.8, the switch assembly shall be connected as shown in Figure A3 and the circuit calibrated as specified in 4.6.6 to deliver  $575 \pm 25$  amperes. Each specified circuit (except the panel lamp dimming circuit) shall have the overload current applied to it five times. The time between applications of the overload current is the time needed by the switch assembly circuit breaker to reclose.

4.6.9 Circuit breaker resistance to short circuit. To determine conformance to 3.4.9, the test specified in 4.6.8 shall be repeated, with 10 additional cycles for each of the tested circuits. Permanent opening of the tested circuit during overload testing meets the requirements of 3.4.9. Subsequent to the testing, the switch assembly shall be tested as specified in 4.6.3 except the ambient air temperature shall be  $80 \pm 5^\circ\text{F}$ , the continuous current shall be at least 21.0 amperes, and the ultimate trip current shall not exceed 32.0 amperes.

4.6.10 Circuit breaker endurance test. To determine conformance to 3.4.10, the switch assembly shall be connected in the circuit shown in Figure A3, and the current set to a minimum of 40 amperes for 2000 cycles as specified in 4.6.6. The values selected for  $R_1$ ,  $R_2$ , and  $L_1$  shall be such that:

$$R_1 + R_{L1} = R_2 + [L_1 / (R_1 + R_{L1})] = 0.026$$

Where:

$R_1, R_2$  = Variable resistances.

$R_{L1}$  = Resistance of coil  $L_1$ .

$L_1$  = Inductance of coil  $L_1$ .

0.026 = Time constant.

Calculation of the time constant involves taking the numeric values of the inductance in Henries (H) and the resistance in ohms ( $\Omega$ ) and performing the indicated arithmetic operations.

Tolerances:

$L_1$ : -20% to +50%

$R_1 + R_{L1}$ : = 10% of  $R_2$

$(R_1 + R_{L1} + R_2) / (R_2[R_1 + R_{L1}]) = \pm 10\%$

The switch assembly shall then be tested as specified in 4.6.3 except the ambient air temperature shall be  $80 \pm 5^\circ\text{F}$ , the continuous current shall be at least 21.0 amperes, and the ultimate trip current shall not exceed 32.0 amperes.

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4.6.11 Conditions after rupture test. To determine conformance to 3.4.11, each of the switch assembly circuits (except the circuit with the series wired resistor) shall be subjected to a rupture current (up to 2000 amperes and 100 VDC) until the circuit opens (excluding the circuit breaker cycling). A different switch assembly shall be used for each circuit test. After the application of rupture current, power shall be applied between Pin F and the switch assembly's case with its levers rotated to all the specified positions. The current flow shall be less than 10 mA.

4.6.12 Switch lever torque test. To determine conformance to 3.4.12, the switch assembly shall be mounted in a suitable test fixture with the interlock disengaged as specified (see 4.6.14). For each of the specified positions of each switch lever, the torque shall be gradually applied until the lever rotates to the next adjacent position. The maximum torque measured during rotation is the torque needed to actuate the lever. Each lever shall be rotated in both the clockwise and counterclockwise directions.

4.6.13 Interlock strength test. To determine conformance to 3.4.13, the switch assembly shall be tested as follows. With the mechanical interlock in the lock position, the main switch lever shall withstand a minimum of 3 lbf-ft (4.1 N-m) of torque applied to the switch lever in the plane of the switch rotation clockwise in OFF, STOP LIGHT, and SERVICE DRIVE positions. With the mechanical interlock in the lock position, the main switch lever shall withstand a minimum of 3 lbf-ft (4.1 N-m) of torque applied to the switch lever in the plane of the switch rotation counterclockwise in B.O. MARKER and B.O. DRIVE positions. There shall be no movement of the main switch lever, or damage to the switch assembly.

4.6.14 Interlock effort test. To determine conformance to 3.4.14, the switch assembly shall be mounted in a suitable test fixture and a torque of  $0.70 \pm 0.15$  lbf-ft shall be applied to the main switch lever in each position.

4.6.15 Endurance test. To determine conformance to 3.4.15, the switch assembly and its levers shall first be subjected to tests specified in 4.6.12, 4.6.14, 4.6.17, and 4.6.18. Proper function of the switch assembly, which includes proper switching and breaking of power to lights, shall be monitored in real-time for correct functionality throughout the entire endurance test. Any deviation from normal operation, even an intermittent anomaly, such that the switch eventually returns to normal operation, shall be recognized as a failure and shall be cause for rejection. Subsequently, the switch assembly shall be subjected to the tests as specified in 4.6.15.1, 4.6.15.2, and 4.6.15.3. All of the contacts listed in TABLE IV shall be monitored with socket contact "A" connected to socket contact "K." Socket contact "F" shall be the sole current source for the entire switch assembly.

4.6.15.1 Preparation. The switch assembly shall be loaded with incandescent lamps connected with specified lengths of cables coming from the specified connector sockets to provide the specified currents in TABLE IV. The exact values for each socket shall be recorded prior to start of the 50,000 cycles.



