MIL-C-13516E
28 March 1979
SUPERSEDING
MIL-C-13516D
26 August 1968

MILITARY SPECIFICATION

CIRCUIT BREAKERS; MANUAL AND AUTOMATIC (28 VOLT)

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

1. SCOPE

1.1 Scope. This specification covers 28 volt manual and automatic circuit breakers for use in military vehicles.

1.2 Classification. Circuit breakers shall be of the following types, grades, and classes, as specified (see 6.2):

Type I	- Manual reset.
Type II	- Automatic reset.
Grade A	- Waterproof.
Grade B	- Nonwaterproof.
Class 1	- 0 to 30 ampere rating.
Class 2	- Over 30 ampere rating.

2. APPLICABLE DOCUMENTS

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

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 Materiel Readiness Command, ATTN: DRSTA-GSS, Warren, MI 48090 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

FSC 5925

SPECIFICATIONS

FEDERAL

QQ-S-571	- Solder, Tin Alloy, Lead-Tin Alloy, and Lead Alloy.

MILITARY

MIL-C-13486	- Cable, Special Purpose, Electrical, Low Tension, Heavy Duty, Single Conductor and Multiconductor
MIL-C-13516/1	- Circuit Breakers, 28 Volt DC, Automatic, Waterproof, 15 to 30 AMP.
MIL-C-13516/2	- Circuit Breakers, 28 Volt DC, Manual, Waterproof, 15 to 30 AMP.
MIL-C-13516/3	- Circuit Breakers, 28 Volt DC, Manual, Nonwaterproof, 105 to 200 AMP.
MIL-C-13516/4	- Circuit Breakers, 28 Volt DC, Manual, Nonwaterproof, 35 to 150 AMP.
MIL-C-13516/5	- Circuit Breakers, 28 Volt DC, Automatic, Nonwaterproof, 10 to 35 AMP.
MIL-C-13516/6	- Circuit Breakers, 28 Volt DC, Manual, Nonwaterproof, 10 to 35 AMP.
MIL-C-13516/7	- Circuit Breakers, 28 Volt DC, Automatic, Nonwaterproof, 35 to 150 AMP.
MIL-C-13516/8	- Circuit Breakers, 28 Volt DC, Automatic, Nonwaterproof, 105 to 200 AMP.
MIL-E-13856	- Electrical Components for Automotive Vehicles, Waterproofness Tests.
MIL-F-13927	- Fungus Resistance Test, Automotive Components.
MIL-E-17555	- Electronic and Electrical Equipment and Associated Repair Parts, Preparation for Delivery of.

STANDARDS

MILITARY

MIL-STD-105	- Sampling Procedures and Tables for Inspection by Attributes.

MIL-STD-129 - Marking for Shipment and Storage
MIL-STD-130 - Identification Marking of US Military Property.
MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.

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

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

NATIONAL BUREAU OF STANDARDS

Handbook H28 - Screw-thread Standards for Federal Services.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20402.)

3. REQUIREMENTS

3.1 First article. The contractor shall furnish sample units for first article inspection and approval (see 4.4 and 6.3). First article samples shall be inspected by the contractor under the surveillance of the Government to determine conformance to the quality assurance provisions of this specification. First article samples shall be fully representative of circuit breakers to be supplied from production tooling and facilities.

3.2 Materials. Materials shall be as specified herein, in applicable specifications, drawings or specification sheets. Materials not specifically designated shall be suitable for use in circuit breakers operating over specified ranges, without any change in physical or dimensional properties that would result in operation of the units falling outside of the specified limits (see 6.6).

3.2.1 Solder. Solder employed in making electrical connections shall conform to QQ-S-571. A rosin flux shall be used.

3.2.2 Dissimilar metals. Except where necessary to complete an electrical circuit, contact between dissimilar metals which encourage galvanic action shall be avoided.

3.3 Design and construction. Circuit breakers shall be constructed to the form and dimensions specified on the applicable military specification sheet in the following list:

MIL-C-13516/1	MIL-C-13516/5
MIL-C-13516/2	MIL-C-13516/6
MIL-C-13516/3	MIL-C-13516/7
MIL-C-13516/4	MIL-C-13516/8

3.3.1 Standard parts. Military standard parts shall be incorporated wherever applicable. Commercial standard parts may be used provided they furnish equivalent performance and are interchangeable with military standard parts without modification.

3.3.2 Threaded parts. All screw threads shall conform to the applicable military specification sheet and to the National Bureau of Standards Handbook, H28 (see 2.2).

