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SUPERSEDING
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MILITARY SPECIFICATION

CIRCUIT BREAKERS, MAGNETIC, UNSEALED OR PANEL SEAL, TRIP-FREE, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers the requirements and test procedures for single and multipole, trip-free, unsealed, magnetic circuit breakers with current ratings of 0.2 to 100 amperes inclusive, up to and including 240 volts, 400 Hertz, 480 volts, 60 Hertz alternating current (ac) and 125 volts direct current (dc), (see 6.1). These circuit breakers may also include auxiliary contacts (see 6.5.1) for monitoring circuits. A voltage sensitive pole is also available in a four pole device. Panel seal mounts are available in 0.2 through 50 amperes.

CAUTION: Calibration of these circuit breakers will be affected if mounted in other than the vertical plane.

1.2 Military part number. The following military part numbering system shall be used to preclude changing existing catalog data.

1.2.1 Single or multipole circuit breakers with identical poles (specification sheets 1 through 12). The military part number identifying the individual circuit breaker consists of the letter "M", the basic number of the specification sheet and a sequentially assigned dash number as follows:

M	55629/6	-001
Military designator	Specification sheet number	Dash number (see 3.1)

1.2.2 Circuit breakers with mixed poles (specification sheets 1 through 6) and all circuit breakers covered by (specification sheets 13 through 22). NOTE: Nondelay poles are not available with the "high-inrush" feature but may be mixed with other delays having that feature. The military part number identifying the individual circuit breaker consists of the letter "M", the basic number of the specification sheet followed by the pole ratings (see 3.1) as follows:

M	55629/6	EAECEC
Military designator	Specification sheet number	Pole ratings (see 3.1)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U. S. Army Electronics Research and Development Command, ATTN: DELET-RS, Fort Monmouth, NJ 07703 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

2. APPLICABLE DOCUMENTS

2.1 Issues 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.

SPECIFICATIONS

FEDERAL

NN-P-71 - Pallets, Material Handling, Wood, Stringer Construction, 2-Way and 4-Way (Partial).
QQ-P-416 - Plating, Cadmium (Electrodeposited).
QQ-S-571 - Solder, Tin Alloy: Tin-Lead Alloy; and Lead Alloy.
QQ-S-781 - Strapping, Steel, and Seals.
QQ-Z-325 - Zinc Coating, Electrodeposited, Requirements for.
PPP-B-566 - Boxes, Folding, Paperboard.
PPP-B-585 - Boxes, Wood, Wirebound.
PPP-B-601 - Boxes, Wood, Cleated-Plywood.
PPP-B-621 - Boxes, Wood, Nailed and Lock-corner.
PPP-B-636 - Boxes, Shipping, Fiberboard.
PPP-B-676 - Boxes, Setup.
PPP-T-60 - Tape: Packaging, Waterproof.
PPP-T-76 - Tape, Packaging, Paper (For Carton Sealing).

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MIL-P-116 - Preservation, Methods of.
MIL-W-5085 - Wire, Electric, Polyvinyl Choride Insulated, Copper or Copper Alloy.
MIL-B-5423 - Boots, Dust and Water Seal (For Toggle and Pushbutton Switches, Circuit Breakers, and Rotary-Actuated Parts), General Specification For.
MIL-T-7928 - Terminals, Lug: Splices, Conductor: Crimp Style, Copper, General Specification For.
MIL-T-10727 - Tin Plating; Electrodeposited or Hot-dipped, For Ferrous and Nonferrours Metals.
MIL-F-14256 - Flux, Soldering, Liquid (Rosin Base).

(See supplement 1 for list of associated specification sheets).

STANDARDS

FEDERAL

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

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MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-147 - Palletized: Unit Loads.
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-794 - Parts and Equipment, Procedures for Packaging and Packing of.
MIL-STD-965 - Parts Control Program.
MIL-STD-1188 - Commercial Packaging of Supplies and Equipment.
MIL-STD-1285 - Marking of Electrical and Electronic Parts.
MIL-STD-45662- Calibration Systems Requirements.
MS20659 - Terminal, Lug, Crimp Style, Copper, Uninsulated, Ring Tongue, Type I, Class 1.
MS25036 - Terminal, Lug, Crimp Style, Copper, Insulated, Ring-Tongue, Bell-Mouthed, Type II, Class 1 (for 105°C Total Conductor Temperature).