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4.6.15.2 Main switch test. The auxiliary switch shall be placed in the “DIM” position. The main switch shall be subjected to the following cycling procedure at a rate of not less than 5 cycles per minute (cpm). One cycle shall consist of the following sequence:

- a. With the main switch in the extreme left position (blackout drive), press the interlock lever and move the main switch lever through each position to the extreme right position (service drive), remaining in each position for 1 second; and
- b. Release the interlock lever and return to the blackout marker position without stopping, then press the interlock lever to return to the blackout drive position. The main switch shall be operated for 50,000 cycles as follows:

<u>Number of cycles</u>	<u>Ambient temperature</u>
15,000	$180 \pm 5^{\circ}\text{F}$
20,000	$80 \pm 10^{\circ}\text{F}$
15,000	$-65 \pm 5^{\circ}\text{F}$

4.6.15.3 Auxiliary switch test. The main switch shall be placed in the “SERVICE DRIVE” position. The auxiliary switch shall be subjected to the same cycling rate, duration, ambient temperature, and number of cycles as the main switch in 4.6.15.2. One cycle for the auxiliary switch shall consist of moving the auxiliary switch levers from the “OFF” position to the “PANEL BRIGHT” position, back through the “OFF” position to the “PARK” position, and returning to the “OFF” position.

4.6.16 Dielectric strength test. To determine conformance to 3.4.16, the auxiliary and main switch levers shall be placed in the “OFF” position and 1000 volt RMS at 60 cycles per second (cps) shall be applied in accordance with MIL-STD-202, Method 301, between each pair of terminals, excepting pair H and M. The same voltage shall also be applied between terminals and grounds. The voltage shall be applied for 1 minute in each position. Switch shall be disassembled and examined. There shall be no evidence of charring, cracking, arcing, rupturing, or other damage.

4.6.17 Switch lever position test. To determine conformance to 3.4.17, the switch lever shall be rotated to each of the specified index positions. To determine the location of the index position, the switch levers shall be subjected to the test as specified in 4.6.18. The angular difference between the center of the switch lever and the index mark shall be within  $5^{\circ}$  of the index marks.

4.6.18 Switch lever indexing test. To determine conformance to 3.4.18, the total angular displacement of the lever resulting from the application of a clockwise and counterclockwise torque of  $0.10 \pm 0.01$  lb-ft ( $0.14 \pm 0.014$  N-m) shall be measured at each specified index position. Movement shall not exceed 5 degrees.

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4.6.19 Crimp termination test. To determine conformance to 3.4.19 and the subparagraphs specified thereby, crimp terminations shall be tested as specified by 4.6.19.1 through 4.6.19.5.

4.6.19.1 Voltage drop test. To determine conformance with 3.4.19.1, the terminal and attached cable shall be connected into a circuit adjusted to pass the current specified in TABLE II. The mV drop shall be measured from the intersection of the tongue and barrel to a point on the cable 1/4 inch (6 mm) from the open end of the barrel. When terminals have cable insulation supports, this point shall be 1/8 inch (3 mm) from the end of the support. The voltage drop and test current shall be recorded.

4.6.19.2 Current rating test. To determine conformance with 3.4.19.2 the terminal and attached cable shall be connected into a test circuit adjusted to pass the current specified in TABLE II. The current shall be continued until the temperature of the terminal and attached cable straining have stabilized. These stabilized temperature values shall be recorded. The temperature of the splice or terminal shall be measured by means of a thermocouple at the barrel diametrically opposite of the crimp. The temperature of the cable straining shall be measured by means of a thermocouple installed in the stranding at a minimum distance of 24 inches from the terminal and the power source. The terminal barrel temperature shall not exceed by more than 9°F of the temperature of the attached conductor stranding.

4.6.19.3 Current overload test. To determine conformance with 3.4.19.3, 125% of the current specified in TABLE II shall be passed through the terminal and attached cable for 2 hours and the stabilized temperatures recorded (see 4.6.19.2). The samples will then be allowed to return to room temperature after which 200% of the currents specified in TABLE IV shall be passed through the terminal and attached cable for five minutes and the stabilized temperatures recorded (see 4.6.19.2). Subsequent to these tests, the samples shall be allowed to return to room temperature and tested as specified in 4.6.19.1. The terminal barrel temperature shall not exceed by more than 18°F the temperature of the attached conductor terminal during the specified testing.

4.6.19.4 Mechanical strength test. To determine conformance with 3.4.19.4, the terminal and attached cable shall be placed in a standard tensile testing machine and sufficient force shall be applied to meet the minimum mechanical strength requirements of TABLE II for 14 AWG conductors. Subsequent to the pull test, the terminal shall not have broken nor have distorted to the extent that they are unfit for further use. The tests shall be made at room temperature with the speed of the machine head no less than 4 inches per minute.

4.6.19.5 Vibration test. To determine conformance with 3.4.19.5, the terminal and an attached 15 inch length of cable shall be mounted on a vibration fixture and the end of the cable secured to a stable support 12 inches from the terminal. The terminal shall be vibrated for 1 hour in each of the 3 perpendicular planes at an amplitude of 0.030 inch (0.060 inch total excursion) and a frequency of 10 to 55 to 10 cycles per second, with the frequency range to be accomplished once each minute. The crimp terminations shall show no evidence of mechanical or electrical

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damage. Subsequent to this test, the terminals shall be subjected to the tests specified by 4.6.19.1 and 4.6.19.4.