3.3.3 Resetting mechanism. The reset button (of type I circuit breakers) shall operate without sticking under all environmental conditions upon application of no more than 5 pounds finger pressure. The button shall be red in color and shall be insulated from current carrying parts. The button and resetting mechanism shall withstand a 50-pound load exerted in the direction of resetting, and application of a 35-pound shear load without distorting or breaking parts. Button rotation shall not be cause for rejection.

3.3.3.1 Trip-free action. The reset mechanism (of type I circuit breakers) shall be so designed that the circuit cannot be maintained closed when carrying overload currents which would normally trip the circuit breaker to the open position (see 4.6.9).

3.3.4 Terminals. Each terminal (stud or tapped insert) of grade B circuit breakers shall be mechanically locked to prevent rotation and shall withstand 10 inch-pounds of torque for class 1 circuit breakers and 50 inch-pounds torque for class 2 circuit breakers without damage to the terminals or adjacent parts.

3.4 Performance requirements.

3.4.1 Continuous current capacity and ultimate trip current. At each of the ambient air temperatures specified in table I, circuit breakers shall carry the percentage of rated current specified for that temperature for no less than 60 minutes without tripping or other current interruption. While at the same temperature, the circuit breaker shall subsequently operate at the higher percentage of rated current and shall trip within 60 minutes.

TABLE I. Continuous current capacities and ultimate trip currents.

Ambient air Temperature	Percent of rated current	
	Continuous current capacity	Ultimate trip current
77° ± 5°F	115 percent	138 percent
65° ± 5°F	140 percent	185 percent
165° ± 5°F	85 percent	115 percent

3.4.2 High temperature reclosing. After conditioning for one hour at 165°F (165 degrees Fahrenheit) ± 5°F and while still in ambient air of that temperature, type II circuit breakers shall reclose the circuit within 30 minutes after breaking the circuit.

3.4.3 No-current trip temperature. When carrying no current, circuit breakers shall not trip at, or below, 265°F.

3.4.4 Temperature rise. After carrying rated current for 1 hour, temperature rise of circuit breaker terminals shall not exceed 117°F.

3.4.5 Speed of operation. At specified overloads, circuit breakers shall meet the following minimum and maximum opening time requirements:

Percent of rated current	Opening time (seconds) Class 1 Minimum	Class 1 Maximum	Class 2 Minimum	Class 2 Maximum
200	8.0	50	8.0	100
300	1.5	15	1.5	30
400	0.6	6	0.6	15
800	0.13	1.5	0.13	5
1000	0.10	1	0.10	2

3.4.6 Overload characteristics. Effective current shall at no time exceed 130 percent of nominal rating. The effective current shall be no less than 75 percent of rated current for class 1 circuit breakers and no less than 35 percent for class 2 circuit breakers, when tested as specified in 4.6.6.

3.4.7 Resistance to short circuit. After having been tested as specified in 4.6.7, circuit breakers shall carry 105 percent of rated current for 60 minutes without tripping and shall trip within 60 minutes when carrying 145 percent of rated current.

3.4.8 Dielectric withstanding voltage. Insulation of circuit breakers shall withstand a potential of 1000 volts root mean square (rms) at a frequency of 60 cycles per second (cps) for no less than 1 minute. Upon examination, circuit breakers shall evidence no cracking, charring, or other damage and shall subsequently meet the requirements of 3.4.1.

3.4.9 Endurance. Circuit breakers shall meet the opening time requirements of 3.4.5 at the overload and number of cycles specified in 4.6.9. Upon completion of cycling, circuit breakers shall carry 105 percent of rated current for 60 minutes without tripping and shall subsequently trip within 60 minutes when carrying 145 percent of rated current.

3.5 Environmental requirements.

3.5.1 Vibration. At an ambient air temperature of $77^{\circ} \pm 5^{\circ}F$, circuit breakers shall carry rated current continuously with no interruption of current flow when tested as specified in 4.6.10. Upon completion of the test, circuit breakers shall meet the requirements of 3.4.1 at $77^{\circ} \pm 5^{\circ}F$ and shall evidence no damage as a result of the test.

3.5.2 Shock. At an ambient air temperature of $77^{\circ} \pm 5^{\circ}F$ circuit breakers shall carry rated current continuously with no interruption of current flow when tested as specified in 4.6.11. Upon completion of the test, circuit breakers shall meet the requirements of 3.4.1 and shall evidence no damage as a result of the test.

3.5.3 Salt spray (corrosion). After having been subjected to the salt-spray test specified in 4.6.12, circuit breakers shall evidence no corrosion affecting performance. Upon completion of testing, circuit breakers shall carry 105 percent of rated current for 60 minutes without tripping and shall subsequently trip within 60 minutes when carrying 145 percent of rated current.