HANDBOOK

MILITARY

MIL-HDBK-53 - Guide for Sampling Inspection.

(Copies of specifications, standards, drawings, 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 are 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.

UNDERWRITERS' LABORATORIES, INC. (UL) STANDARD

UL489 - Standard for Safety. Molded-Case Circuit Breakers and Circuit Breaker Enclosures.
UL1077 - Standard for Appliance Protectors for use in Electrical Appliances and Components.

(Application for copies should be addressed to the Underwriters' Laboratories, Inc., 207 East Ohio Street, Chicago, IL 60611.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSIY32.2-1975 - Graphic Symbols for Electrical and Electronics Diagrams.

(Applications for copies should be addressed to the American National Standards Institute, 10 East 40th Street, New York, NY 10016.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

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

3.2 Circuit breaker categories. Circuit breakers furnished under this specification shall be category I, II, or III, as defined herein.

3.2.1 Category I. Circuit breakers completely defined by a military specification sheet (see 3.1, 4.5, and 6.2.1).

3.2.2 Category II. Circuit breakers are the same as category I, except for minor differences such as mounting means, current rating, voltage, time delay, and coil construction, which do not change the basic design or construction of the qualified circuit breaker. Category II circuit breakers shall be procured from a source listed on the applicable qualified products list for the particular similar product in category I. Category II circuit breakers are nonstandard (see 4.6.1 and 6.2.2). Test reports shall be prepared in accordance with MIL-STD-965.

3.2.3 Category III. Circuit breakers not covered by specification sheets. These circuit breakers are nonstandard (see 4.6.2 and 6.2.3). Test reports shall be prepared in accordance with MIL-STD-965.

3.3 Qualification. Category I circuit breakers furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.5 and 6.3).

3.4 Material. Material 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 guaranty of the acceptance of the finished product.

3.4.1 Metals. Metals shall be of a corrosion-resistant type or shall be suitably plated or treated to resist corrosion (see 3.21). Cadmium or zinc plating, if used, shall be in accordance with class 2, type II, QQ-P-416 and class 2, type II, QQ-Z-325, respectively. However, zinc plating shall not be used for mounting hardware.

3.4.1.1 Dissimilar metals. When dissimilar metals are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided. The use of dissimilar metals in contact, which tend toward active electrolytic corrosion (particularly brass, copper, or steel used in contact with aluminum or aluminum alloy) is not acceptable. However, metal plating or metal spraying of dissimilar base metals to provide similar or suitable abutting surfaces is permitted. The use of dissimilar metals separated by a suitable insulating material is also permitted. Dissimilar metals are defined in 6.4 through 6.4.4 and table VI.

3.4.1.2 Decals. Metal or metalized labels shall not be used.

3.4.2 Fungus resistance. Materials shall be used that are not nutrients for fungus as specified in requirement 4, MIL-STD-454.

3.4.3 Solder and soldering flux. Solder, when used, shall be composition Sn60 in accordance with QQ-S-571 and soldering flux shall be in accordance with MIL-F-14256; however, composition Sn95 may be used for soldering the delay tube to the mechanism frame.

3.5 Design and construction. Circuit breakers shall be of the design, construction, and physical dimensions specified (see 3.1).

3.5.1 Trip-free feature. Circuit breakers shall be designed so that the circuit cannot be maintained closed by physically holding the actuator lever in the closed position when any pole is carrying overload currents that would normally automatically trip the circuit breaker to the open position.

3.5.2 Trip indication. Circuit breakers shall be designed so that when the circuit breaker contacts open automatically on overload, the actuator lever shall indicate the operation by moving to the "off" ("trip") position.