4.6.20 Operating voltage range test. To determine conformance to 3.4.20, the switch shall operate normally when +23V DC to +33V DC steady state voltage is applied to the switch, and the switch shall also operate normally under starting disturbances in accordance with MIL-STD-1275.

4.6.21 Voltage spike test. To determine conformance with 3.4.21, the switch shall withstand imported spikes as specified in MIL-STD-1275. The switch shall also pass the exported spike tests as specified in MIL-STD-1275.

4.6.22 Voltage surge test. To determine conformance to 3.4.22, the switch shall withstand imported surges as specified in MIL-STD-1275.

4.6.23 Ripple voltage test. To determine conformance with 3.4.23, the switch shall withstand imported ripple voltage as specified in MIL-STD-1275. The switch shall not exceed the exported ripple voltage limits as specified in MIL-STD-1275.

4.6.24 Electromagnetic interference test. To determine conformance with 3.4.24, the switch shall meet the military ground platform requirements of MIL-STD-461 Methods CE102, RE102, CS114, CS115, CS116, and RS103 for conducted and radiated radio frequency emissions and susceptibility as applicable.

4.6.25 Electrostatic discharge test. To determine conformance with 3.4.25, the switch shall meet the requirements for electrostatic discharge as specified in SAE J1113-13 under the packaging, handling, and operation (power mode) of the switch. Electrostatic discharge shall be applied to switch connector pins with the switch grounded, as well as applied to test points normally accessible to the switch operator.

4.6.26 Function test. To determine conformance with 3.4.26, the switch shall be tested as specified in 4.6.15 with the following exceptions: test temperature shall be at  $80 \pm 10^{\circ}\text{F}$  only, the duration of the test shall be 1,000 cycles with the main switch section, and 1,000 cycles with the auxiliary switch section. Proper function of the switch assembly, which includes proper switching and breaking of power to lights, shall be monitored in real-time for correct functionality throughout the entire endurance test. Any deviation from normal operation, even an intermittent anomaly, such that the switch eventually returns to normal operation, shall be recognized as a failure and shall be cause for rejection. All of the contacts listed in TABLE IV shall be monitored with socket contact "A" connected to socket contact "K." Socket contact "F" shall be the sole current source for the entire switch assembly.

#### 4.7 Environmental and physical tests.

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4.7.1 Waterproofness test. To determine conformance with 3.5.1, the energized switch shall be tested in accordance with Drawing 12480561 Test Type I, Pressure/Vacuum immersion for meeting waterproof requirements in military ground platform applications.

4.7.2 Corrosion tests. To determine conformance to 3.5.2, the switch assembly shall be subjected to the salt atmosphere test as specified in MIL-STD-202, Method 101, test condition D, for a duration of 200 hours.

4.7.3 Fungus test. To determine conformance to 3.5.3, the switch shall be subjected to fungus growth tests as specified in MIL-STD-810, Method 508.5 with an incubation period of 90 days.

4.7.4 Drop test. To determine conformance with 3.5.4, the energized switch shall be subjected to the random drop test as specified in MIL-STD-202, Method 203.

4.7.5 Thermal shock test. To determine conformance with 3.5.5, the energized switch shall be tested in accordance with Drawing 12480561 Test Type II, Thermal Shock Immersion.

4.7.6 Water jet spray test. To determine conformance with 3.5.6, the energized switch shall be tested in accordance with Drawing 12480561 Test Type III, Water Jet Spray.

4.7.7 Vibration test. To determine conformance to 3.5.7, the switch assembly shall be connected to circuits as specified in 4.5.9.1 and mounted as in its intended use. The switch assembly shall be subjected to the vibration test as specified in MIL-STD-202, Method 204, test condition E. Vibration shall be applied for 1 hour in the three major orthogonal axes of the switch assembly. The main and auxiliary switch levers shall be set at each indicating position for equal periods of time during the test.

4.7.8 Shock test - switch assembly. To determine conformance to 3.5.8, the switch assembly shall be connected to circuits as specified in 4.6.15.1, mounted as in its intended use, and tested as specified in 4.7.8.1 and 4.7.8.2.

4.7.8.1 Shock test - switch lever. The main switch lever shall be placed in the BLACKOUT DRIVE position and the auxiliary switch lever in the PANEL DIM position. The position of the levers shall be the measured. Subsequently, the switch assembly shall be subjected to the shock test specified in MIL-STD-202, Method 213, test condition G, except the shock pulse shall be 100 peak gravity (g). The shock pulse shall be applied in the direction of the three major orthogonal axes of the switch assembly. Subsequent to this shock testing, the position of the specified levers shall be measured as specified. The difference in their positions is the movement of the levers.

