MILITARY SPECIFICATION

CIRCUIT BREAKERS, TRIP-FREE, AIRCRAFT, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. The primary function of this specification is to cover the general requirements of one-, two-, and three-pole trip-free circuit breakers for use in aircraft electric systems conforming to MIL-STD-704. As a secondary function, this specification may possibly cover the general requirements of one-, two- and three-pole circuit breakers for use in primary vehicles, other than aircraft, when mounted directly to the structure.

1.2 Classification. Circuit breakers shall be classified into types and styles. Variations from the basic style of each circuit breaker shall be indicated by the part number from the appropriate specification sheet (see 3.1).

1.2.1 Types. Circuit breakers shall be of the following types as specified (see 6.2).

Type I - Thermal Type
Type II - Magnetic Type

1.2.2 Styles. A style of circuit breakers shall consist of all part numbers covered by one Military Standard (MS sheets). For example:

a. All part numbers of MS25244 shall be the same style.

b. All part numbers of MS22073 shall be the same style.

* The same style classification applies to all MS sheets and specification sheets covered by this specification.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Systems Engineering and Standardization Department (Code 53), Naval Air Engineering Center, Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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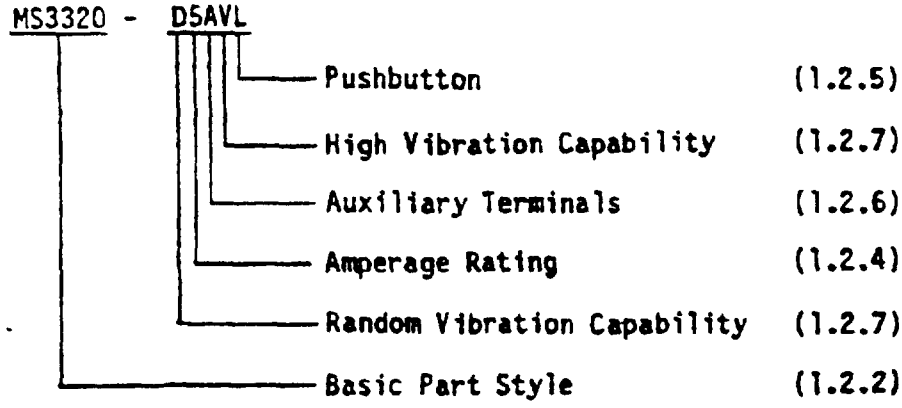
1.2.3 Part numbers. The part numbers for circuit breakers in accordance with this specification shall conform to the example below. Alpha numeric characters shall be used to designate variations from the basic style of each circuit breaker.



When a designator for a variation is not applicable it shall be omitted from the part number.

1.2.4 Amperage ratings. The amperage rating designator shall be a number specified in each detail specification to indicate the nominal amperage rating.

1.2.5 Pushbuttons. The circuit breakers pushbutton shall be designated as follows. Standard length pushbutton, as specified in the detail specification, shall have no designator letter.

L - Extra length pushbutton (see 6.4.9).

1.2.6 Auxiliary terminals. The use of auxiliary terminals when allowed by the MS or specification sheet shall be designated as follows. Circuit breakers with standard terminals only, as specified in the MS or specification sheet, shall have no designator letter.

A - Auxiliary terminals.

1.2.7 Vibration level. The vibration level of the circuit breaker shall be specified in the MS or specification sheet and shall be indicated in the part number by one or more of the following designators. Standard sine vibration capabilities shall have no designator (see 4.7.11.2).

V - High Level sine capabilities (see 4.7.11.3).

C thru K - Random vibration capabilities (see 4.7.11.1).

1.2.8 Mounting configurations. Unless otherwise specified, the circuit breakers mounting configuration shall be designated as follows. Standard bushing mounted circuit breakers shall have no designator.

P - Cover-plate mount.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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

SPECIFICATIONS

MILITARY

MIL-M-14	Molding Plastics and Molded Plastic Parts, Thermosetting
MIL-P-997	Plastic Material, Laminated, Thermosetting, Electric Insulation, Sheets, Glass Cloth, Silicone Resin
MIL-W-5086	Wire, Electric, Polyvinyl Chloride Insulated, Copper or Copper Alloy
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series, General Specification for
MIL-T-7928	Terminals, Lug and Splice, Crimp-Style, Copper, General Specification for
MIL-P-15037	Plastic Sheet, Laminated, Thermosetting, Glass-cloth, Melamine Resin
MIL-E-17555	Electronic and Electrical Equipment, Accessories, and Provisioned Items (Repair Parts); Packaging of
MIL-W-22759	Wire, Electric, Fluoropolymer Insulated, Copper or Copper Alloy
MIL-N-25027	Nut, Self-Locking, 250 Deg. F, 450 Deg. F, and 800 Deg. F
MIL-W-81044	Wire, Electric, Crosslinked Polyalkene, Crosslinked Alkane-Imide Polymer, or Polyarylene Insulated, Copper or Copper Alloy
MIL-W-81381	Wire, Electric, Polyimide Insulated, Copper or Copper Alloy

See Supplement 1 for list of associated specifications.

STANDARDS

MILITARY

DOD-STD-100	Engineering Drawing Practices
MIL-STD-104	Limit for Electrical Insulation Color
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-143	Standards and Specifications, Order of Precedence for the Selection of
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-454	Standard General Requirements for Electronic Equipment
MIL-STD-704	Aircraft Electric Power Characteristics
MIL-STD-889	Dissimilar Metals
MIL-STD-1285	Marking of Electrical and Electronic Parts
MIL-STD-45662	Calibration System Requirments
MS25036	Terminal, Lug, Crimp Style, Copper, Insulated, Ring Tongue, Bell Mounted, Type II, Class 1

See Supplement 1 for list of MS sheet form standards.

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

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D635-81	Plastics, Rate of Burning and/or Extent and Time of Burning of Self Supporting Plastics in a Horizontal Position.

(Application for copies of ASTM publications should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification and MS sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet or MS sheet. In the event of any conflict between the requirements of this specification and the specification sheet or MS sheet, the latter shall govern.

3.2 Qualification. The circuit breakers furnished under this specification shall be products which are authorized by the Qualifying Activity for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.5 and 6.3).

3.2.1 First article inspection. Circuit breakers furnished under this specification not covered by specification sheets or not qualified at the time set for opening of bids shall be subjected to the tests specified in 4.5.

3.3 Materials. Materials shall be as specified herein. However, when a definite material is not specified, a suitable material shall be used that will enable the circuit breakers to conform to the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guarantee of the acceptance of the finished product.

3.3.1 Fungus. Materials shall be used which are not nutrients for fungus as specified in Requirement 4 of MIL-STD-454.

3.3.2 Metal. All metals used in the construction of circuit breakers shall be corrosion resistant or shall be suitably protected to resist corrosion. The use of dissimilar metals, especially contacts between brass, copper, or steel and aluminum or magnesium alloys, shall be avoided. Where contact between dissimilar metals is unavoidable, the metals shall be protected against electrolytic corrosion. Dissimilar metals are defined on MIL-STD-889. When thermostatic bimetals and trimetals are used, corrosion resulting from tests specified herein shall not adversely affect the performance of the breaker.

3.3.3 Plastics. Plastic materials used in the housing, insulator base, and any internal parts exposed to arcing or surface creepage shall conform to MIL-P-997, MIL-P-15037, or MIL-M-14. Other types of plastic materials may be used provided the manufacturer submits satisfactory evidence to the activity responsible for qualification that the materials are suitable for the purpose intended. The plastic materials used shall neither support combustion nor give off noxious gases when subjected to arcs, such as those caused by interrupting heavy short circuit currents, or explosions of gaseous vapors to which the materials may be subjected in service. Plastic materials with cellulose

fillers will not be permitted in parts that may be subjected to arcing or surface creepage. Plastic materials used shall be certified to exhibit a minimum ignition time of 90 seconds and a maximum extinguishing time of 90 seconds when tested for flammability in accordance with ASTM D635-81.

3.3.4 Protective treatment. The use of any protective coating that will crack, chip, or scale will not be permitted.

3.3.5 Selection of materials. Specifications and standards for all materials, parts and Government certification and approval of processes and equipment, which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with MIL-STD-143, except as provided in 3.3.5.1.

3.3.5.1 Standard parts. Standard parts (MS or AN) shall be used wherever they are suitable for the purpose, and shall be identified on the drawing by their part numbers. Commercial utility parts, such as screws, bolts, nuts and cotter pins may be used, provided they possess suitable properties and are replaceable by the standard parts (MS or AN) without alteration, and provided the corresponding standard part numbers are referenced in the parts list and, if practicable, on the contractor's drawings. In the event there is no suitable corresponding standard part in effect on date of invitation for bids, commercial parts may be used provided they conform to all requirements of this specification.

3.3.6 Cleaning. Prior to final assembly, the circuit breaker shall be thoroughly cleaned of loose, spattered, or excess solder, metal chips, and other foreign material. Burrs, sharp edges and resin flash shall be removed.

3.4 Design and construction.

3.4.1 General. Circuit breakers shall conform to the applicable MS (Military Standard) or specification sheet.

3.4.2 Mounting means. The circuit breaker shall be provided with a suitable mounting means as shown on the applicable MS or specification sheet. If self-locking nuts are used, they shall meet the performance requirements of MIL-N-25027.

3.4.3 Actuator of push-pull circuit breakers. The portion of the actuator visible when the circuit breaker is in closed position shall be black and shall expose a white band when in the open or tripped position. The exterior portion of the actuator shall be insulated from all current-carrying parts. The actuator shall not work out to an intermediate position, give a false trip indication, or be removable from the breaker.

3.4.3.1 Manual circuit opening. Push-pull circuit breakers shall be designed to permit manual opening of the circuit by pulling out the actuator.

3.4.4 Toggle circuit breakers with metal actuators. The exposed portion of the actuator shall be provided with a nonglaring finish and shall be insulated from all current-carrying parts. There shall be a groove in the ball tip of the toggle breaker actuators to identify trip-free breakers.

3.4.5 Terminals. Terminal construction shall be as specified on the applicable MS or specification sheet and shall be designed for use with terminal lugs conforming to MS25036 and MIL-T-7928.