3.5.3 Attitude. Circuit breakers shall be constructed to trip within maximum and minimum limits of the specified trip times (see 3.1 and 6.5.5), when mounted on a vertical panel (normal mounting means) (see 4.8.5).

3.5.4 Actuator. The actuator shall be as specified (see 3.1). The exposed portion of actuators shall be insulated from all current-carrying parts. The exposed portion of metal actuators shall have a smooth, nonglare, metallic finish. Actuators shall not work to an intermediate position, give a false trip indication, or be removable from the circuit breaker. Multipole circuit breakers having individual pole actuators (see 6.5.3), shall be provided with handle ties for convenient manual switching, and the circuit breaker shall be designed so that it will be impossible by any manipulation of the actuator to close less than the total number of contacts. Actuators of the lever type shall point in the "normally upward" (top of the circuit breaker) direction when the circuit breaker is in the "closed" ("on") position. Actuators of the push-pull type shall be in the "closed" ("on") position when the actuator button is pushed in.

3.5.5 Mounting means. Mounting means shall be as specified (see 3.1).

3.5.6 Terminal and mounting hardware (as applicable). Terminal and mounting hardware shall be as specified (see 3.1). For direct Government procurement, the hardware shall be assembled in proper order, as specified (see 3.1).

3.5.7 Threaded parts. Screw threads on external threaded parts used for mounting shall be in accordance with FED-STD-H28.

3.5.8 Terminals.

3.5.8.1 Line and load terminals (see 6.5.2). The main line and load terminals shall be designed and mounted as specified (see 3.1). For bushing-mounted types of circuit breakers, where a locating keyway is used, load terminals will be on the side of the keyway and line terminals will be on the side opposite the keyway. Each terminal shall be capable of carrying rated current and voltage per pole of the circuit breaker.

3.5.8.2 Auxiliary contact terminals. When specified (see 3.1) circuit breakers shall be provided with auxiliary contacts (see 6.5.1) of the specified switching type, and terminals of the design and location specified (see 3.1). Contacts and terminals shall be capable of carrying specified loads. Auxiliary contacts shall be of double throw configuration with permanent designations as follows adjacent to the contact terminals: "NO" for normally open, "NC" for normally closed, and "C" for common. The auxiliary contacts shall be arranged in a manner to insure (regardless of actuating lever or push-button position) that the normally open contacts are closed when the main circuit

breaker contacts are closed, and the normally closed contacts are closed when the main circuit breaker contacts are open.

3.5.8.2.1 Solder terminals. Unless otherwise specified, solder terminals may be of any shape, and shall be capable of being readily soldered. Solder terminals shall not be gold plated.

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

3.5.10 Tamper-proof calibration. Circuit breakers shall be secured with a tamper-proof closure so that the calibration of the device is kept intact and cannot be disturbed without it being dismantled.

3.5.11 Solder. Solder shall not be used primarily for obtaining mechanical strength. Electrical connections shall be mechanically secure before and electrically continuous after soldering.

3.5.12 Voltage rating. Voltage rating shall be as specified (see 3.1).

3.5.13 Continuous current carrying capacity. Circuit breakers shall be capable of carrying the rated current as specified (see 3.1).

3.5.14 Circuit diagram. The circuit diagram shall be as specified (see 3.1).

3.5.15 Panel. When panel sealing is accomplished by the use of boots, they shall be in accordance with MIL-B-5423 as specified (see 3.1).

3.6 Solderability (applicable to solder terminals). When circuit breakers are tested as specified in 4.8.2, 95 percent of the total length of fillet, which is between the standard wrap wire and the terminal, shall be tangent to the surface of the terminal being tested. There shall be no pinholes, voids, etc. A ragged or interrupted line at the point of tangency between the fillet and the terminal under test shall be considered a defect. After the test, there shall be no evidence of fracture, loosening of parts, or any other mechanical failure of the circuit breakers. A movement of the terminals within the confines of the terminal-anchoring device will be permitted provided continuity of electrical contact is not impaired. When any movement of the terminal is noted, the dielectric withstanding voltage shall be as specified in 3.7.