4.7.8.2 Shock test - connector. The test shall be as specified in 4.7.8.1 with the following exceptions:

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- a. The cables shall be mounted to structures that move with the switch assembly.
- b. A minimum of 8 inches (20 centimeters (cm)) of cable shall be unsupported behind the rear of the connector.
- c. The shock pulse shall be 50 peak gravity (g). If the test set-up specified in this paragraph is used in 4.7.8.1, this test may be omitted.

TABLE I. Circuit breaker speed of operation.

Current Amperes $\pm$ 10%	Time to trip (sec)	
	Min	Max
40	8	50
60	1.5	15
80	0.6	6
160	0.13	1.5
200	0.1	1

TABLE II. Conductor requirements.

Cable Size (AWG)	Test Current Amperes $\pm$ 5%	Max Voltage Drop (mV)		Mechanical Strength (min)	
		Before	After test	lbf	N
20	11	7	12	19	85
18	16	7	12	28	125
16	22	7	12	37	165
14	32	6	11	45	200
12	44	5	8	95	423
10	69	5	8	150	667
8	95	5	8	195	867
6	139	5	8	270	1201
4	165	5	8	350	1557
2	226	5	8	555	2469
1	264	5	8	650	2891
0	307	5	8	760	3380
00	353	5	8	860	3825
0000	460	5	8	1000	4448

TABLE III. Continuous current capacities and ultimate trip current.

Ambient air temperature.	Continuous current capacity (min. A)	Ultimate trip current (max. A)
80 $\pm$ 5°F (27 $\pm$ 2.8°C)	23.0	30.0
-65 $\pm$ 5°F (-53.9 $\pm$ 2.8°C)	28.9	40.2
180 $\pm$ 5°F (82 $\pm$ 2.8°C)	17.6	24.0

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TABLE IV. Current capacities.

<b>Circuit</b>	<b>Current (A <math>\pm</math> 5%)</b>	<b>Wire length (m)</b>	<b>Wire length w/ trailer (m)</b>
A	2.0	Refer to Note 1	Refer to Note 1
B	1.2	1.83	
C	2.0	6.1	22.2
D	1.2	3.66	
E	4.4	6.1	22.2
F	18.0	3.66	
H	3.0	6.1	22.2
J	3.5	6.1	22.2
K	2.0	Refer to Note 1	Refer to Note 1
L	1.6	6.1	22.2
M	7.5	3.66	
N	0.8	6.1	22.2

## NOTES:

1. The free ends of the wires from sockets "A" and "K" shall be connected together. Circuits "A" and "K" are not directly loaded, however the wire size must be sufficient for the specified currents.
2. Wire size shall be 14 AWG.

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TABLE V. Order of first article test.

Sample	Order	Test Procedure	Title
A	1	4.6.1	Electrical continuity
	2	4.6.2	Voltage drop
	3	4.6.20	Operating voltage range
	4	4.7.7	Vibration
	5	4.7.8	Shock
	6	4.6.4	Circuit breaker high temperature reclosing
	7	4.6.10	Circuit breaker endurance
	8	4.7.5	Thermal shock
B	1	4.6.5	Circuit breaker no-current trip temperature
	2	4.6.6	Circuit breaker speed of operation
	3	4.6.13	Interlock strength
	4	4.6.14	Interlock effort
	5	4.6.21	Voltage spike
	6	4.6.22	Voltage surge
	7	4.6.15	Endurance
	8	4.7.6	Water jet spray
C	1	4.7.2	Corrosion
	2	4.6.17	Switch lever position
	3	4.6.18	Switch lever indexing
	4	4.6.23	Ripple voltage
	5	4.6.24	Electromagnetic interference
	6	4.6.8	Overload
	7	4.6.9	Circuit breaker resistance to short circuit
D	1	4.6.3	Circuit breaker continuous current capacity and ultimate trip current
	2	4.7.4	Drop
	3	4.6.12	Switch lever torque
	4	4.7.3	Fungus
	5	4.6.25	Electrostatic discharge
	6	4.6.7	Circuit breaker overload
	7	4.7.1	Waterproofness
E, F, G, H, I, J, K, L, M	1	4.6.26	Function test
	2	4.6.11	Conditions after rupture
	3	4.6.16	Dielectric strength
N	1	4.6.19.1	Voltage drop
	2	4.6.19.2	Current rating
	3	4.6.19.3	Current overload
	4	4.6.19.4	Mechanical strength
P	1	4.6.19.1	Voltage drop
	2	4.6.19.4	Mechanical strength
	3	4.6.19.5	Vibration



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TABLE VI. Order of control tests.

Sample	Test Procedure	Test Title
1	4.6.8	Overload
	4.6.26	Function test
	4.6.9	Circuit breaker resistance to short circuit
	4.6.2	Voltage drop
	4.6.16	Dielectric strength
2	4.6.3	Circuit breaker continuous current capacity and ultimate trip current
	4.6.6	Circuit breaker speed of operation
	4.7.8	Shock
	4.6.17	Switch lever position
	4.6.26	Function test
3	4.6.2	Voltage drop
	4.6.7	Circuit breaker overload
	4.7.7	Vibration
	4.6.12	Switch lever torque
	4.6.14	Interlock effort
	4.6.26	Function test
4	4.6.2	Voltage drop
	<b>Crimp terminations</b>	
4	4.6.19.1	Voltage drop
	4.6.19.4	Mechanical strength

TABLE VII. Classification of defects.