3.4.5.1 Terminal hardware. Lockwashers captive to the terminal screws shall be supplied only when specified in the MS or specification sheet.

3.4.6 Housing. The circuit-breaker mechanism shall be enclosed in a housing securely attached to the insulator base and to the mounting plate when one is used. The housing may be integral with the insulator base.

3.4.7 Ratings. The ratings of push-pull and toggle circuit breakers shall be as specified on the applicable MS or specification sheet.

3.4.8 Trip indication and reset. The circuit breakers shall be so designed that when the breaker contacts open automatically on overload, the actuator shall indicate the operation by moving to the tripped position, as shown on the applicable MS. The white color specified on the applicable MS for the trip indicator on push button circuit breakers shall conform to Class 1 of MIL-STD-104. All poles of a multi-pole breaker shall trip free on a single pole fault or overload.

3.4.8.1 Reset mechanism. The reset mechanism shall be so designed that retaining the actuator in the closed position after automatic tripping occurs shall not adversely affect subsequent performance of the circuit breaker.

3.4.9 Position. Circuit breakers shall operate satisfactorily when mounted in any position.

3.4.10 Mounting screw clearance. The mounting screws shall be capable of being screwed into the circuit breaker a minimum depth, as shown on the applicable MS. The mounting nuts shall be backed or provided with other means to prevent mounting screws of excess length from interfering with the operation of the breaker. Screws of excess length shall not fracture the housing or the explosion-preventive seal.

3.4.11 Creepage and clearance distance. The minimum creepage path and the minimum clearance between current-carrying parts and any part of the current breaker other than insulating material, and also between current-carrying parts of opposite polarity, shall be 3/16 inch and 1/8 inch, respectively.

3.4.12 Tamper-proof calibration. Breakers shall be so constructed that tampering with the calibration is not possible without dismantling the device or breaking a seal.

3.4.13 Ambient temperature. Unless otherwise specified (see 3.1), circuit breakers shall perform within one of the following ambient temperature conditions, as specified in the MS or specification sheet:

Condition A -55° to 71°C
Condition B -55° to 121°C

3.5 Interchangeability. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. The drawing number requirements of DOD-STD-100 shall govern changes in the manufacturer's part numbers.

3.6 Screw threads. Screw threads on removable or replaceable threaded parts shall be as specified in MIL-S-7742. Threading of nonmetallic parts is not permitted.

3.7 Performance. The circuit breakers shall perform satisfactorily when subjected to tests specified in Section 4, and there shall be no breakage, malfunction, or evidence of any damage which would impair ability of the breakers to meet the requirements of subsequent tests.

3.7.1 Examination of product. The circuit breakers shall show no defects when examined in accordance with 4.7.1.

3.7.2 Dielectric withstanding voltage. The circuit breakers shall withstand the voltages impressed as called out in 4.7.2 with no evidence of breakdown or subsequent malfunction.

3.7.3 Insulation resistance. Unless otherwise specified, the insulation resistance of circuit breakers shall not be less than 100 megohms when tested in accordance with 4.7.3.

3.7.4 Strength of actuator. Circuit breaker actuators shall not show evidence of breaking, cracking or jamming when tested in accordance with 4.7.4.1 and 4.7.4.2. The circuit breaker shall then meet the performance requirements defined when tested in accordance with 4.7.4.3.

3.7.5 Strength of threaded parts. There shall be no breakage or evidence of damage when threaded parts are tested in accordance with 4.7.5.

* 3.7.6 Operating force. The force necessary for operation of the circuit breaker when tested in accordance with 4.7.6, shall be within the limits specified on the applicable MS. The minimum operating force shall not be less than 15 percent of the specified maximum value unless otherwise specified on the MS.

3.7.7 Calibration. The circuit breaker's performance shall be within the limits specified on the applicable MS or specification sheet when tested and calibrated in accordance with 4.7.7.

3.7.8 Endurance. The circuit breaker shall make and break the specified current without failure, when tested in accordance with 4.7.8 and the applicable MS.

3.7.9 Overload cycling. The circuit breaker shall make and break the specified overload current without failure, when tested in accordance with 4.7.9.

3.7.10 Reclosing. When tested in accordance with 4.7.10, manual reset circuit breakers shall show no electrical continuity.

3.7.11 Vibration. Circuit breakers shall be tested in accordance with 4.7.11 with the vibration levels and test conditions specified in the detail specification. If no vibration level is specified in the detail specification, the sine vibration with test condition A shall be performed (see 4.7.11.2). The circuit breakers shall not trip or show any electrical discontinuity in excess of 10 microseconds. After completion of vibration test circuit breakers shall show no evidence of physical damage and shall meet the requirements of the 200% overload calibration test performed at 25°C and the dielectric withstanding voltage tests in accordance with 4.7.7.3 and 4.7.2.

3.7.12 Mechanical shock. The circuit breaker contacts shall remain in the proper position when tested in accordance with 4.7.12.

3.7.13 Acceleration. The circuit breaker contacts shall remain in the proper position when tested in accordance with 4.7.13.

3.7.14 Interrupting capacity (formerly rupture capacity). The circuit breaker performance shall be as specified in 4.7.14 when tested in accordance with 4.7.14.

3.7.15 Sand and dust. The circuit breaker performance shall be as specified in 4.7.15 when tested in accordance with 4.7.15.

3.7.16 Corrosion. The circuit breaker performance shall be as specified in 4.7.16 when tested in accordance with 4.7.16.

3.7.17 Moisture resistance. The circuit breaker performance shall be as specified in 4.7.17 when tested in accordance with 4.7.17.

3.7.18 Explosion. Ignition of the explosive mixture outside the circuit breaker shall constitute failure when tested in accordance with 4.7.18.

3.7.19 Voltage drop. Voltage drop across the circuit breaker greater than that specified on the applicable MS or specification sheet shall constitute failure when tested in accordance with 4.7.19.

3.8 Markings. All circuit breakers shall be permanently and legibly marked as shown on the applicable MS or specification sheet. The markings shall remain legible during and after all the tests specified in this specification.

* 3.8.1 Push-pull actuators. The exposed end of the push-pull actuator shall be marked with a white or silver, raised or depressed, number indicating the applicable current rating (MS dash number) of the breaker.

3.8.2 Toggle actuators. The tip of actuators of toggle breakers shall be marked with a raised or depressed number indicating the applicable current rating (MS dash number).

3.8.3 Terminals. The line terminals shall be clearly and permanently marked "LINE" adjacent to the terminals, when shown on the applicable MS or specification sheet. Terminals shall be marked as described in Figure 1 when shown on the applicable MS or specification sheet.

3.8.4 Multi-phase breakers. Primary terminal identification shall be the same as for single phase breakers, as identified above, except that the phase shall be identified by a letter prefix reading consecutively from right to left as viewed from the rear of the breaker (see Figure 1c).

3.9 Identification of product. Each circuit breaker shall be permanently and legibly marked for identification in accordance with MIL-STD-1285 as follows:

Part No. (see 1.2.3)

Manufacturer's name or trademark and date code

3.10 Workmanship. The circuit breaker, including all parts and accessories, shall be constructed and finished in a careful and workmanlike manner in accordance with good design and sound practice. Particular attention shall be given to neatness and thoroughness of soldering, wiring, impregnation of coils, marking of parts and assemblies, welding and brazing, painting, riveting, machine screw assemblies, and freedom of parts from burrs and sharp edges (see 4.7.1).

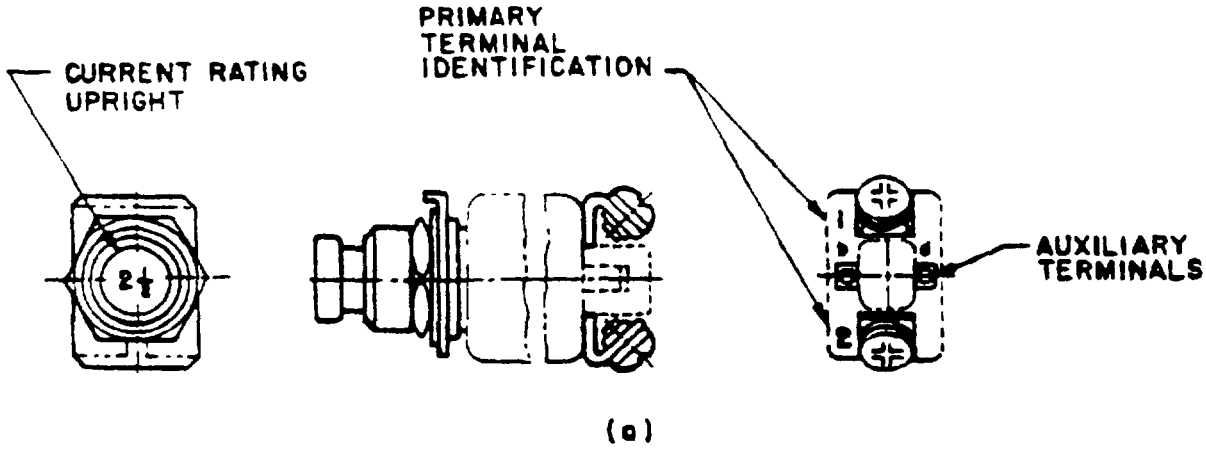
4. QUALITY ASSURANCE PROVISIONS

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

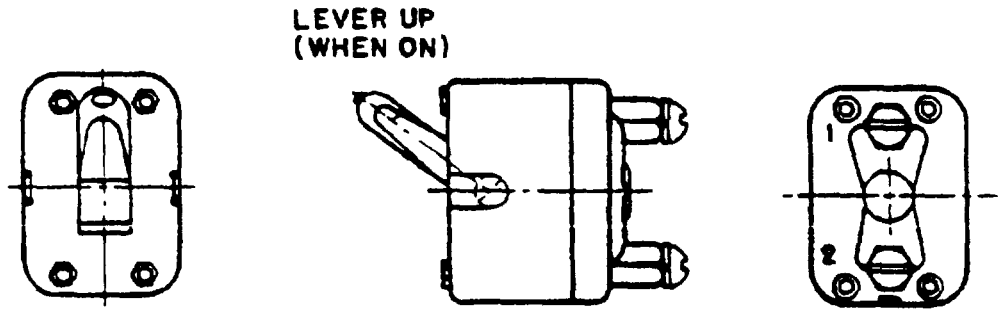
4.1.1 Responsibility for compliance. All items must meet all requirements of Sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Test equipment and inspection facilities. The supplier shall establish and maintain a calibration system in accordance with MIL-STD-45662.