3.7 Dielectric withstanding voltage. When circuit breakers are tested as specified in 4.8.3, the leakage current shall not exceed 500 microamperes with the exception of 1 mA after 1 hour following the moisture resistance test. There shall be no evidence of flashover, mechanical damage, arcing, or breakdown.

3.8 Insulation resistance. When circuit breakers are tested as specified in 4.8.4, the insulation resistance shall be not less than 100 megohms.

3.9 Calibration. When circuit breakers are tested as specified in 4.8.5, the tripping time (see 6.5.6) shall not exceed the limits as specified (see 3.1). Circuit breakers shall also trip within these specified limits when subjected to the trip-free calibration test (see 4.8.16). In multipole circuit breakers, all poles shall trip upon application of overload on any pole or combination of poles. Circuit breakers tested for high inrush (see 3.1) shall not trip during the high-inrush test. Circuit breakers requiring the voltage trip test shall trip within 30 milliseconds after application of each specified voltage (see 3.1).

3.10 Resistance or impedance. When circuit breakers are tested as specified in 4.8.6, the main series resistance or impedance shall not exceed the maximum values specified (see 3.1), except after endurance and interrupting capacity. The variation after these tests shall be within plus 10 percent or 0.1 ohm, whichever is greater, than the specified values (see 3.1). The auxiliary contact resistance shall not exceed 0.050 ohm initially or 0.10 ohm after endurance.

3.11 Actuator (see 4.8.7).

3.11.1 Actuator strength. When circuit breakers are tested as specified in 4.8.7.1 and 4.8.7.2, there shall be no evidence of mechanical damage after the specified load (see 3.1) is applied to the actuator lever or pushbutton.

3.11.2 Actuator operating force. When circuit breakers are tested as specified in 4.8.7.3, the applied force necessary to operate the lever in either direction shall not exceed the value specified (see 3.1).

3.12 High- and low-temperature operation. When circuit breakers are tested as specified in 4.8.8, there shall be no evidence of mechanical damage, and tripping time shall not exceed the extreme temperature limits specified (see 3.1), and when applicable, the auxiliary contacts shall operate as specified in 3.5.8.2. Circuit breakers shall also meet the following requirements when tested under the conditions specified in 4.8.8:

a. Dielectric withstanding voltage (see 3.7).
b. Insulation resistance (see 3.8).

3.13 Endurance. When circuit breakers are tested as specified in 4.8.9, there shall be no failure, and no evidence of mechanical damage or loosening of parts. Circuit breakers shall also meet the following requirements:

a. Dielectric withstanding voltage (see 3.7).
b. Insulation resistance (see 3.8).
c. Calibration (see 3.9).
d. Resistance or impedance (see 3.10).

3.14 Terminal strength. When circuit breakers are tested as specified in 4.8.10, there shall be no short-circuiting, breakage, loosening, bending, stripping of threads, or rotation of terminals, as applicable, and no damage to the circuit breaker body around the terminals.

3.15 Mounting strength. When circuit breakers are tested as specified in 4.8.11, there shall be no breakage, malfunction, or evidence of any damage which would impair the ability of the breakers to meet the requirements of subsequent tests.

3.16 Vibration. When circuit breakers are tested as specified in 4.8.12, main circuit breaker contacts shall not trip. There shall be no closing of open main or auxiliary contacts, nor opening of closed main or auxiliary contacts in excess of 10 microseconds duration, nor shall there be any evidence of mechanical or electrical damage.

3.17 Moisture resistance. When circuit breakers are tested as specified in 4.8.13, the change in resistance or impedance between the initial and final recorded measurements shall not exceed 10 percent for circuit breaker current ratings of less than 5.0 amperes; 25 percent for current ratings of 5.0 through 25.0 amperes; 30 percent for current ratings over 25.0 through 50.0 amperes; and shall not deviate more than 50 percent for circuit breakers over 50 amperes through 100 amperes. The insulation resistance shall be a minimum of 1 megohm (wet) at the end of the 10th cycle and a minimum of 100 megohms at the end of the 24-hour drying period, and there shall be no evidence of breaking, cracking, spalling, or loosening of terminals. Circuit breakers shall also meet the following requirements:

a. Dielectric withstanding voltage (see 3.7).
b. Calibration (see 3.9).