Category	Defect	Method of Inspection
<u>Major</u>		
101	Improper materials (see 3.2)	Visual
102	Dimensions affecting interchangeability (see 3.3)	Gauge
103	Improper mechanical interlock (see 3.3.4)	Visual
104	Improper protective finish and color (see 3.6)	Visual
<u>Minor</u>		
201	Dimensions not affecting interchangeability (see 3.3)	Gauge
202	Improper identification marking (see 3.7)	Visual
203	Workmanship (see 3.8)	Visual

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TABLE VIII. Order of acceptance test.

Test Procedure	Title
4.6.26	Function test
4.6.3 (only at 80°F)	Circuit breaker continuous current capacity and ultimate trip current
4.6.6 (only at 40A)	Circuit breaker speed of operation
4.6.2	Voltage drop
4.7.1	Waterproofness
4.7.7	Vibration
4.6.12	Switch lever torque
4.6.17	Switch lever position
4.6.16	Dielectric strength
4.6.26	Function test

## 5. PACKAGING

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

## 6. NOTES

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

6.1 Intended use. The switch covered by this specification is intended for use as a master lighting control switch in military vehicles. The switch is equipped with an automatic interlock to prevent the accidental energizing of any lights except the blackout marker lights.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1, 2.2.2, and 2.3).
- c. If first article inspection is required (see 3.1).
- d. If sample size for first article inspection should be other than as specified (see 4.3).
- e. If sampling plan should be other than as specified (see 4.4.1).
- f. Packaging requirements (see 5.1).

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6.3 Definitions.

6.3.1 Tripped. For the purpose of this specification, tripped means that the circuit breaker opened its electric circuit.

6.3.2 Definitions of terms used in sampling inspection.

- a. Classification of defects. A classification of defects is the enumeration of possible defects of the unit of product classified according to their seriousness. A defect is any nonconformance of the unit of product with specified requirements. Defects will normally be grouped into one or more of the following classes: critical, major, and minor defects. Also, defects may be grouped into other classes or into subclasses within these classes.
- b. Critical defective. A critical defective is a unit of product which contains one or more critical defects and may also contain major and/or minor defects.
- c. Defective. A defective is a unit of product which contains one or more defects.
- d. Formation of lots or batches. The product should be assembled into identifiable lots, sublots, batches, or in such other manner as may be prescribed (see I). Each lot or batch should, as far as is practicable, consist of units of product of a single type, grade, class, size, and composition, manufactured under essentially the same conditions, and at essentially the same time.
- e. Lot or batch. The term lot or batch means “inspection lot” or “inspection batch”, i.e., a collection of units of product from which a sample is to be drawn and inspected and may differ from a collection of units designated as a lot or batch for other purposes (e.g., production, shipment, etc.).
- f. Lot or batch size. The lot or batch size is the number of units of product in a lot or batch.
- g. Major defect. A major defect is a defect, other than critical, that is likely to result in failure, or to reduce materially the usability of the unit of product for its intended purpose.
- h. Major defective. A major defective is a unit of product which contains one or more major defects, and may also contain minor defects but contains no critical defect.
- i. Minor defect. A minor defect is a defect that is not likely to reduce materially the usability of the unit of product for its intended purpose, or is a departure from established standards having little bearing on the effective use or operation of the unit.
- j. Minor defective. A minor defective is a unit of product which contains one or more minor defects but contains no critical or major defect.
- k. Presentation of lots or batches. The formation of the lots or batches, lot or batch size, and the manner in which each lot or batch is to be presented and identified by the supplier should be designated or approved by the responsible authority. As necessary, the supplier should provide adequate and suitable storage space for each lot or batch, equipment needed for proper identification and presentation, and personnel for all handling of product required for drawing of samples.
- l. Representative sampling. When appropriate, the number of units in the sample

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should be selected in proportion to the size of sublots or subbatches, or parts of the lot or batch, identified by some rational criterion. When representative sampling is used, the units from each part of the lot or batch should be selected at random.

- m. Sample. A sample consists of one or more units of product drawn from a lot or batch, the units of the sample being selected at random without regard to their quality. The number of units or product in the sample is the sample size.
- n. Sampling plan. A sampling plan indicates the number of units of product from each lot or batch which are to be inspected (sample size or series of sample sizes) and the criteria for determining the acceptability of the lot or batch (acceptance and rejection numbers).
- o. Time of sampling. Samples may be drawn after all the units comprising the lot or batch have been assembled, or samples may be drawn during assembly of the lot or batch.

6.33 Recovered material. Waste materials and by-products that have been recovered or diverted from solid waste. It does not include those materials and by-products generated from, and commonly reused within, an original manufacturing process.

6.34 Recycled material. Product or other material recovered from the solid waste stream for use in the form of raw materials in the manufacture of new products other than fuel for producing heat or power by combustion.

6.4 Subject term (key word) listing.

Blackout marker lights  
Electromagnetic interference  
Electrostatic discharge  
Instrument panel  
Lighting control  
Master vehicle light switch  
Stop light  
Tail light

6.5 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.