3.5.4 Fungus resistance. After having been subjected to the test specified in 4.6.13, circuit breakers shall evidence no microbial growth that would adversely affect performance. Subsequent to the test, circuit breakers shall meet the requirements of 3.4.1.

3.5.5 Waterproofness. When tested as specified in 4.6.14, grade A circuit breakers shall evidence no leakage and shall subsequently meet the requirements of 3.4.1.

3.5.6 Condition after failure. Circuit breakers shall be so designed that ultimate failure shall always result in an open circuit with no current-carrying member grounded to the frame or case.

3.6 Marking. Circuit breakers shall be marked in accordance with MIL-STD-130. Each circuit breaker shall be marked with the following information:

Circuit breaker
Rating 28 volts _____ amps dc
Military part number _____
Federal stock number _____
US
Manufacturer's name or trade mark
Date of manufacture (month and year)

3.7 Workmanship. Workmanship shall be such to assure a product free of chips, burrs, sharp edges, rust, loose or defective connectors or terminals, cracked insulation, faulty soldering, or cracked cases.

4. QUALITY ASSURANCE PROVISIONS

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

4.2 Classification of inspections. Inspections specified herein are classified as follows:

a. First article inspection (see 4.4).
b. Quality conformance (see 4.5).

4.3 Inspection conditions. Except where otherwise specified herein, tests shall be performed in still air, at a temperature of 77° ± 5°F. When no other test voltage is specified, tests shall be conducted at 28 ± 2 volts direct current (dc). Test currents shall be maintained, automatically or manually, at specified values. The value of resistance for the R_e leg of the circuit (figures 1 and 2) shall be adjusted to equal the resistance of the R_{CB} leg of the circuit within ± 5 percent (1/). Where possible, the circuit shall be adjusted after switching in the circuit breaker to yield the instrument readings specified in the applicable test. Current conducting cables shall conform to MIL-C-13486, and shall be exposed to the same ambient air temperatures as specified for the circuit breakers. Test cables shall be 3 feet long and of the following sizes for the rated circuit breaker capacities specified:

Ratings - Amps	Cable size
0 - 15	14
16 - 30	12
31 - 40	8
41 - 60	6
61 - 90	4
91 - 120	2
121 - 200	00

1/ Resistance measurements shall be obtained with an ohmmeter employing a current of 1 milliampere or less.

4.3.1 Calibration of test equipment. Unless otherwise specified herein, test equipment accuracy shall be such as to permit measurement of 10 percent of product or test specification tolerance. Calibration of test equipment shall be conducted at intervals sufficient to establish required accuracy. Records of calibration shall be made available to the Government. The Government inspector may refuse to allow inspection where accuracy of test equipment has not been established to the satisfaction of the Government. Measuring instrument tolerances shall be as listed in table II.

TABLE II. Measuring instrument tolerances.

Instrument	Maximum accuracy tolerance
Voltmeter, dc	1 percent
Ammeter, dc	1 percent

4.4 First article inspection. First article inspection shall be performed after award of contract and prior to production (see 3.1). Five circuit breakers shall be submitted for first article inspection. Inspection shall be performed on sample units which have been produced with equipment and procedures normally used in production. First article approval is valid only on the contract under which it is granted, unless extended by the Government to other contracts.

4.4.1 Inspection routine. Samples shall be subjected to examination as specified in 4.5.1.2 and tests specified in table III, in the order shown.

TABLE III. Order of first article testing.

	Tests
Sample A	
1. Continuous current capacity and ultimate trip current test	4.6.1
2. High temperature reclosing test	4.6.2
3. Vibration test	4.6.10
4. Shock test	4.6.11
5. Endurance test	4.6.9
Sample B	
1. Continuous current capacity and ultimate trip current test	4.6.1
2. Temperature rise test	4.6.4
3. High temperature reclosing test	4.6.2
4. Vibration test	4.6.10
5. Salt spray (corrosion) test	4.6.12
Sample C	
1. Continuous current capacity and ultimate trip current test (at 77° ± 5°F only)	4.6.1
2. Dielectric withstanding voltage test	4.6.8
3. Speed of operation test	4.6.5
4. Overload test	4.6.6
5. Waterproofness test (grade A only)	4.6.14
Sample D	
1. Continuous current capacity and ultimate trip current test (at 77° ± 5°F only)	4.6.1
2. No-current trip temperature test	4.6.3
3. Resistance to short circuit test	4.6.7
4. Condition after failure test	4.6.15

TABLE III. Order of first article testing. - Continued

Sample E	Test
1. Continuous current capacity and ultimate trip current test (at 77°F ± 5°F only)	4.6.1
2. Dielectric withstanding voltage test	4.6.8
3. Fungus resistance test	4.6.13
4. Continuous current capacity and ultimate trip current test (at 165°F only)	4.6.1

4.4.2 Failure. One or more failures shall be cause for refusal to grant first article approval (see 3.1).

4.5 Quality conformance inspection.

4.5.1 Sampling.

4.5.1.1 Lot formation. A lot shall consist of all circuit breakers of one type, grade, class, and part number submitted at one time for acceptance.