3.18 Thermal shock. When circuit breakers are tested as specified in 4.8.14, there shall be no evidence of mechanical damage.

3.19 Shock. When circuit breakers are tested as specified in 4.8.15, main circuit breaker contacts shall not trip. There shall be no closing of open main or auxiliary contacts, nor opening of closed main or auxiliary contacts, nor shall there be any evidence of mechanical or electrical damage.

3.20 Trip-free calibration. When circuit breakers are tested as specified in 4.8.16, tripping times shall be as specified in 3.9. After the circuit breaker has tripped, the contacts shall not automatically return to the closed position even momentarily. Subsequent performance of the circuit breaker shall not be adversely affected. The auxiliary contacts shall indicate the main contact condition even when the actuator is held in the closed position (see 3.5.8.2).

3.21 Salt spray (corrosion). When circuit breakers are tested as specified in 4.8.17, there shall be no evidence of excessive corrosion (see 3.4.1). Excessive corrosion is defined as that which interferes with the electrical or mechanical performance or in the case of plated metals, corrosion that has passed through the plating and attacked the base metal. There shall be no warping, cracking, or other damage to the circuit breaker. After the test, the hardware, if applicable (see 3.5.6), shall be readily removable.

3.22 Explosion (when specified). When circuit breakers are tested as specified in 4.8.18, there shall be no explosion within the test chamber whether or not explosion occurs within the circuit breaker.

3.23 Temperature rise. When circuit breakers are tested as specified in 4.8.19, they shall not trip, and the temperature rise of the terminals shall not exceed 25°C for 10.0 ampere circuit breakers and below, 35°C for circuit breakers over 10.0 amperes through 25.0 amperes, and 50°C for circuit breakers over 25.0 amperes through 100 amperes (55°C for circuit breakers over 50 amperes through 100 amperes tested at 400 Hz).

3.24 Interrupting capacity. When circuit breakers are tested as specified in 4.8.20, circuit breakers shall trip automatically; there shall be no dielectric breakdown, and when applicable (see 3.1 and 3.5.8.2), the auxiliary contacts shall operate, indicating position of the main contacts. Circuit breakers shall also meet the following requirements:

a. Dielectric withstanding voltage (see 3.7).
b. Trip at 200 percent of rated current (see 3.9).
c. Resistance or impedance (see 3.10).

3.25 Panel seal. When circuit breakers are tested as specified in 4.8.21, there shall be no visible air bubbles indicative of leakage.

3.26 Marking (see 3.1).

3.26.1 Identification marking. The following information shall be marked on the circuit breaker in accordance with MIL-STD-1285. The resistance to solvents test does not apply.

a. Part number (see 3.1).
b. Current rating, voltage, and operating frequency (see 3.1).
c. Supplier's name or code symbol and date code.
d. Circuit schematic using symbols in accordance with ANSI Y32.2-1967. Metal or metalized labels shall not be used.

3.26.2 Other marking. The "on" and "off" positions of lever-type actuators (see 3.5.4); the main "line" terminal(s) (see 6.5.2); and where applicable, the auxiliary contact terminals (see 3.1 and 3.5.8.2) and line and load terminal numbers (see 3.1), shall be clearly and permanently marked on each unit. Multipole breakers with mixed current ratings and/or trip curves shall be marked so the ratings of each pole are identified.

3.27 Workmanship. Circuit breakers shall be processed in such a manner as to be uniform in quality and shall be free from cracked or displaced parts, sharp edges, burrs and other defects that will affect life or serviceability.

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 Governement. 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 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662.

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

a. Materials inspection (see 4.3).
b. Qualification inspection (see 4.5).
c. Quality conformance inspection (see 4.7).

4.3 Materials inspection. Materials inspection shall consist of certification supported by verifying data that the materials listed in table I, used in fabricating the circuit breakers, are in accordance with the applicable referenced specifications or requirements prior to such fabrication.