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



(a)



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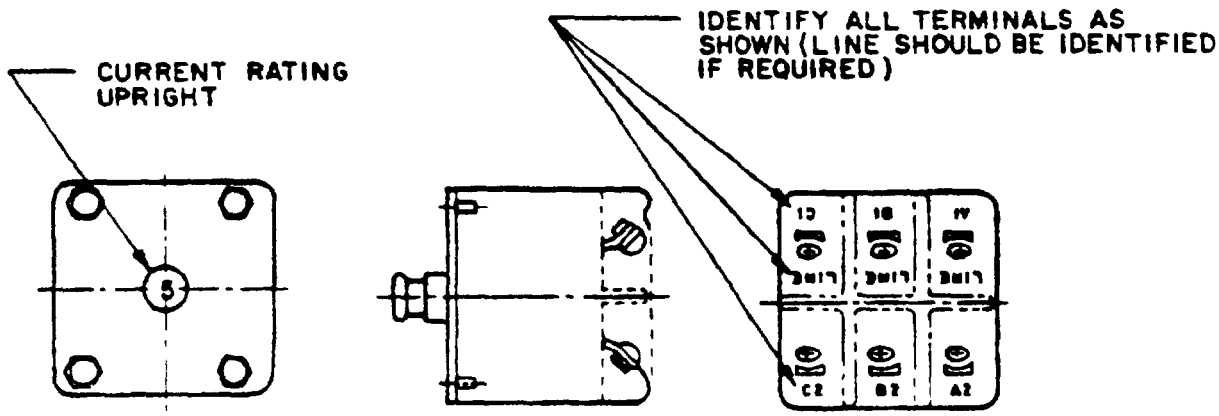


(c)

FIGURE 1. Terminal identification.

a. Materials inspection (4.3).

b. Qualification (4.5).

c. Quality conformance inspection (4.6).

4.3 Materials inspection. Material inspection shall consist of certification that the materials are in accordance with the requirements of 3.3.

4.4 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the General Requirements of MIL-STD-202.

4.4.1 Calibration. The supplier shall establish and maintain a calibration system in accordance with MIL-STD-45662. Calibration tests of circuit breakers shall be performed at a temperature specified on the applicable MS or specification sheet with the current maintained at a constant value. Test sample units with leads and terminals attached in accordance with Figure 2 shall be maintained at the specified ambient temperature for 1 hour prior to application of the specified current during all calibration tests. Test circuit may be in accordance with Figure 2. Calibration tests shall be conducted at all voltages and frequencies shown on the MS or specification sheet, where applicable.

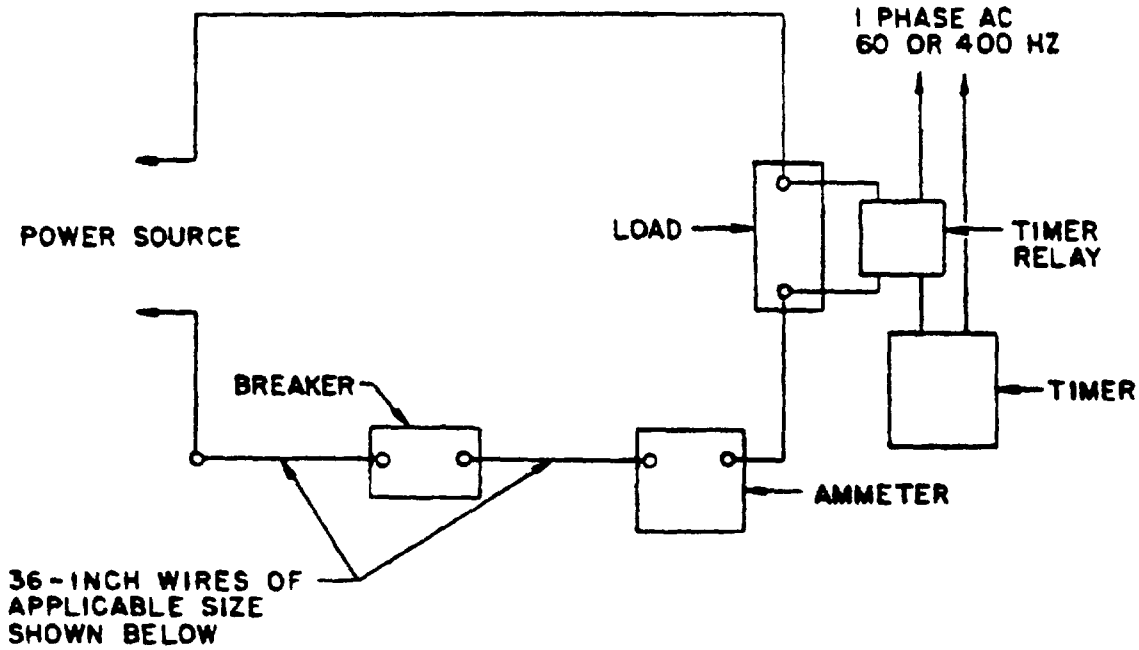
4.4.1.1 Production calibration tests. For calibration tests performed during production only (not for qualification or quality conformance tests), it will be permissible to use test methods so designed as to expedite calibration testing, provided the vendor can demonstrate that the results are comparable to the calibration tests specified herein.

4.4.2 Thermal circuit breakers. Tests of thermal circuit breakers requiring passage of current may be conducted using alternating current at commercial frequencies.

4.5 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (6.3) on sample units produced with equipment and procedures normally used in production.

4.5.1 Sample size. Thirty-one single-phase circuit breaker specimens or ten three-phase circuit breaker specimens as defined in any one specific detail specification shall constitute a sample size. The combination of specimens to be tested shall be determined by the qualifying activity based upon the manufacturer's desired listing. The qualifying activity reserves the right to request additional untested samples to be submitted with the qualification test report.

4.5.2 Test routine. The qualification inspection samples for one and three phase circuit breakers shall be subjected to the tests specified in Table I and IA, respectively. All sample units shall be subjected to Test Group I then divided as indicated into the various remaining test groups. At the option of the qualifying activity, the environmental tests consisting of vibration, mechanical, shock, acceleration, sand and dust, corrosion and



(a) Circuit breaker capacity (amperes)	Wire size (AWG designation)	Insulated terminal lug (MS Part No.)
1 and below	20	MS25036-103
2 to 6 incl	18	MS25036-103
7 to 10 incl	16	MS25036-108
11 to 15 incl	14	MS25036-108
16 to 20 incl	12	MS25036-112
21 to 25 incl	10	MS25036-112
26 to 40 incl	8	MS25036-115
41 to 50 incl	6	MS25036-119
51 to 60 incl	6	MS25036-121
61 to 90 incl	4	MS25036-124
91 to 120 incl	2	MS25036-127
121 to 150 incl	0	MS25036-133
151 to 200 incl	00	MS25036-136

Test wires shall conform to MIL-W-5086, MIL-W-22759, MIL-W-81044 or MIL-W-81381. Test terminals shall conform to MIL-T-7928. Ammeter: Accuracy within 0.5% at full scale.

* (a) For circuit breakers with nominal amperage rating between steps of the above table, use the wire of the next larger physical wire size.

(b) For Group A or B quality conformance tests terminal lead lugs may be the spade or electrical spring clamp type provided the electrical resistivity and thermal conductivity are equivalent to MS25036 ring type terminals.

FIGURE 2. Calibration test circuit.

TABLE I. Qualification inspection (single phase circuit breakers).

Tests and sample units	Requirement paragraph	Test paragraph
Test Group I - 10 sample units		
Examination of product	3.7.1	4.7.1
Dielectric withstanding voltage	3.7.2	4.7.2
Insulation resistance	3.7.3	4.7.3
Minimum limit of ultimate trip	3.7.7	4.7.7.1
Maximum limit of ultimate trip	3.7.7	4.7.7.2
Overload calibration	3.7.7	4.7.7.3
Test Group II - 1 sample unit		
Voltage drop	3.7.19	4.7.19
Temperature/altitude dielectric strength	3.7.2	4.7.2.2
Trip-free calibration	3.7.7	4.7.7.4
Strength of threaded parts	3.7.5	4.7.5
Mechanical cycling (endurance)	3.7.8	4.7.8.3
Operating force	3.7.6	4.7.6
Test Group III - 1 sample unit		
Voltage drop	3.7.19	4.7.19
Reclosing	3.7.10	4.7.10
Overload cycling	3.7.9	4.7.9
Vibration	3.7.11	4.7.11
Corrosion	3.7.16	4.7.16
Test Group IV - 1 sample unit		
Ambient effect on calibration	3.7.7	4.7.7.5
Trip-free calibration	3.7.7	4.7.7.4
Acceleration	3.7.13	4.7.13
Sand and dust	3.7.15	4.7.15
Test Group V - 1 sample unit		
Endurance		
Inductive load (ac)	3.7.8	4.7.8.1.1
Operating force	3.7.6	4.7.6
Test Group VI - 1 sample unit		
Endurance		
Resistive load (ac)	3.7.8	4.7.8.1.2
Operating force	3.7.6	4.7.6
Test Group VII - 1 sample unit		
Mechanical shock	3.7.12	4.7.12
Moisture resistance	3.7.17	4.7.17
Operating force	3.7.6	4.7.6
Impact force on push button	3.2.4	4.7.4.3
Strength of actuator	3.7.4	4.7.4

TABLE I. Qualification inspection (continued).