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

4.5.1.3 Sampling for acceptance testing. Samples for acceptance testing shall be selected in accordance with inspection Level S3 of MIL-STD-105.

4.5.2 Quality conformance examination.

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

Classification	AQL
Major	1.0
Minor	2.5

4.5.2.2 Classification of defects. For examination purposes, defects shall be classified as follows:

Major defects (1.0 AQL)	Examination method
Dimensions affecting interchangeability not within tolerance (see 3.3).	Gage
Defective resetting mechanism (see 3.3.3).	Traction
Defective terminals (see 3.3.4).	Torque gage

Minor defects (2.5 AQL)	Examination method
Dimensions not affecting interchangeability not within tolerance (see 3.3).	Gage
Improper marking (see 3.6).	Visual
Faulty workmanship (see 3.7).	Visual

4.5.3 Classification of tests.

a. Acceptance tests (see 4.5.3.1).
b. Control tests (see 4.5.3.2).

4.5.3.1 Acceptance tests. Samples selected in accordance with 4.5.1.3 shall be subjected to the tests specified in 4.6.1 (at 77°F only), 4.6.5 (at 200 percent of rated current only), and 4.6.8, using an AQL of 6.5 on the basis of percent defective.

4.5.3.2 Control tests.

4.5.3.2.1 Sampling. Control test samples shall be selected at the rate of four of each 500 produced, under a particular military specification sheet, except that not less than four nor more than eight shall be selected in any 30 day period.

4.5.3.2.2 Test routine. Samples shall be examined for the defects specified in 4.5.2.2 and subsequently tested as specified in 4.6.1, 4.6.5, 4.6.6, and 4.6.9.

4.5.3.2.3 Failure. Failure of a control test sample to pass any specified examination or test may be cause for the Government to refuse to accept subsequent lots until it has been proven, to the satisfaction of the Government, that the faults revealed by the test have been corrected.

4.6 Conformance verification.

4.6.1 Continuous current capacity and ultimate trip current test. To determine conformance to 3.4.1, each circuit breaker shall be conditioned in turn at each of the ambient temperatures specified in table I until the sample reaches the temperature range specified. After conditioning, and while still at that temperature, the circuit breaker shall be subjected to the percentage of rated current specified for not less than 60 minutes. The circuit breaker shall subsequently be subjected to the higher percentage of rated current specified for ultimate trip current for a period of 60 minutes.

4.6.2 High temperature reclosing test. To determine conformance to 3.4.2, the circuit breaker shall be conditioned for one hour at 165 ± 5°F and, while still in ambient air at that temperature, a current equal to 300 percent of rated current shall be passed through the circuit breaker until tripping occurs. The circuit breaker shall then be allowed to stand in ambient air at the same temperature until contacts reclose, or until 30 minutes have passed.

4.6.3 No-current trip temperature test. To determine conformance to 3.4.3, the circuit breaker 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°F for 1 hour, after which a determination of contact position shall be made.

4.6.4 Temperature rise test. To determine conformance to 3.4.4, the circuit breaker shall be mounted on a test stand and thermocouples installed at each of the terminals. The circuit breakers shall then be subjected to rated current for 1 hour and the temperature rise noted.

4.6.5 Speed of operation test. To determine conformance to 3.4.5, the circuit breaker shall be connected in the circuit shown in figure 1 and the circuit calibrated for each value of current employed. Calibration shall consist of opening switch S2 and closing switch S1, and varying the load resistance (R_L) until the desired value of current is registered on the ammeter. Subsequently the switch S1 shall be opened, S2 closed and the time required for the circuit breaker to open recorded.

4.6.6 Overload test.

4.6.6.1 Apparatus. Test apparatus shall include a stop watch, an electronic cycle-counting timer, a controllable load resistance for adjusting the demand current, and other switches, wiring, and fixtures necessary to conduct the test. The cycle-counting timer shall consist of an electronic counter and a frequency-controlled oscillator. The oscillator output shall be fed to the counter only when the circuit breaker contacts are closed. The instrument shall indicate the accumulated conducting time in milliseconds or smaller increments of time.