TABLE I. Materials inspection.

Material	Requirement paragraph	Applicable specification
Metal plating	3.4.1	QQ-P-416 or QQ-Z-325
Fungus resistance	3.4.2	MIL-STD-454
Solder and solder flux	3.4.3	QQ-S-571 and MIL-F-14256

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 Power supply. Unless otherwise specified herein, the power supply shall have no more than 10 percent regulation at the specified test load. A dc power supply shall have no more than 5 percent voltage ripple. An ac power supply shall be within 10 percent of the specified frequency and shall be sinusoidal with a form factor of 1.25 maximum. When specified (see 3.1), the ac or dc power supply shall be capable of simulating the normal and abnormal power conditions described in MIL-STD-704.

4.5 Qualification inspection (category I circuit breakers only, see 3.2.1). Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.3) on sample units produced with equipment and procedures normally used in production.

4.5.1 Sample size. The number of circuit breakers to be subjected to qualification inspection shall be as specified in the appendix to this specification.

4.5.2 Inspection routine (specification sheets 1 through 12) tripping time delays A through G. Sample units, grouped as specified in the appendix, shall be subjected to the qualification inspection specified in table II, in the order shown. All 42 sample units shall be subjected to the inspection of group I. Then the 42 sample units shall be allocated as follows into six 7-unit groups, as specified in the appendix, and subjected to the inspection for their particular group.

Group II - One 7-unit group covering the highest current rating.

Groups III, IV, and V - One 7-unit group each; each 7-unit group uniformly composed of circuit breakers at either the highest or lowest current rating at the option of the supplier.

Group VI - One 7-unit group covering the highest current rating and one 7-unit group covering the lowest current rating.

(For inspection routine of tripping time delays H, I, and J, see 20.1).

TABLE II. Qualification and retention of qualification inspection.

Inspection	Requirement paragraph	Test method paragraph
Group I (all sample units) 1/		
Visual and mechanical inspection 2/	3.1, 3.4 to 3.5.15 incl, 3.26 thru 3.26.2, 3.27	4.8.1
Solderability (applicable to solder terminals) (3 sample units only)	3.6	4.8.2
Dielectric withstanding voltage 3/	3.7	4.8.3
Insulation resistance	3.8	4.8.4
Calibration	3.9	4.8.5
Resistance or impedance	3.10	4.8.6
Actuator strength (2 sample units only)	3.11.1	4.8.7.1 and 4.8.7.2
Group II		
High- and low-temperature operation 5/	3.12	4.8.8
Endurance 3/	3.13	4.8.9
Actuator operating force (2 sample units only)	3.11.2	4.8.7.3
Group III		
Terminal strength	3.14	4.8.10
Mounting strength	3.15	4.8.11
Vibration	3.16	4.8.12
Moisture resistance	3.17	4.8.13
Group IV		
Thermal shock	3.18	4.8.14
Shock	3.19	4.8.15
Moisture resistance	3.17	4.8.13
Group V 4/		
Trip-free calibration 3/	3.20	4.8.16
Salt spray (corrosion)	3.21	4.8.17
Explosion (when specified)	3.22	4.8.18
Group VI		
Temperature rise 3/	3.23	4.8.19
Interrupting capacity 3/	3.24	4.8.20
Panel seal (2 sample units only) 5/	3.25	4.8.21

1/ Nondestructive inspections and tests.

2/ Dimensional measurements may be made on two units only.

3/ This test is not required for initial qualification or retention of qualification when documentation in the form of the UL engineering report in accordance with UL489 or UL1077 or both is furnished.

4/ After completion of group V tests, one circuit breaker of the group shall be opened and examined internally in accordance with 4.8.1.

5/ When applicable (see 3.1).