Tests and sample units	Requirement paragraph	Test paragraph
Test group VIII - 1 sample unit		
Interrupting capacity (available current short circuit ac)	3.7.14	4.7.14 Table VII-A
Dielectric withstanding voltage	3.7.2	4.7.2
Test Group IX - 1 sample unit		
Interrupting capacity (available current close-in ac)	3.7.14	4.7.14 Table VII-B
Dielectric withstanding voltage	3.7.2	4.7.2
Test Group X - 1 sample unit		
Interrupting capacity (available intermediate current interrupting ac)	3.7.14	4.7.14 Table VII-E
Dielectric withstanding voltage	3.7.2	4.7.2
Test Group XI - 1 sample unit		
Interrupting capacity (available intermediate current interrupting dc)	3.7.14	4.7.14 Table VII-F
Dielectric withstanding voltage	3.7.2	4.7.2
Explosion (ac)	3.7.18	4.7.18.1
Test Group XII - 1 sample unit		
Interrupting capacity (available current close-in ac)	3.7.14	4.7.14 Table VII-B
Dielectric withstanding voltage	3.7.2	4.7.2
Test Group XIII - 5 sample units		
Strength of actuator	3.7.4	4.7.4
Impact force on push button	3.7.4	4.7.4.3
Test Group XIV - 1 sample unit		
Interrupting capacity (available current short circuit dc)	3.7.14	4.7.14 Table VII-C
Dielectric withstanding voltage	3.7.2	4.7.2
Test Group XV - 1 sample unit		
Interrupting capacity (available current close-in dc)	3.7.14	4.7.14 Table VII-D
Dielectric withstanding voltage	3.7.2	4.7.2
Test Group XVI - 1 sample unit		
Interrupting capacity (available intermediate current interrupting ac)	3.7.14	4.7.14 Table VII-E
Dielectric withstanding voltage	3.7.2	4.7.2

TABLE I. Qualification inspection (continued).

Tests and sample units	Requirement paragraph	Test paragraph
Test Group XVII - 1 sample unit		
Interrupting capacity (available intermediate current interrupting dc)	3.7.14	4.7.14 Table VII-F
Dielectric withstanding voltage	3.7.2	4.7.2
Test Group XVIII - 2 sample units		
Explosion (ac)	3.7.18	4.7.18.1
Test Group XIX - 2 sample units		
Explosion (dc)	3.7.18	4.7.18.2
Test Group XX - extra sample units		
These breakers may be used for repetition of any test considered advisable by the activity responsible for qualification		

* TABLE IA. Qualification inspection (3-phase circuit breakers).

Tests and sample units	Requirement paragraph	Test paragraph
Test Group I - 10 sample units		
Examination of product	3.7.1	4.7.1
Dielectric withstanding voltage	3.7.2	4.7.2
Insulation resistance	3.7.3	4.7.3
Minimum limit of ultimate trip	3.7.7	4.7.7.1
Maximum limit of ultimate trip	3.7.7	4.7.7.2
Overload calibration	3.7.7	4.7.7.3
Test Group II - 1 sample unit		
Voltage drop	3.7.19	4.7.19
Temperature/altitude dielectric strength	3.7.2	4.7.2.2
Trip-free calibration	3.7.7	4.7.7.4
Strength of threaded parts	3.7.5	4.7.5
Mechanical cycling (endurance)	3.7.8	4.7.8.3
Operating force	3.7.6	4.7.6
Test Group III - 1 sample unit		
Voltage drop	3.7.19	4.7.19
Reclosing	3.7.10	4.7.10
Overload cycling	3.7.9	4.7.9
Vibration	3.7.11	4.7.11
Corrosion	3.7.16	4.7.16

TABLE IA. Qualification inspection (continued).

Tests and sample units	Requirement paragraph	Test paragraph
Test Group IV - 1 sample unit		
Ambient effect on calibration	3.7.7	4.7.7.5
Trip-free calibration	3.7.7	4.7.7.4
Acceleration	3.7.13	4.7.13
Sand and dust	3.7.15	4.7.15
Test Group V - 1 sample unit		
Endurance		
Inductive load (ac)	3.7.8	4.7.8.1.1
Operating force	3.7.6	4.7.6
Test Group VI - 1 sample unit		
Endurance		
Resistive load (ac)	3.7.8	4.7.8.1.2
Operating force	3.7.6	4.7.6
Test Group VII - 1 sample unit		
Mechanical shock	3.7.12	4.7.12
Moisture resistance	3.7.17	4.7.17
Operating force	3.7.6	4.7.6
Strength of actuator	3.7.4	4.7.4
Impact force on push button	3.2.4	4.7.4.3
Test Group VIII - 1 sample unit		
Interrupting capacity (available current short circuit ac)	3.7.14	4.7.14 Table VII-G
Dielectric withstanding voltage	3.7.2	4.7.2
Test Group IX - 1 sample unit		
Interrupting capacity (available current close-in ac)	3.7.14	4.7.14 Table VII-H
Dielectric withstanding voltage	3.7.2	4.7.2

moisture resistance (4.7.11, 4.7.12, 4.7.13, 4.7.15, 4.7.16 and 4.7.17) may be omitted when qualifying additional ratings under a specification sheet provided that two amperage ratings of the same sample style have previously completed these tests satisfactorily. Qualification of additional circuit breaker styles or amperage ratings by similarity to circuit breakers previously qualified may be determined by the qualifying activity.

4.5.3 Retention of qualification. To retain qualification, the supplier shall forward at 24-month intervals to the qualifying activity a summary of the results of Group A and B tests, indicating as a minimum the number of lots which passed and the number which failed, and a summary of the results of Group C tests, including the number and type of failures. The summary shall include those tests performed during that 24 month period. If the summary of

the test results indicates nonconformance with specification requirements, action shall be taken to remove the failing product from the Qualified Products List. Failure to submit the summary shall result in loss of qualification for that product. In addition to the periodic submission of inspection data, the supplier shall immediately notify the qualifying activity, through the local Government representative, at any time during the 24 month period that the inspection data indicates failure of the qualified product to meet the requirements of the specification. In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If there has been no production during the next reporting period the manufacturer may be required by the qualifying activity to perform Group C testing in accordance with 4.6.2.2 on the products.

4.6 Quality conformance inspection.

4.6.1 Inspection of product for delivery. Inspection of product for delivery shall consist of Group A inspection. Except as specified in 4.6.2, delivery of products which passed Group A inspection shall not be delayed pending the results of Groups B and C inspection.

4.6.1.1 Inspection lot. An inspection lot shall consist of all the circuit breakers covered by a single style (1.2.2) offered for inspection at one time.

4.6.1.1.1 Group A inspection. Group A inspection shall consist of the examinations and tests specified in Table II and shall be made on the same set of sample units, in the order shown.

4.6.1.1.1.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection Level II. The acceptable quality level (AQL) shall be as specified in Table II. Critical, major and minor defects shall be as specified in MIL-STD-105.

4.6.1.1.1.2 Rejected lots. If an inspection lot is rejected, the supplier may rework it to correct the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.6.2 Periodic inspection. Periodic inspection shall consist of Groups B and C inspection.

4.6.2.1 Group B inspection. Circuit breakers shall be tested as specified in Table III in the order shown.

4.6.2.1.1 Sampling plan. Three sample units shall be selected at random out of every 1000 units or every three months, whichever occurs first, from each style (1.2.2) manufactured. Group B inspection shall be performed on sample units which have passed Group A inspection, unless the Government considers it more practical to select a separate sample.

TABLE II. Sampling plan A tests.

Test	Inspection level	Requirement paragraph	Test paragraph	AQL percent defective		
				Critical	Major	Minor
Examination of product	II	3.7.1	4.7.1	.25	.65	4.0
Dielectric withstanding voltage	II	3.7.2	4.7.2	N/A	1.0	N/A
Calibration (overload at minimum and maximum limit of ultimate trip and 200% rated current only at room temperature	II	3.7.7	4.7.7	N/A	1.0	N/A

TABLE III. Group B inspection.

Test	Requirement paragraph	Test paragraph
Insulation resistance	3.7.3	4.7.3
Trip-free calibration	3.7.7	4.7.7.4
Operating force (at room ambient temperature)	3.7.6	4.7.6

4.6.2.1.2 Failures. If one or more sample units fail to pass Group B inspection, the sample shall be considered to have failed.

4.6.2.1.3 Disposition of sample units. Sample units which have passed Group B inspection may be delivered on the contract.

4.6.2.2 Group C inspection. Circuit breakers shall be tested as specified in Table IV in the order shown.

TABLE IV. Sampling plan C tests.

Sample Group	Sample Size Units		Tests	Requirement paragraph	Test paragraph
	Single Phase	Three Phase			
1	3	1	Ambient effect on calibration Mechanical cycling (endurance)	3.7.7 3.7.8	4.7.7.5 4.7.8.3
2 2/	3	1	Voltage drop Endurance	3.7.19 3.7.8	4.7.19 4.7.8.2.1
3	3	3	Vibration Mechanical shock Moisture resistance	3.7.11 3.7.12 3.7.17	4.7.11 4.7.12 4.7.17
4 2/	3	1	Interrupting capacity (formerly rupture capacity) 1/	3.7.14 --	4.7.14 Table VII-C or G
5 2/	3	1	Interrupting capacity (formerly rupture capacity) 1/	3.7.14	4.7.14 Table VII-D or H
6	5	1	Strength of threaded parts Strength of actuator	3.7.5 3.7.4	4.7.5 4.7.4
7	3	1	Reclosing Overload cycling	3.7.10 3.7.9	4.7.10 4.7.9
8	3	1	Temperature-altitude dielectric withstanding voltage Corrosion	3.7.2 3.7.16	4.7.2.2 4.7.16

1/ This test is to be run at one-half of the maximum current level specified on the applicable MS or specification sheet for rupture test designations (A) and (B) or at a level of 500 amperes, whichever is less.

2/ For Sample Groups 2, 4 and 5, three 3-phase circuit breakers shall be tested using ac current and single phase breakers shall be tested using dc current.

4.6.2.2.1 Sampling plan. For sampling plan C tests (Table IV) 26 single phase breakers or 10 3-phase breakers representative of each style (1.2.2) shall be selected at random each year. Sample units that have been subjected to and have passed sampling plans A and B tests shall be used, unless the qualifying activity considers it more practical to select separate sample units.

4.6.2.2.2 Failures. If one or more sample units fail to pass Group C inspection, the sample shall be considered to have failed.

4.6.2.2.3 Disposition of sample units. Sample units which have been subjected to Group C inspection shall not be delivered on the contract or order.