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APPENDIX A

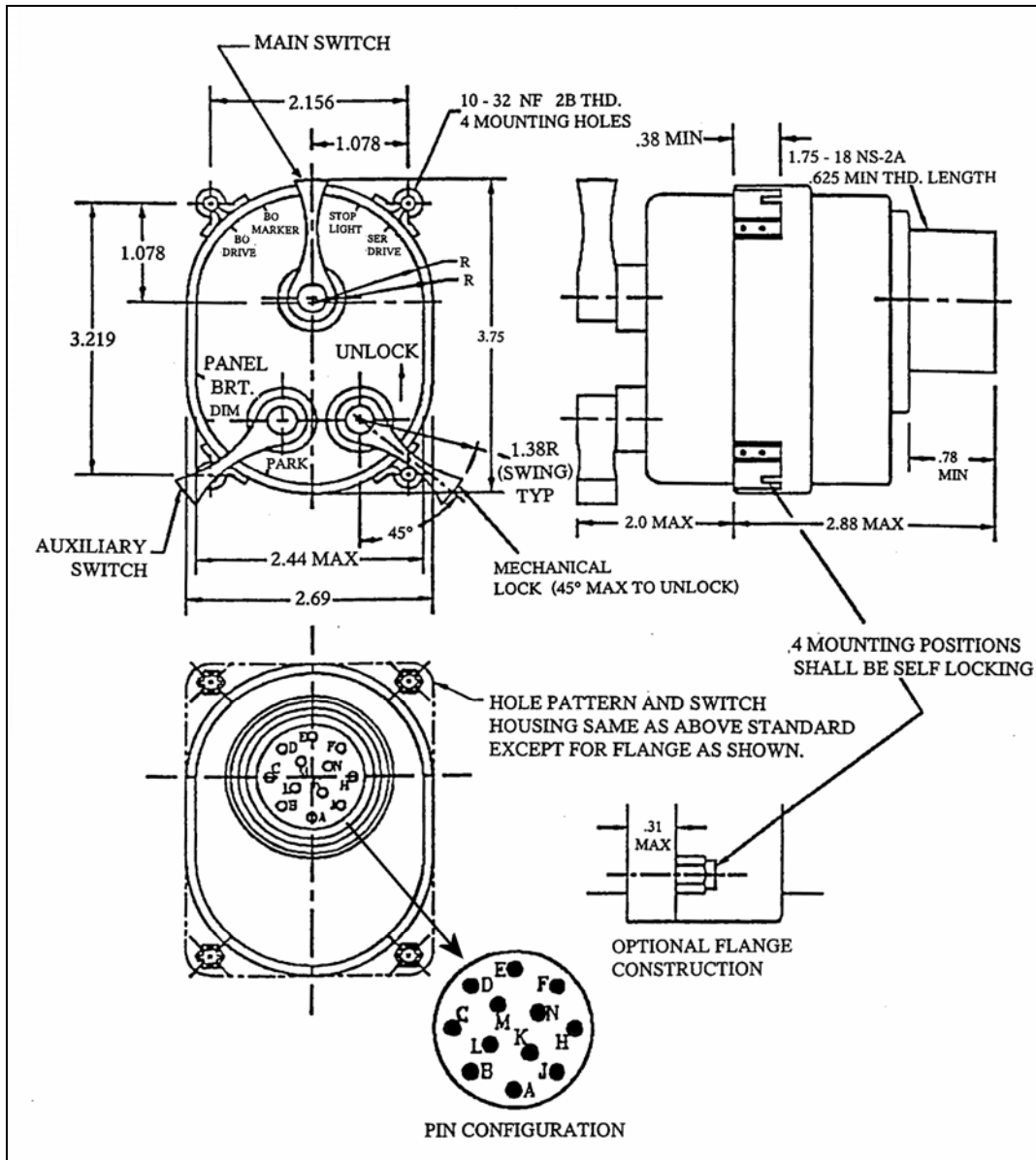


FIGURE A1. Vehicular light switch.

NOTES:

1. Unless otherwise specified dimensions are in inches: Tolerances  $\pm 0.005$  on decimals  $\pm 5^\circ$  on angular dimensions.
2. This drawing is not intended to limit construction to features other than shown hereon by dimensions, notations and referenced documents.

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SWITCH POSITION DATA

OFF POSITION - MAIN SWITCH - ALL CIRCUITS OPEN

BLACKOUT MARKER POSITION - MAIN SWITCH

Battery to blackout marker and clearance lamps.

Battery to blackout tail lamp.

Battery to feed to blackout turn indicator switch.

Battery to feed to stop lamp switch.

Stop lamp switch (dead side) to blackout stop lamp.

Auxiliary switch can be moved to off, dim or bright panel lamps.

BLACKOUT DRIVE POSITION - MAIN SWITCH

Battery to blackout marker and clearance lamps.

Battery to blackout tail lamp.

Battery to feed to blackout turn indicator switch.

Battery to feed to stop lamp switch.

Battery to blackout driving lamp.