4.6.6.2 Test procedure. The circuit breaker shall be connected in the circuit shown in figure 1 and calibrated as specified in 4.6.5. Closure of switch S2 and activation of the stop watch shall be simultaneous. The test shall consist of 10 cycles of breaker opening and closing, the last 5 cycles only being used for computation. The total time for the last five cycles shall be measured by means of a stop watch. The test shall be conducted with demand currents of 130, 150, 250, 600, and 1000 percent of circuit breaker rating. Effective current values shall be calculated by means of the following equation to determine conformance to 3.4.6:

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

Where:

I = Effective value of current passed, amperes.
i = Demand value of current, amperes.
t = Accumulated conducting time (last five cycles only).
T = Total time (last five cycles only).

4.6.7 Resistance to short circuit test. To determine conformance to 3.4.7, the circuit breaker shall be connected in a manner similar to figure 1 and calibrated as specified in 4.5.6. With 28.5 ± 0.5 volts applied, the circuit breaker shall subsequently be cycled according to the following schedule:

Classification	Line current (amperes)	Minute cycles	Rate of cycling
Type I - Class 1	575 ± 25	120	Reset every 2 minutes
Type I - Class 2	875 ± 25	120	Reset every 2 minutes
Type II - Class 1	575 ± 25	240	Not less than 120 cycles per hour
Type I - Class 2	875 ± 25	80	Not less than 40 cycles per hour

NOTE: Under no conditions shall the applied voltage exceed 28.5 ± 0.5 volts, even if the actual line current is less than that specified.

4.6.8 Dielectric withstanding voltage test. The circuit breaker shall be tested in accordance with Method 301 of MIL-STD-202 between each terminal and ground. After testing the circuit breaker shall be examined to determine conformance to 3.4.8 and tested to determine conformance to 3.4.1.

4.6.9 Endurance test. To determine conformance to 3.4.9, the circuit breaker shall be connected in the circuit shown in figure 2, and calibrated as specified in 4.5.7 at 200 percent of rated current. The values selected for R_1, R_2 and L_1 shall be such that:

$$R_1 \pm R_{L_1} = R_2 \text{ and } \frac{L1}{R_1 \pm L_1} = .026$$

Where:
R_1 = Variable resistance in right leg of circuit.
R_{L_1} = Resistance of coil L1 in right leg of circuit.
R_2 = Variable resistance in left leg of circuit.
L1 = Inductance of coil L_1 in right leg of circuit.
.026 = Dimensionless time constant.

Type I circuit breakers shall operate for 500 cycles (make and break) and type II for 2000 cycles, and shall subsequently be subjected to 105 percent and 145 percent of rated current. During testing, circuit breakers shall be observed to determine conformance to 3.3.3.1.

4.6.10 Vibration test. To determine conformance to 3.5.1, the circuit breaker shall be mounted as in intended operation, electrically connected, and subjected to the vibration test specified in Method 201 of MIL-STD-202. Vibration shall be applied for one hour in the direction of each of the three major axes. Upon completion of the test, the circuit breaker shall be tested as specified in 4.5.2 at $77^{\circ} \pm 5^{\circ}F$ only).

4.6.11 Shock test. While carrying rated current and connected in a test circuit which includes a recording ammeter, the circuit breaker shall be subjected to the shock test specified in test condition C, Method 213, of MIL-STD-202. At the conclusion of the test, the circuit breaker shall be inspected for loose or broken parts or other evidence of damage, and the ammeter recording examined for evidence of current interruption. Subsequently, the circuit breaker shall be tested as specified in 4.5.2 at $77^{\circ} \pm 5^{\circ}F$ only to determine conformance to 3.5.2.

4.6.12 Salt spray (corrosion) test. The circuit breaker shall be subjected to the salt spray test specified in Method 101 of MIL-STD-202 for 100 hours. Upon completion of this test period, the circuit breaker shall be tested, while carrying the specified percentage of rated current, to determine conformance to 3.5.3.

4.6.13 Fungus resistance test. To determine conformance to 3.5.4, circuit breakers shall be subjected to the applicable tests specified in MIL-F-13927, with the test period extending continuously for 90 days.

4.6.14 Waterproofness test. To determine conformance to 3.5.5, grade A circuit breakers shall be subjected to the test specified for Type II, Class 2 components in MIL-E-13856. The breakers shall subsequently be tested as specified in 4.5.2 at 77° ± 5°F only.