4.6.2.3 Noncompliance. If a sample fails to pass Group B or C inspection the supplier shall take corrective action on the materials or processes, or both, as warranted, and on all units or processes which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance of the project shall be discontinued until corrective action, acceptable to the Government has been taken. After the corrective action has been taken, Group B or C inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the Government). Group A inspection may be reinstituted; however, final acceptance shall be withheld until the Group B or C reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and the corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity.

4.6.3 Inspection of preparation for delivery. Sample packages or packs and the inspection of the preservation, packaging, packing and marking for shipment and storage shall be in accordance with the requirements of Section 5.

4.7 Inspection.

4.7.1 Examination of product. Circuit breakers shall be inspected to verify that the materials, design, construction, weight, physical dimensions, marking and workmanship conform to the applicable requirements.

4.7.2 Dielectric withstanding voltage. The circuit breaker shall withstand 1,000 volts (rms) plus twice maximum rated voltage ac at commercial frequency (1,500 volts minimum) and shall show no evidence of breakdown, flashover, or current flow in excess of 1.0 milliampere:

a. Between line and load terminals with the circuit breakers in the OFF or TRIPPED position.

b. Between terminals and parts normally grounded (such as frame, shell, mounting plate, etc.) with the circuit breakers in both CLOSED (or RESET) and OFF (or TRIPPED) positions.

The potential shall be applied at a maximum rate of increase of 250 volts per second, until the test potential is reached, and shall be maintained for 1 minute during qualification tests. During quality conformance tests, a potential equal to 120 percent of the above values may be applied for a duration of 5 seconds.

4.7.2.1 Dielectric withstanding voltage following another test. Where the dielectric withstanding voltage is called for following another test, the dielectric test voltage shall be reduced to 75 percent of the value specified.

4.7.2.2 Temperature-altitude dielectric withstanding voltage. Qualification test sample units shall be subjected to the dielectric withstanding voltage test in accordance with 4.7.2 at the maximum operating altitude and temperature specified on the applicable MS or specification sheet. The potential applied shall be 500 volts (rms). The temperature and altitude conditions shall be maintained prior to and during application of the test potential.

4.7.3 Insulation resistance. Circuit breakers shall be tested in accordance with Method 302 of MIL-STD-202. The following details shall apply:

a. Test condition letter - B.

b. Points of measurement - between mutually insulated metal parts.

4.7.4 Strength of actuator. There shall be no malfunction, breakage, or evidence of damage during the following tests.

4.7.4.1 Strength of actuating lever pivot and lever stop. The lever pivot and stop shall be subjected to a 25 pound load applied for 1 minute to the tip of the actuating lever, as follows:

a. Perpendicular to the lever axis and parallel to the line of lever travel at each end position of the lever.

b. Same as condition a., but in both directions perpendicular to the line of travel at each position of the lever.

c. Coaxial with the lever axis toward the lever pivot throughout the entire range of travel of the lever.

d. Coaxial with the lever axis away from the lever pivot throughout the entire range of travel of the lever.

4.7.4.2 Strength of pushbutton. A 25 pound force shall be applied for 1 minute in both directions, along the line of pushbutton travel. With the pushbutton in the fully extended position, a force of 25 pounds shall be applied at the extremity for 1 minute in two mutually perpendicular directions, each normal to the line of pushbutton travel.

4.7.4.3 Impact force on pushbutton. The circuit breaker shall be subjected to an impact force as specified in Table V.

TABLE V. Impact force.

Sample No.	Weight	Height
1	3 pounds	1.5 inches
2	3 pounds	2.5 inches
3	3 pounds	3.5 inches
4	3 pounds	4.0 inches
5	3 pounds	5.0 inches

a. With the pushbutton in the closed or reset position, the circuit breaker shall be mounted by its normal mounting means to a rigid panel with the pushbutton in the upright or longitudinal direction. The impact force shall be applied by dropping a specified weight (see Table V) from a designated height onto the extremity of the pushbutton. One circuit breaker sample shall be used for each height specified. Each sample shall receive 3 impacts.

b. When similarity of design actuators and latching systems exist, five sample units shall be tested to the requirements of Table V. Circuit breakers with the highest and lowest ampere ratings must be 2 of the 5 sample units selected to qualify all the other amperage ratings by similarity.

c. During or after the impact tests the circuit breaker shall meet the requirements of the overload calibration of 4.7.7.3 and the requirements of 4.7.6 operating forces; or the circuit breaker may fail in a safe manner. A failsafe circuit breaker in this application is defined as a breaker with a broken or jammed pushbutton in either the open or closed position with the contacts either in the open position unable to carry current, or in the closed position capable of being tripped to the open position by a 200 percent overload condition within the prescribed time limits shown on the applicable MS.

d. When 5 or more three phase ratings are being qualified, one unit from each rating is sufficient to satisfy Table V requirements, provided all ratings have identical actuator and latch systems.

4.7.5 Strength of threaded parts. Unless otherwise specified on the applicable MS, the force levels shown in Table VI shall be applied to the nuts and screws or bolts for terminals and mounting means. If terminals are tested with lead lugs, the lugs shall conform to the type described in Figure 2.

TABLE VI. Strength of threaded parts.

Terminals		
Stud or screw size	Tensile load (pounds)	Torque (inch-pounds)
No. 6	25	10
No. 8	25	15
1/4 inch	50	60
5/16 inch	70	80
Mounting Means		
Stud or nut size	**Axial loads (pounds)**	**Torque (inch-pounds)**
No. 6	30	10
No. 8	35	20
7/16 inch	N/A	40
15/32 inch	N/A	50

4.7.5.1 Strength of terminals. The tensile load shall be applied to each terminal successively, in a direction most likely to cause failure, for a period of one minute; then the torque value specified shall be applied to the screw head about the thread axis for one minute without damage to the terminals.

4.7.5.2 Strength of mounting means. The axial load shall be applied for a period of one minute after which the specified torque shall be applied to the screw head or mounting nut about the thread axis for one minute without damage to the mounting means.

* 4.7.6 Operating force. The force necessary for operation of the circuit breaker shall be determined. For toggle breakers, the force shall be applied at the ball tip of the actuator, and in the direction of operation. For push-pull breakers, the force shall be applied parallel to the line of travel of the actuator. The forces required for operation of the circuit breakers either during or as a result of the tests shall be as specified on the applicable MS. The specified operating force shall be applicable with the breaker carrying rated load under rated room ambient conditions.

4.7.7 Calibration. Single pole circuit breakers shall be subjected to calibration tests given in paragraphs 4.7.7.1 to 4.7.7.5. Each section of multipole breakers shall be subjected to the calibration current specified, with remaining pole or poles passing no current. Multipole breakers shall also be subjected to tests in which each of the poles is carrying the specified current simultaneously.

* 4.7.7.1 Minimum limit of ultimate trip. The circuit breaker shall be subjected to the minimum limit of ultimate trip current for the time specified on the applicable MS or specification sheet. For qualification tests only, the temperature rise of the breaker terminals shall be obtained by the use of a suitable thermocouple. The breaker shall be monitored to determine that it does not trip and unless otherwise specified (3.1), the temperature rise shall be measured at the terminals for a rise not to exceed 75°C. The thermocouple shall be attached to the terminals outside but adjacent to the breaker case. Each pole of multipole breakers shall be tested with each of the poles carrying the current specified in the specification sheet.

* 4.7.7.2 Maximum limit of ultimate trip. The circuit breaker shall be subjected to the maximum limit of ultimate trip current specified on the applicable MS or specification sheet and shall be monitored for tripping within the time limits specified. Each pole of multipole breakers shall be tested with each of the poles carrying the current specified in the specification sheet.

4.7.7.3 Overload calibration. The circuit breaker shall be subjected to the overload calibration values shown on the applicable MS or specification sheet, and shall be monitored for operation within the limits specified. Each pole of multipole breakers shall be tested separately with the remaining pole or poles carrying zero current.

4.7.7.4 Trip-free calibration. The circuit breaker shall be in the closed position and subjected to the calibration test at maximum ultimate trip current. The test shall be repeated, using the values of overload calibration current shown on applicable MS or specification sheet. The actuator shall be held in for 10 minutes after tripping occurs. For recycling trip-free breakers, the breaker may close momentarily during this waiting period, but subsequent performance shall not be adversely affected. During this test the breaker shall be tested with each major axis held in the vertical plane and in any other position likely to cause malfunctioning. The breaker shall be monitored for automatic tripping within the specified limits and subsequent performance which is adversely affected.

4.7.7.5 Ambient effect on calibration. The circuit breaker shall be tested at ambient temperatures and loads specified on the applicable MS or specification sheet and shall be monitored for operation within the time limits specified.

4.7.8 Endurance. The circuit breaker shall be subjected to the number of cycles of make-and-break operation specified in the applicable MS or specification sheet and shall make and break the specified current throughout the cycling period. Operating cycle is defined as the mechanical opening and

closing of the breaker. At the option of the manufacturer, operation shall be performed at a minimum rate of 2 cycles per minute (cpm) or at a faster rate, and the ratio of the ON time to OFF time shall be approximately 1 to 5. The mechanical operation shall simulate manual operation, including overtravel. Each pole of multipole breakers shall be simultaneously subjected to the required load tests. The test for operating forces shall be performed at the approximate midpoint and again at completion of the test; the breaker shall calibrate within the limits of 90 percent of the specified minimum ultimate trip current and 110 percent of the maximum ultimate trip current (4.7.7). Upon completion of endurance cycling the breaker shall pass the dielectric withstanding voltage test (4.7.2).

4.7.8.1 Alternating current. During the alternating-current endurance tests, the voltage and frequency shall be as specified on the applicable MS or specification sheet.

4.7.8.1.1 Inductive load. The power factor during this test shall be between 0.6 and 0.7 lag unless otherwise specified by the applicable MS. The load shall be the rating of the circuit breaker unless otherwise specified by the applicable MS or specification sheet.

4.7.8.1.2 Resistive load. Resistive operation shall be accomplished at rated load with a power factor between 0.9 and unity.

4.7.8.2 Direct current. During the direct-current endurance tests the voltage shall be within the limits specified on the applicable MS or specification sheet.