Stop lamp switch (dead side) to blackout stop lamp.

Auxiliary switch can be moved to off, dim or bright panel lamps.

STOP LIGHT POSITION - MAIN SWITCH

Battery to feed to service turn indicator switch.

Battery to feed to stop lamp switch.

Stop lamp switch (dead side) to service stop lamp.

Auxiliary switch can be moved to off, dim or bright panel lamps.

SERVICE DRIVE POSITION - MAIN SWITCH

Battery to feed to service turn indicator switch.

Battery to feed to stop lamp switch.

Battery to service tail lamp.

Battery to clearance lamp.

Battery to service headlamps.

Stop lamp switch (dead side) to service stop lamp.

Auxiliary switch can be moved to parking lamps,  
plus dim panel lamps or service headlamps with  
off, dim or bright panel lamps.

FIGURE A1. Vehicular light switch - Continued.

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12 PIN CONNECTOR (28-51P)	
PIN	CONNECTS TO:
A	STOP LAMP SWITCH
B	PANEL LAMPS
C	SERVICE STOP LAMPS
D	BLACKOUT DRIVING LAMP
E	BLACKOUT CLEARANCE LAMP
	BLACKOUT MARKER LAMP
	BLACKOUT TURN INDICATOR L & R
	BLACKOUT TAIL LAMPS
F	BATTERY
H	SERVICE TAIL LAMPS
	SERVICE CLEARANCE LAMPS
J	SERVICE TURN INDICATOR L & R
K	STOP LAMP SWITCH (DEAD SIDE)
L	PARKING LAMPS
M	SERVICE HEADLAMPS
N	BLACKOUT STOP LAMPS

FIGURE A1. Vehicular light switch - Continued.



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APPENDIX A

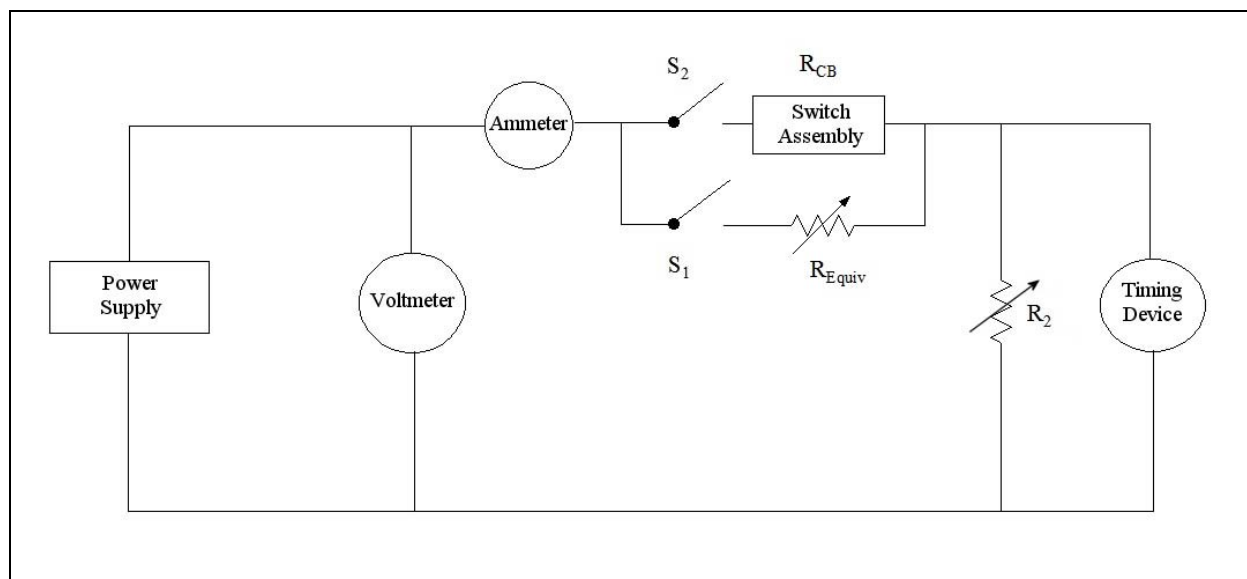


FIGURE A2. Circuit breaker speed of operation test circuit schematic.