4.6.15 Condition after failure test. The circuit breaker shall be subjected to maximum rupture current (up to 2000 amperes) that breaker will conduct at 30 volts dc until rupture occurs. The circuit breakers shall then be inspected to determine conformance to 3.5.6.

4.6.16 Inspection of packaging. The Government inspector shall, at unscheduled intervals, inspect all materials and processes involved in packaging to determine conformance to requirements of section 5. Any evidence of deviation from specified requirements shall be cause for refusal to conduct further inspection until objective evidence has been provided by the contractor that corrective action has been taken.

5. PACKAGING

5.1 Preservation, packaging, packing and marking. Preservation, packaging, packing and marking shall be in accordance with the applicable packaging data sheet specified by the procuring activity (see 6.2). When no detailed instructions are provided, cleaning, drying, preservation, packaging and marking shall be in accordance with applicable level of MIL-E-17555. In addition to any special marking required by the contract or order, (see 6.2), unit packages, intermediate packs, and shipping containers, shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Circuit breakers covered by this specification are intended for use in tactical military vehicles. Thermally sensitive, bimetallic type circuit breakers are usually furnished under this specification; however, the specification is not restrictive to this type.

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification.
b. Type, grade, and class of circuit breaker (see 1.2).
c. Applicable military specification sheet (see 3.3).
d. Military part number (see 3.6).
e. Rating in amperes (see 3.6).
f. Level of packaging and packing protection required (see 5.1).

6.3 First article. When a first article is required, it should be tested and approved under the appropriate provisions of 7-104.55 of

the Armed Services Procurement Regulation. The contracting officer should include specific instructions in all procurement instruments regarding arrangements for examination, tests and approval of the first article (see 3.1).

6.4 Definition. The ultimate trip point of a circuit breaker (see 3.4.1 and 4.6.1), by defintion, is the point where it would ultimately trip and begin to cycle. On the curve (figure 3), this point is shown where the curve abruptly departs from linearity. On the diagonal to the left of the ultimate trip point, the circuit breaker is continuously conducting current; on the curve to the right of the ultimate trip point, the circuit breaker (type II) is cycling, i.e., intermittently conducting and interrupting current. The ultimate trip point is determined graphically from the characteristic load curve by extending the cycling portion of the curve to the noncycling portion of the curve. The characteristic curve (see figure 3) is a graphical representation of the performance, expressed in terms of effective current passed by the circuit breaker versus current demanded by the load. It portrays at a given ambient temperature, the ability of a circuit breaker to regulate the electrical energy passing into a load under both normal and abnormal conditions. The horizontal coordinate represents the ratio of current demanded by the load to nominal circuit breaker rating. The vertical coordinate represents the ratio of effective current passed by the circuit breaker to nominal circuit breaker rating. Ratios are used, rather than actual values of current, to simplify the comparison of characteristic load curves of circuit breakers with widely different ratings.

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

6.6 Recycled materials. The use of recycled materials which meet the requirements of the applicable material specifications without jeopardizing the intended use of the item shall be encouraged.