4.7.8.2.1 Inductive load. Twenty-eight volt dc loads shall be computed in accordance with the formula: $W = 0.14\ I^{1.18}$, in which "W" is the energy in joules which must be delivered to the electric contacts under test and the "I" is the dc inductive current rating of the contacts. Unless otherwise specified on the applicable MS, the dc inductive current rating shall be 10 amperes for circuit breaker ratings of 10 amperes and above and rated current for ratings below 10 amperes. The energy delivered to the contacts shall be measured as follows: A shunt capacitor shall be placed across the contacts to absorb the arc energy. The voltage drop across this shunt capacitor shall be measured upon circuit interruption by means of an oscilloscope. The voltage drop across the capacitor during circuit interruption shall be taken as the peak value of the first oscillation. The voltage drop and the value of capacitance shall be substituted in the formula:

$$W = (1/2)CE^2$$

Where: W = energy in joules

C = capacitance of shunt capacitor in farads

The energy thus calculated is the energy which would be dissipated by the contacts if the capacitor were removed. The energy shall be within +10 percent of the energy calculated by the formula $W = 0.14\ I^{1.18}$. This method of energy measurement requires the use of a capacitor having a working voltage of 1000 V. The size of the capacitor shall be such that the peak voltage measured shall be not less than 200 nor greater than 900 volts.

4.7.8.2.2 Resistive load. Resistive operations shall be accomplished at rated load.

4.7.8.3 Mechanical cycling. The circuit breaker shall be subjected to the number of cycles of opening and closing specified on the applicable MS or specification sheet. The rate of cycling shall be 6 to 7 cpm.

* 4.7.9 Overload cycling. At 200 percent rated current resistive load, the circuit breaker shall be subjected to manual-make and automatic-break applied as follows: Single-pole breakers shall be subjected to 50 cycles of normal tripouts from the closed position and 50 cycles of trip-free trip-outs while the reset actuator is held in the closed position. Three phase breakers shall be subjected to 25 cycles of normal tripouts from a balanced three phase overload. Each pole of the breaker shall then be individually subjected to 25 trip-free tripouts. These tests shall be run at a manual cycling rate of 2 to 3 minutes per operation. Failure to trip automatically within the maximum limit specified on the applicable MS or specification sheet throughout the test shall constitute failure. Following this test, the breaker shall meet the requirements of the minimum and maximum ultimate trip of 4.7.7.1 and 4.7.7.2. The breaker shall also meet the 200 percent calibration requirement of 4.7.7.3 at 25°C. For three phase breakers, each phase must be tested separately, while other phases carry zero current.

4.7.10 Reclosing. Manual reset circuit breakers shall remain open after being tripped automatically and subjected to the maximum and minimum ambient temperature specified on the applicable MS or specification sheet for 1 hour. Continuity shall be checked during both of these exposures. This test may be waived if the design of the breaker precludes automatic closing.

4.7.11 Vibration. Circuit breakers shall be tested in accordance with one or more of the test paragraphs listed below. The following details shall apply for all vibration tests:

a. Mounting. Circuit breakers shall be mounted as designed in normal application.

b. Electrical Load. Unless otherwise specified, circuit breakers shall carry their rated current load in the "on" position at room ambient temperature.

c. Measurements. Circuit breakers shall be continuously monitored by a continuity tester capable of detecting electrical discontinuities of 10 microseconds or less.

d. Post Test Measurements. Following vibration testing, circuit breakers shall be visually examined for physical damage, then subjected to the 200% overload calibration at 25°C and the dielectric withstanding voltage test specified in 4.7.7.3 and 4.7.2.

4.7.11.1 Random vibration. Circuit breakers shall be subjected to the vibration test method 214 test conditions C thru K, of MIL-STD-202. Circuit breakers shall be vibrated 3 hours in each of the three principle axes. During the first 1-1/2 hours of vibration in each axis, the circuit breakers shall be monitored for discontinuity. During the remaining time, the circuit breakers shall be monitored for tripping only.

4.7.11.2 Sine vibration. Circuit breakers shall be subjected to the vibration test method 204, condition A, of MIL-STD-202.

* 4.7.11.3 High level sine vibration. Circuit breakers shall be subjected to vibration testing in accordance with Method 204 of MIL-STD-202. The following test conditions shall apply:

* a. Test Condition B - No Electrical Load.

* b. Test Condition C - Rated Electrical Load.

4.7.12 Mechanical shock. Circuit breakers shall be tested in accordance with Method 213 of MIL-STD-202. The following details and exceptions shall apply:

a. Mounting - by normal mounting means.

b. Test - condition letter - A, or as specified.

c. Electrical load conditions.

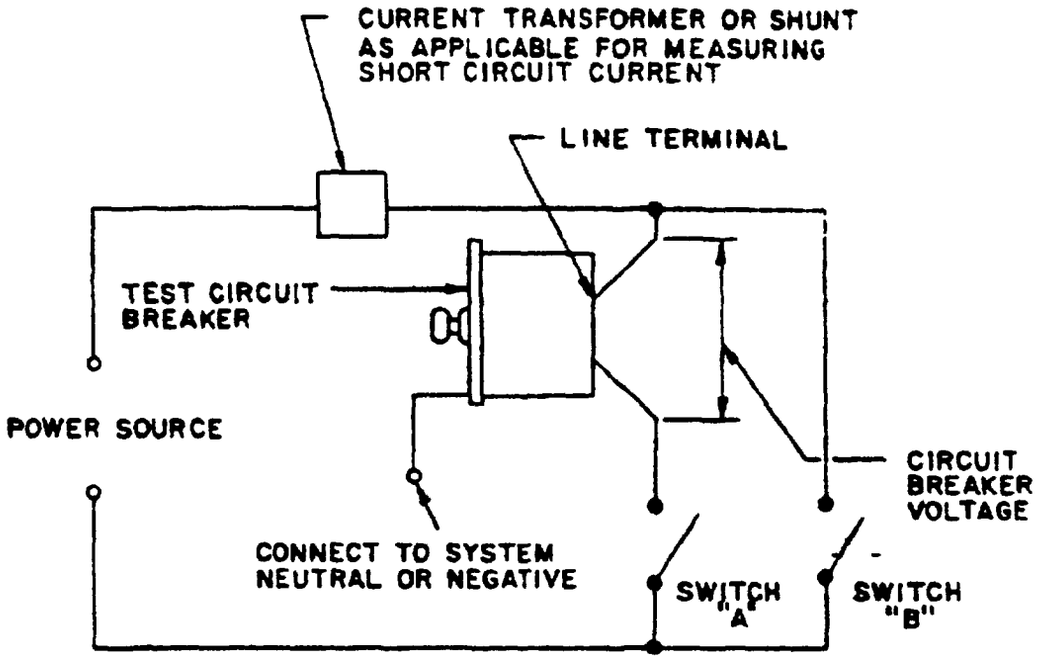
* Three separate shocks shall be applied to each of the three principal axes with the breaker contacts in the closed position, and three separate shocks shall be applied to each of the axes with the breaker contacts in the open position. All sections of the breaker shall be carrying rated current. A chronoscope, an oscilloscope or other device capable of detecting momentary opening or closing periods not exceeding 1/2 millisecond duration, shall be used to determine that the breaker contacts in the closed position remain closed, and circuit breaker contacts in the open position remain open. Following the test, the breaker shall meet the requirement of the 200 percent overload calibration of 4.7.7.3 at 25°C. For three phase breakers, each phase must be tested separately while other phases carry zero current.

* 4.7.13 Acceleration. The circuit breaker shall be mounted by its normal mounting means on a centrifuge in a position most likely to cause malfunctioning. The centrifuge shall be brought up to the radial speed required to produce a radial acceleration of 10g. The rates of centrifuge acceleration and deceleration shall be controlled so that the vector components (radial and tangential) or their vector sum shall not exceed 10g. Once the specified radial acceleration is obtained, it shall be stabilized and maintained for a period of not less than 1 minute. All poles of the breaker shall be carrying rated current during, and for 30 minutes prior to test. The test shall be repeated with the breaker contacts in the open position. An oscilloscope or oscillograph shall be used to determine the ability of the breaker contacts to

remain in the proper position. There shall be no opening or closing of contacts and there shall be no damage caused by acceleration. Following the test, the breaker shall be subjected to the 200 percent overload calibration (4.7.7.3) at 25°C. For three phase breakers, each phase must be tested separately while other phases carry zero current.

* 4.7.14 Interrupting capacity (formerly rupture capacity). For the interrupting capacity tests, the circuit breaker shall be so connected to the power source that currents specified on the applicable MS or specification sheet are provided at the circuit breaker terminals. The test circuit of Figure 3 may be used. The open circuit voltage before application of the interrupting current shall be as specified on the applicable MS or specification sheet. The open circuit recovery voltage shall be the value specified on the applicable MS or specification sheet. Oscillographic records of current, voltage and time shall be obtained. The circuit breaker shall be subjected to the interrupting capacity tests of Table VII as specified on the applicable MS or specification sheet and shall close on and open with the interrupting currents and voltages specified. When the MS or specification sheet list multiple current levels under test designation "E" and "F," tests shall be conducted consecutively at listed current levels "a," then "b," then "c," in accordance with the applicable MS or specification sheet. After each interruption, the open circuit voltage specified by the applicable MS or specification sheet shall be maintained across the breaker for a minimum of 5 seconds. There shall be sufficient time to permit proper cooling and reset between each cycle of operation. Interrupting tests shall not be repeated within 5 minutes of the previous test. Failure of circuit breaker to reset after 10 minutes shall be cause for rejection. Following the last operation of each test, the circuit breaker shall meet the requirements for dielectric withstanding voltage (4.7.2) and 200 percent overload calibration at 25°C. The breaker tripping time shall be within 120 percent of the upper limit specified in 4.7.7.3, and there shall be no dielectric breakdown. Each pole of multipole breakers in turn shall be subjected to this test while the other pole or poles are carrying rated current. For multipole circuit breakers, one operation shall be performed for each test altitude specified. Upon completion, the breaker shall again be subjected to this test while each of the poles is simultaneously carrying 60 +10 -0 percent of the single phase fault current specified on the applicable MS or specification sheet.