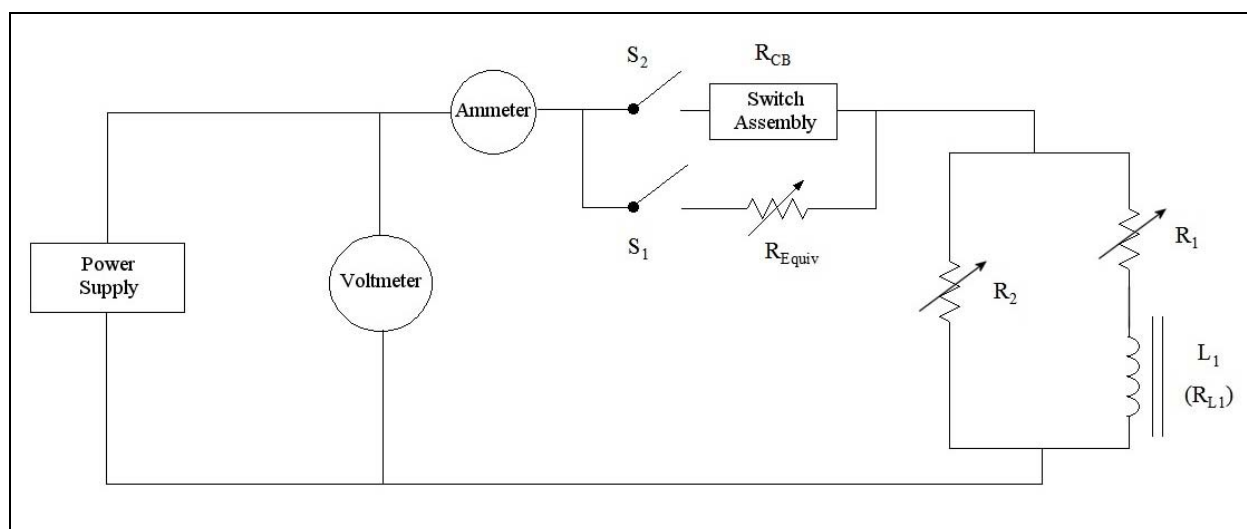
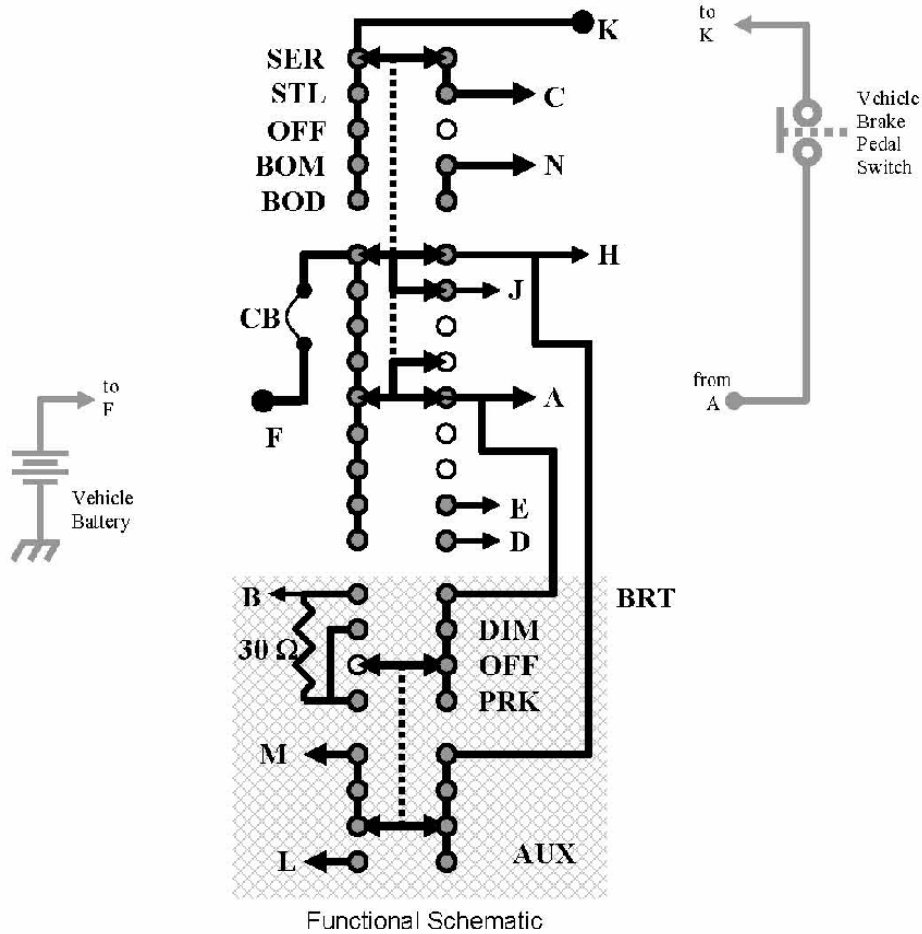


FIGURE A3. Circuit breaker endurance test circuit schematic.

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APPENDIX A

**Functional Schematic**



(A) Stop Lamp Switch	(E) B.O. Clearance Lamp B.O. Marker Lamp B.O. Turn Indicator B.O. Tail Lamp
(B) Panel Lamps	
(C) Service Stop Lamp	
(D) Blackout Driving	
(F) Battery <b>(from)</b>	(K) Stop Lamp Switch <b>(from)</b>
(H) Service Tail Lamp Service Clearance	(L) Parking Lamps
(J) Ser. Turn Indicator	(M) Service Headlamp
	(N) Blackout Stop Lamp

Pin Connections

FIGURE A4. Functional Schematic.

NOTES:

1. Figure A4 is for reference only, not for switch design.

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Custodians:

Army - AT  
Navy - YD  
Air Force - 99

Preparing Activity:

Army - AT

(Project 2590-2006-001)

Review Activities:

Army – CR, TE  
Navy - MC  
DLA – CC

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 <http://assist.daps.dla.mil>.