Custodian:
Army - AT
Navy - MC
Air Force - 85

Preparing activity:
Army - AT

Project No. 5925-0123

Review activities:
Army - ER, CR, MI, MU
Air Force - 99
DESC - ES

User activities:
Army - AV, ME

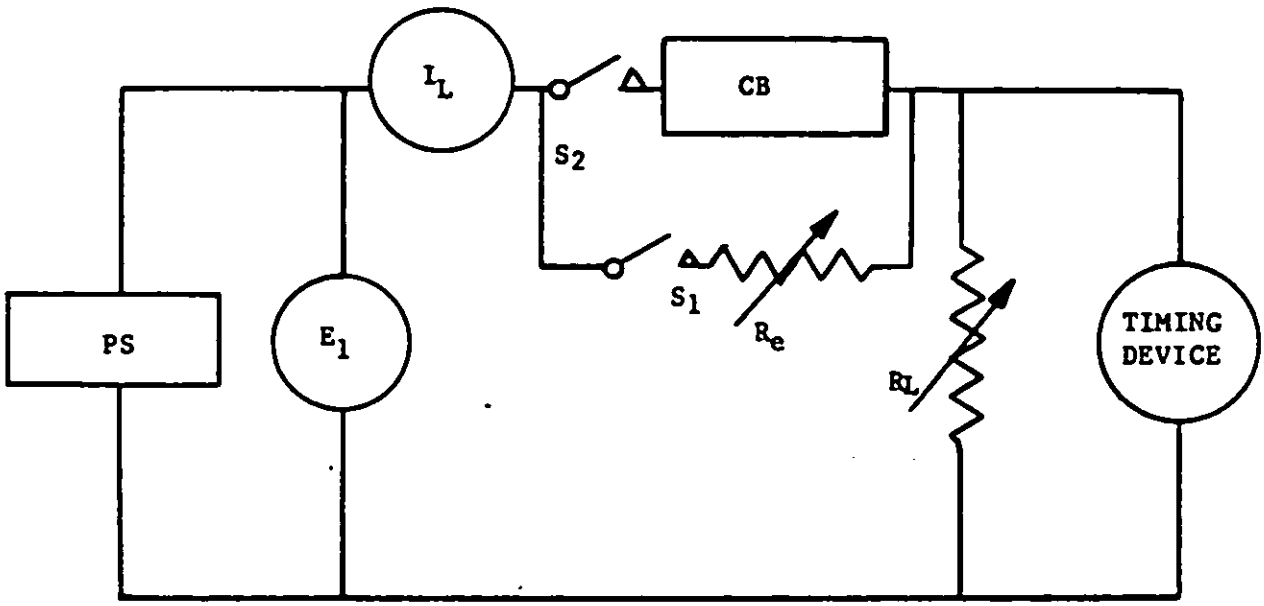

FIGURE 1. Speed of operation test.

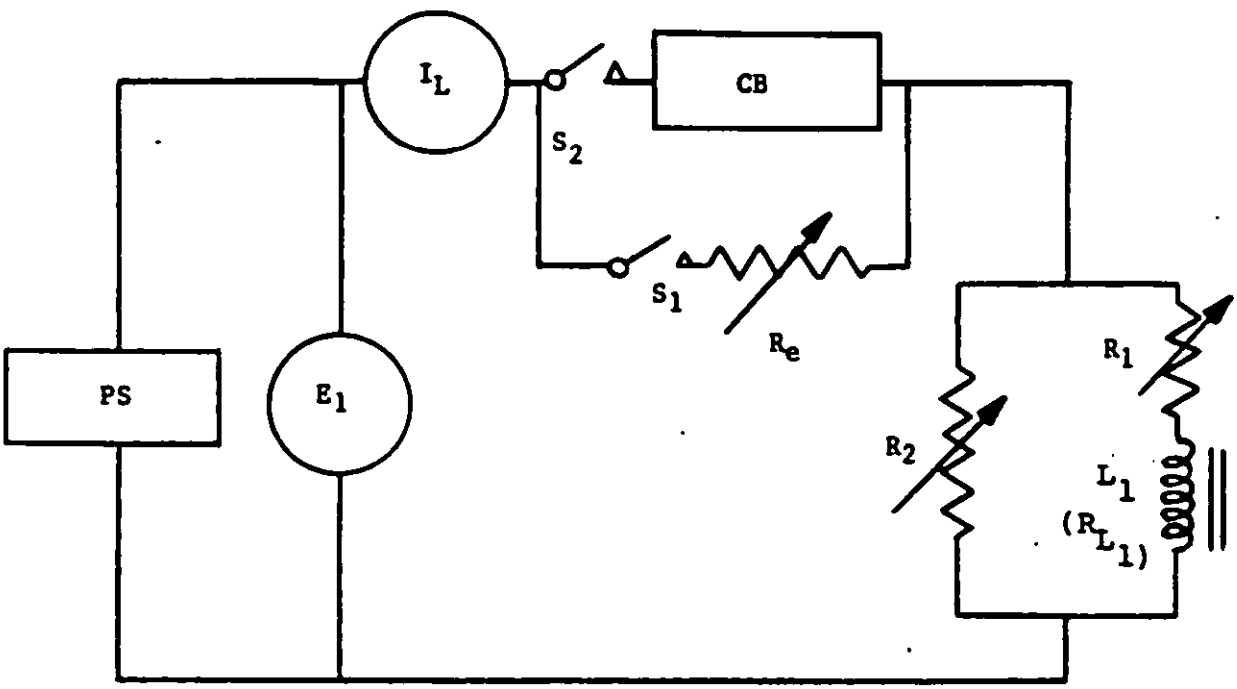

FIGURE 2. Endurance test.