* 4.7.15 Sand and dust. While in the ON position and mounted on a dummy panel, the circuit breaker shall be subjected to sand and dust in accordance with the sand and dust test, Method 110, Test Condition A, of MIL-STD-202 with no evidence of mechanical or electrical failure. At the conclusion of this test, the breaker shall be held in at 500 percent of rated load, thus causing the breaker to trip free. On three-phase brakers, each pole shall be tested separately. Failure to trip within 10 seconds shall constitute failure. The circuit breaker shall meet the requirements for 200 percent overload calibration at room ambient as specified in 4.7.7.3. Toggle type circuit breakers shall be operated for 2,500 cycles (no load) at approximately seven cycles per minute during part I of Test Condition A of the sand and dust test.



(a) A-C OR D-C SHORT CIRCUIT RUPTURE TEST

Open test circuit breaker and switch "A."
Close switch "B" and adjust current in accordance with applicable MS requirement.
Open switch "B."
Close test circuit breaker.
Close switch "A."

A-C OR D-C CLOSE-IN RUPTURE TEST

Open test circuit breaker and switch "A."
Close switch "B" and adjust current in accordance with applicable MS requirement.
Open switch "B."
Close switch "A."
Close test circuit breaker.

(a) Interrupting current (formerly rupture current) shall be measured by a current transformer or shunt as indicated and suitable recording oscillograph. The voltage across the breaker shall be recorded simultaneously with interrupting current and at the point indicated.

FIGURE 3. Interrupting (formerly rupture) test circuit.

TABLE VII. Interruption (formerly rupture) test procedures.

Test designation	Test description	Operations 1/	System	Open circuit voltage	Calibrated fault current amperes	Transient rms voltage after calibrated fault current interruption
A	Available current short circuit interruption (ac)	2 CO2/ at SL 2 CO at Alt	'Y' connected 400 Hz 115/200 volts	120 +5	Current specified on applicable MS in 10 to 25 cycles after fault initiation	120 within 3 cycles 150 within 6 cycles 165 maximum
B	Available current close-in interruption (ac)	2 OCO3/ at SL 2 OCO at Alt				
C	Available current short circuit interruption (dc)	2 CO at SL 2 CO at Alt	28 V dc	30 +2V	Current specified on applicable MS on 0.01 to 0.03 seconds after fault initiation	28 within 0.002 seconds 50 maximum
D	Available current close-in interruption (dc)	2 OCO at SL 2 OCO at Alt				
E	Available intermediate current interruption (ac)	1 CO at Alt 1 OCO at SL For each value of current specified on applicable MS	'Y' connected 400 Hz 115/200 volts	120 ±5	Currents as specified on applicable MS	120 within 3 cycles 150 within 6 cycles 165 maximum
F	Available intermediate current interruption (dc)		28V dc	30 ±5		28 within 0.002 seconds 50 maximum
G	Available current short circuit (ac) for 3-phase circuit breakers only	1 CO SL 1 CO Alt	'Y' connected 400 Hz 115/200 volts	Single phase 120 ±5	Current specified on applicable MS in 10 to 25 cycles after fault initiation	120 within 3 cycles 150 within 6 cycles 165 maximum
		1 CO SL 1 CO Alt		3-phase 205 ±5		205 within 3 cycles 255 within 6 cycles 280 maximum
H	Available current close-in interruption (ac) for 3-phase circuit breakers only	1 OCO SL 1 OCO Alt		1-phase 120 ±5		120 within 3 cycles 150 within 6 cycles 165 maximum
		1 OCO SL 1 OCO Alt		3-phase 205 ±5		205 within 3 cycles 265 within 6 cycles 280 maximum

1/ Current and maximum operating altitude are specified on applicable MS.
2/ CO is an operation in which the circuit breaker is closed before initiation of the fault
3/ OCO is an operation in which the fault is initiated, and the circuit breaker is closed to complete the fault.

* 4.7.16 Salt spray (corrosion). The circuit breaker in the closed (ON) position with all hardware shown on the applicable MS or specification sheet installed finger tight shall be subjected to the salt spray test Method 101, Test Condition B, of MIL-STD-202 with a 5-percent salt solution. Within 10 minutes after the test, the breakers shall be washed for 5 minutes under running water not warmer than 37.8°C accompanied by a slight brushing, and dried for 6 hours in a forced-draft oven at approximately 57°C. At the conclusion of this test, the breaker shall be held in at 500 percent of rated load, thus causing the breaker to trip free. On three-phase breakers, each pole shall be tested separately. Failure to trip within 10 seconds shall constitute failure. The breaker shall then meet the requirements for 200 percent overload calibration at room ambient at 25°C, except that the tripping time shall be within 80 percent of the lower limit and 120 percent of the upper limit specified. All hardware shall be removable without damage to the circuit breaker or hardware.

4.7.17 Moisture resistance. Three circuit breakers in the closed (ON) position with all hardware shown on the applicable MS or specification sheet installed finger tight shall be subjected and designated as test sample units 1, 2 and 3, and subjected to the moisture resistance test of Method 106 of MIL-STD-202, except that no vibration is required during step 7b, and distilled demineralized or deionized water having a pH of between 6.5 and 7.2 at 25°C (77°F) shall be used to obtain the desired humidity. Prior to subjected sample units 2 and 3 to this test, the contact resistance of each sample unit shall be determined as specified in 4.7.17.1. Before, during and after the moisture resistance test, the contacts shall be maintained in the closed position. On removal from the chamber, the breakers shall be manually shaken to remove excess water and then permitted to stabilize at room temperature for 45 minutes. The following operations shall be performed on the three samples as indicated:

For sample unit 1:

a. Conduct a normal trip test with 500 percent rated load on each pole separately with the remaining pole or poles carrying zero current. Failure to trip within 10 seconds shall constitute failure.

b. Stabilize for 1 hour at room temperature.

c. Conduct a trip-free test with 300 percent rated load on each pole separately, with the remaining pole or poles carrying zero current.

d. Stabilize for 2 hours at room temperature.

e. Conduct the specified overload calibration trip test of 4.7.7.3 with 200 percent rated load on each pole separately with the remaining pole or poles carrying zero current except that tripping time may vary within ±10 percent of the specified limits.

f. Stabilize for 4 hours at room temperature.

g. Conduct the dielectric withstanding voltage test of 4.7.2. The breaker must meet this test and shall show no evidence of breaking, cracking, spalling, excessive corrosion, or loosening of terminals. All hardware shall be removable without damage.

For sample units 2 and 3:

a. Without disturbing the contacts, the samples shall be subjected to the storage test (4.7.17.2).

4.7.17.1 Contact resistance. The purpose of this test is to establish a level of contact resistance before and after the tests on moisture resistance (4.7.17) and storage (4.7.17.2). No specific absolute value of contact resistance is required. The parameter desired is comparison of contact resistance before and after 4.7.17 and 4.7.17.2. The circuit breaker contacts (sample units 2 and 3) shall be manually operated to successively interrupt and make a test circuit having a dc resistance load of one-half the current rating on the circuit breaker or 200 milliamperes, whichever is less, at 26 $\pm$2 volts. The contact resistance (specified as millivolt drop) shall be computed by averaging the results of 10 measurements. Each measurement shall be taken after a consecutive contact closure. All measurements shall be made across the circuit breaker external electrical terminal.

4.7.17.2 Storage test. Within 24 hours of completing prior applicable tests, the breakers shall then be stored, in an area free from chemicals which give off vapors known to be reactive with metals, for 10 days at a minimum temperature of 20°C and a relative humidity of not less than 40 percent. Throughout the above test, the circuit breaker contacts shall be maintained in the closed position. Upon completion of 10 days, the breakers shall be subjected to the contact resistance test 4.7.17.1. The contact resistance shall not exceed the initial contact resistance by more than 250 millivolts. These circuit breakers shall be submitted to and meet the requirements for calibration at room ambient with 200 percent of rated current, except that the tripping time shall be within 80 percent of the lower limit and 120 percent of the upper limit specified. All hardware shall be removable without damage.

4.7.18 Explosion. The circuit breaker shall be subjected to explosion test, Method 109 of MIL-STD-202, except that the test shall be conducted only at sea level. Ignition of the explosive mixture outside the breaker shall constitute failure.

4.7.18.1 Alternating current. Circuit breakers shall be subjected to operations required for the ac short circuit rupture tests as specified on the applicable MS. Where both Test A and E of Table VII are specified, one sample unit shall be subjected to each of these tests. Where only Test A or E of Table VII is specified, two sample units shall be subjected to that test.

4.7.18.2 Direct current. Circuit breakers shall be subjected to the operations required for the dc short circuit rupture tests as specified on the applicable MS. Where both Test C and F of Table VII are specified, one sample unit shall be subjected to each of these tests. Where only Test C or F of Table VII is specified, two sample units shall be subjected to that test.

4.7.19 Voltage drop. The voltage drop of the circuit breaker from terminal to terminal of one pole shall be measured while subjected to rated current, and the voltage drop, as measured from terminal to terminal, shall not exceed the value specified by the applicable MS. This test shall be performed after the breaker has been carrying its rated current for at least 30 minutes. The power loss shall be determined. In no case shall the power dissipation exceed 15 watts.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, packing and marking. Circuit breakers shall be preserved and packaged in accordance with Level A or C of MIL-E-17555, as specified (see 6.2). They shall be packed in accordance with Level A, B or C, as specified (see 6.2), and marked in accordance with MIL-E-17555.

6. NOTES

6.1 Intended use. The trip free circuit breakers defined herein are intended for use in AC and DC circuits. MIL-C-5809 circuit breakers are not generally designed to be used as switches and should not be used as such per MIL-STD-454.

6.2 Ordering data. Procurement documents should specify the following:

a. MS part number, type and title.

b. Ambient temperature (see 3.4.13).

c. Levels of preservation, packaging and packing (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable QPL, whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the QPL is the Commanding Officer, Naval Avionics Center (Code B/714), 6000 East 21st Street, Indianapolis, IN 46219-2189, and information pertaining to qualification of products may be obtained from that activity. Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

6.4 Definitions.

6.4.1 Ultimate trip current. Ultimate trip current is the smallest value of current that will cause tripping of the circuit breaker under a given set of ambient conditions.

6.4.1.1 Ultimate trip limits. The specified limits of ultimate trip current are maximum ultimate trip current and minimum ultimate trip current. At the maximum specified ultimate trip current the breaker will open within the specified time, and at the minimum specified ultimate trip current the breaker will not open.

6.4.2 Line terminal. The terminal attached to the isolated stationary contact, with the circuit breaker in the open or tripped position, is considered as the line terminal. When both contacts of a circuit are isolated, only one terminal shall be designated the line terminal.

6.4.3 Push-pull circuit breaker. Push-pull circuit breakers are those which can be manually actuated by an actuator moving in a direction perpendicular to the plane of the mounting plate.

6.4.4 Toggle circuit breaker. Toggle circuit breakers are those circuit breakers which can be manually actuated by an actuator which pivots about a point on or within the breaker.

6.4.5 Multipole circuit breaker. A multipole circuit breaker has two or more poles controlled by a single actuating member. Separately operable breakers in a common case will not be considered as multipole breakers, but will be treated throughout as single-pole breakers.

6.4.6 Trip free. A circuit breaker so designed that the circuit cannot be maintained closed and cannot be held against a fault when any pole is carrying overload currents that would automatically trip the breaker to the open position.

6.4.6.1 Recycling trip free. A circuit breaker so designed that the circuit will automatically recycle, open and momentarily close, as long as the actuator is maintained in a closed position.

6.4.6.2 Nonrecycling trip-free. A circuit breaker so designed that after tripping with the actuator held in a closed position, the breaker will not automatically reclose.

6.4.7 Interrupting capacity. Former revisions referred to this parameter as "Rupture capacity." Interrupting capacity is the maximum potential short circuit current at rated voltage which a circuit breaker is required to interrupt under the operating duty specified and with a normal frequency recovery voltage not less than rated voltage.

6.4.8 Available short circuit and close in interrupting capacity tests. These tests use a voltage regulated circuit in which the calibrated fault current is obtained after the regulator has provided maximum excitation.

6.4.9 Extra-length pushbutton. Unless otherwise specified, a push-pull actuated circuit breaker with a pushbutton nominally .375 inches longer than the standard length pushbutton is designated as an extra-length pushbutton circuit breaker. The standard and extra length of pushbutton for each style circuit breaker is shown in each individual MS or specification sheet.

6.4.10 Separable link. A mechanism designed such that it shall be able to open a circuit under current overload condition if the normal tripping mechanism malfunctions.

6.5 International standardization agreement. Certain provisions (1.1) of this specification are the subject of international standardization agreement ASCC 12/3. When amendment, revision or cancellation of this specification is provided which will affect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization offices, if required.

* 6.6 Subject term (keyword) listing.

Air, electric, circuit breaker
Magnetic type circuit breaker
Non-trip-free circuit breaker
Power distribution panel
Push pull circuit breaker
Pushbutton circuit breaker
Thermal type circuit breaker
Toggle actuated circuit breaker
Trip-free circuit breaker

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

Custodians:
Navy - AS
* Air Force - 85
Army - ER

Users:
Army - WC

Reviewers:
Army - AV, AT, MI, MU

Preparing activity:
Navy - AS
(Project No. 5925-0184)

APPENDIX

CIRCUIT BREAKER, FIRST STEP SELECTION GUIDE

10. SCOPE. This appendix is included as a "first step" guide in the selection of the proper circuit breaker and shall not be used as a substitute for the pertinent MS sheet form standard.

10.1 Single-phase circuit breakers. Table VIII is a selection guide for single-phase circuit breakers.

10.2 Three-phase circuit breakers. Table IX is a selection guide for three-phase circuit breakers.

20. APPLICABLE DOCUMENTS

20.1 Government documents.

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

SPECIFICATIONS

MILITARY

MIL-C-27715	Circuit Breaker, Trip-Free, High Temperature, Aircraft, General Specification for

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

30. NOTES.

30.1 The existence of a part number on an MS or specification sheet must not be construed as a guarantee that the part or the current rating you require has a qualified source. Consult the latest revision QPL 5809 and the qualifying activity for possible interim letters of approval before specifying a breaker.

30.2 A qualification inspection test sample of MIL-C-5809 circuit breaker is required to endure only one of the listed endurance requirements such as no load cycles, or one of the loaded requirements, but not the sum total of cycles for all load conditions as in MIL-C-27715.

TABLE VIII. Single-phase circuit breakers

Spec. range amps	MS part number	25°C Trip limits % of rating		Trip time in seconds at specified overloads (25°C)					Temp effect % of rating				Interrupting capacity (110 amps) at		Voltage drop (range or max.)	Endurance (note I) 1,000 cycles (auto-trip)				Maximum envelope dimensions		WR lbs	Alt & feet	Remarks
		Hold	Trip	150%	200%	400%	500%	600%	1000%	Hold	°C	Trip	28V DC	115V 400 Hz		Inductive DC	Inductive 400 Hz	Res.	No load	Panel space	Depth behind panel			
5-20	22073	115	145	-	2-20	-	16-1 0	-	.046- 20	125 90	-55 +71	180 130	•	•	.15-2.0	2 5	2.5	5	5	25/32 x 19/32	1-13/16	004	80	Also available with random and "V" level vibration capability
5-5	22078	110	130	-	•	•	-	•	-	110 110	-00 71	130 130	•	•	.05-1.21	2.5	2 5	5	5			.1	65	
5 20	28574	115	145	-	2-20	-	16-1 0	-	046- 20	125 90	-55 +71	180 130	•	•	.15-2.0	2 5	2 5	5	5	25/32 x 19/32	1-27/64	004	80	Also available with auxiliary contacts, extended pushbutton, or random vibration capability
1-50	25304	110	150	-	10-80	1-0	-	.02-4	-	110 110	-54 +120	175 150	30	30	00-20.0	10	10	10	10	2-1/2 x 3/4	2	270	50	Toggle-magnetic
5-50	25244	115	170	-	15-55	2-7	-	1-3 5	-	•	-00 +71	•	00	35	.25-1.1	2 5	2.5	5	5	1-3/32 x 34	1-13/16	.100	65	Also available with random vibration capability
5-15	24509	115	130	-	•	•		•		130 00	-00 +71	160 120	00	35	0-.75	1	5	5	10	1-3/0 x 34	1-5/16	.000	70	Toggle located off center
5-15	24510	115	130	-	•	•		•		130 00	-00 +71	160 120	00	35	.5-.75	1	5	5	10	1-3/0 x 3/0	1-5/16	.070	70	Pushbutton located off center
	25337	115	130	-	15-20	2-7	-	1-3 5	-	•	-00 +71	•	00	30	.5	2.5	2 5	5	10	2-13/64 x 3/0	2	.000	05	Toggle
50-100	25361	105	130	-	15-65	2-10	-	1.6	-	125 70	-00 +71	165 125	00	30	3	2 5	5	5	10	2-13/64 x 3/0	0-1/0	.200	70	Also available with random and "V" level vibration capability
5-70	3370	110	130	-	5-15	•	.5-1 5	-	.12-.35	115 100	-55 121	140 130	00	•	05-.30					25/32 x 19/32	1-11/32	.005	70	Also available with extended pushbutton, random and "V" level vibration capability
25-35	14105	115	130	-	4-20	-	0.4-1 7	-	0.1-0 0	115 100	-00 121										1.303			Also available with extended pushbutton and random vibration capability

*See specification sheet - ratings vary by amp rating.

TABLE IX. Three-phase circuit breakers

Spec range amps	MS part number	25°C Trip limits, % of rating: Hold	25°C Trip limits, % of rating: Trip	Trip time in seconds at specified overloads (25°C): 100%	200%	400%	500%	600%	1000%	Temp. effect % of rating: Hold	°C	Trip	Interrupting capacity (150 amps) at: 28V DC	115V 400 Hz	Voltage drop (range or max.)	Endurance (note 2) 1,000 cycles (pole-break): Inductive DC	Inductive 400 Hz	Res.	No load	Maximum overall dimensions: Panel space	Behind panel	Wt. lbs	Alt. ft feet	Remarks
1-35	18193	110	145	-	.8-2	-	1-.63	-	.10-.53	110 100	-25 +71	105 105	-		.25-1.1	-	2 5	5	5			.25	70	
1-20	18150	110	145	-	4-20	-	.8-2	-	.1- 53	110 100	-55 71	105 105	-		25-1.1	-	2 5	5	5			.15	70	
5-80	21980	105	130	-	10-70	2-9	-	-	35-1.0	120 70	-54 +71	100 110	-	15-30 25-90	.3	-	9	5	5	2-13/64 x 2-1/4	2-1/8	.300	80	
5-50	10151	105	130	-	10-70	2-9	-	-	35-1 4	120 70	-54 +71	100 110	- -	15-30 25 90	3	-	5	5	5	1-5/32 x 1-5/16	1-5/32	.300	80	

NOTES

This appendix is supplied as a "first step" guide in the selection of the proper circuit breaker and must not be used as a substitute for the MS detail sheets.

1 The existence of an MS part number must not be construed as a guarantee that the part or the current rating you require has a qualified source. Consult the latest QPL sheet and the qualifying activity for possible interim letters of approval before specifying a breaker.

2 A qualification inspection test sample of MIL-C-5809 circuit breaker is required to endure only one of the listed endurance requirements such as no load cycles, or one of the loaded requirements, but not the sum total of cycles for all load conditions as in MIL-C-27715.

INSTRUCTIONS. In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge *(DO NOT STAPLE)*, and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

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1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-C-5809G	CIRCUIT BREAKERS, TRIP-FREE, AIRCRAFT, GENERAL SPECIFICATION FOR

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION (Mark one)
	☐ VENDOR ☐ USER ☐ MANUFACTURER ☐ OTHER (Specify) _____
b. ADDRESS (Street, City, State, ZIP Code)	

5. PROBLEM AREAS

a. Paragraph Number and Wording

b. Recommended Wording

c. Reason/Rationale for Recommendation

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) – Optional	b. WORK TELEPHONE NUMBER (Include Area Code) – Optional
c. MAILING ADDRESS (Street, City, State, ZIP Code) – Optional	8. DATE OF SUBMISSION (YYMMDD)

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