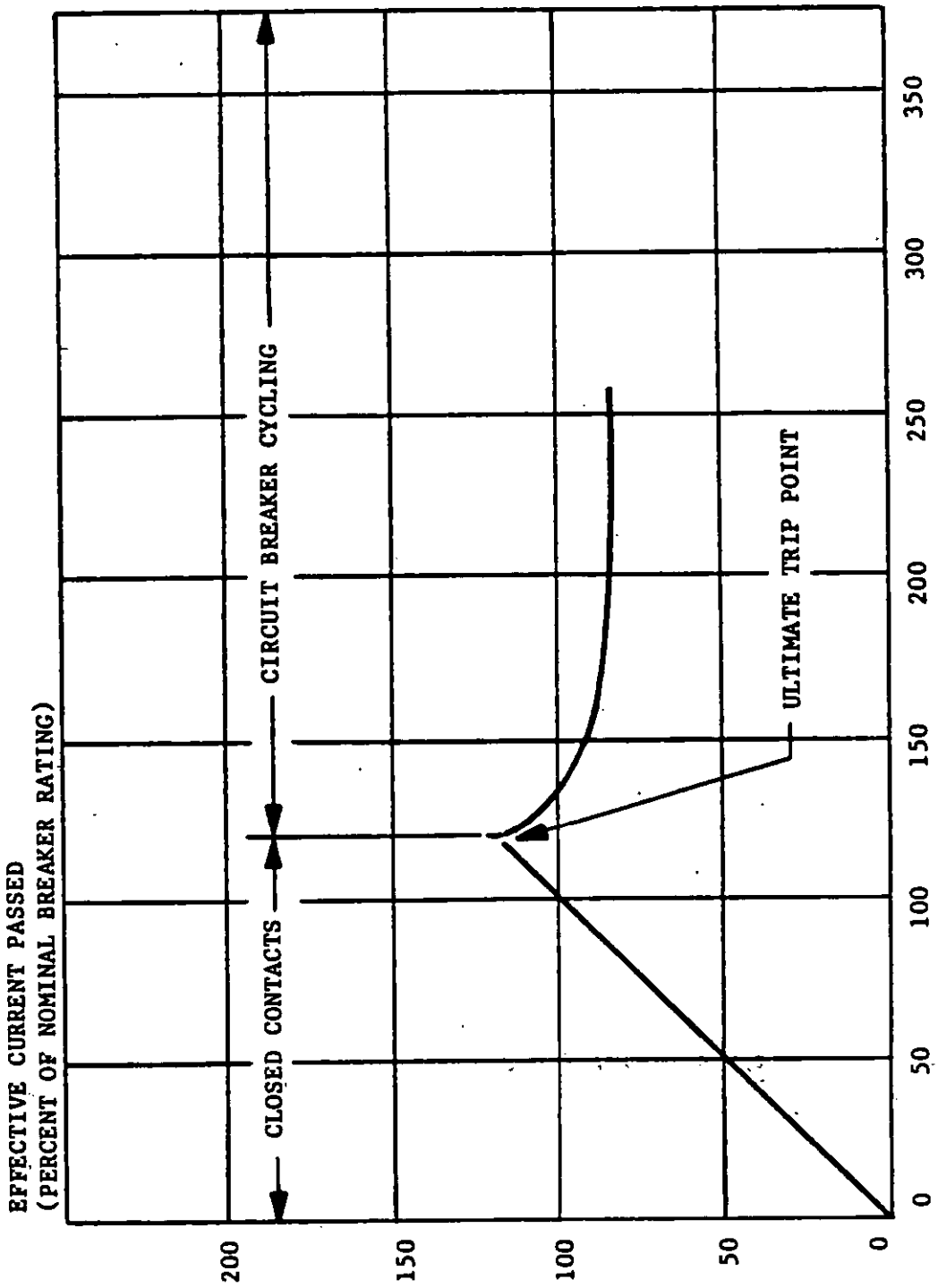

FIGURE 3. Typical performance curve.

FOLD

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval
No. 22-R255

INSTRUCTIONS: The purpose of this form is to solicit beneficial comments which will help achieve procurement of suitable products at reasonable cost and minimum delay, or will otherwise enhance use of the document. DoD contractors, government activities, or manufacturers/ vendors who are prospective suppliers of the product are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.

DOCUMENT IDENTIFIER AND TITLE
MIL-C-13516E

NAME OF ORGANIZATION AND ADDRESS

CONTRACT NUMBER

MATERIAL PROCURED UNDER A
☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?
   A. GIVE PARAGRAPH NUMBER AND WORDING.

   B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY DOCUMENT REQUIREMENT CONSIDERED TOO RIGID

3. IS THE DOCUMENT RESTRICTIVE?
   ☐ YES ☐ NO *(If "Yes", in what way?)*

4. REMARKS

SUBMITTED BY *(Printed or typed name and address - Optional)*

TELEPHONE NO.

DATE

DD FORM 1 JAN 72 1426

REPLACES EDITION OF 1 JAN 68 WHICH MAY BE USED