4.5.2.1 Inspection routine (specification sheets 13 through 19). Sample units shall be subjected to the qualification inspection specified in table II in the order shown. All 18 sample units shall be subjected to the inspection of group I. Then the 18 sample units shall be divided into three subsets as specified in 20.1.1. Each subset shall be assigned to a group, either II, III, or IV of table II, and subjected to the inspection for that group then any two of these sample units or two new sample units (at the option of the manufacturer) shall be subjected to the salt spray (corrosion) test of group V. If the device being qualified is not UL labeled or recognized, six additional sample units (style to be specified by the qualifying activity) shall be subjected to the trip-free calibration of group V and the tests specified in group VI. At least one half the sample units shall be of the maximum current rating.

4.5.3 Failures. One or more failures shall be cause for refusal to grant qualification approval.

4.5.4 Retention of qualification.

4.5.4.1 Primary method. To retain qualification, the contractor shall forward a report at 36-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of:

a. A summary of the results of the tests performed for inspection of product for delivery (group A), indicating as a minimum the number of lots that have passed and the number that have failed, including the number and type of part failures. The results of tests of all reworked lots shall be identified and accounted for.
b. A summary of the results of inspection performed for retention of qualification, including the number and mode of failures. The summary shall include results of all retention of qualification inspection tests performed and completed during the 36-month period. The inspection shall consist of the examinations and tests specified in table II, in the order shown. If the summary of the test results indicates nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list (see 4.5.4.3)
c. Contractors using Underwriters (UL) for part of the retention of qualification tests (see table II, footnote 3) shall provide certification of current UL listing and an analysis of any discrepancy found during the UL follow-up service program affecting quality of product, or changes in design, construction, or materials.

Failure to submit the report within 30 days after the end of each 36-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 36-month period that the inspection data indicates failure of the qualified product to meet the requirements of this 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 during two consecutive reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit a representative product of the highest and lowest current rating covered by each major design set to testing in accordance with the qualification inspection requirements.

4.5.4.1.1 Retention of qualification sampling plan. Eighteen sample units representing each major design set shall be selected from inspection lots which have passed group A inspection. Sample units shall be representative, as far as production permits, of all combinations of poles, and tripping time delays, mounting styles (see specification sheets 20 through 22) with and without auxiliary contacts. Unless otherwise specified (see footnote 3, table II), the 18-sample units shall be composed of six groups of three each. Each 3-unit group shall be composed of circuit breakers specified by and assigned a sample group number by the qualifying activity. All sample groups shall receive group I inspection of table II. Then sample groups 1, 2, 3, and 4 shall be subjected to groups II, III, IV, and V inspections, respectively. Sample groups 5 and 6 shall be subjected to group VI inspection. If there is no production of circuit breakers covered by a major design set within a 36-month period, the qualifying activity shall be notified and the sample units for the retention of qualification inspection shall be selected and tested from the first production thereafter.

4.5.4.1.2 Failures. If one or more sample units fail to pass retention of qualification inspection, the sample shall be considered to have failed.

4.5.4.1.3 Disposition of sample units. Sample units which have been subjected to group II, III, IV, V, or VI inspection shall not be delivered on the contract or order.

4.5.4.2 Optional retention method. To retain qualification of a major design set, the contractor shall at 1 year intervals, forward to the qualifying activity a brief analysis of quality conformance data for the entire product line (see 6.5.8).

a. As a minimum the analysis shall include:
   1. An estimate of the process average during the reporting interval for the product line plus upper and lower limits shall be calculated in accordance with MIL-HDBK-53 (Guide for Sampling Inspection).
   2. The number of lots presented for inspection, the number of failed lots and the disposition of each failed lot.
   3. A brief history of any production or failure problems in the reporting interval which caused a change in process or design to be considered.

b. The following conditions shall be met:
   1. Prior to the start of the first reporting interval, the contractor shall provide to the qualifying activity a specific definition of his product line in terms of the item identifying (part numbering) techniques which are applied to the items. Examples are as follows:
      (a) The part numbering system for all regular catalog items.
      (b) The major design set of military specification item which is included in the product line and for which qualification is to be retained.
      (c) The contractor's part numbering system for items with special performance or test requirements.
   2. Prior to the start of the reporting interval the contractor shall notify the qualifying activity that the optional retention method is to be used.

c. The following certifications, signed by a responsible official of management, are required:
   1. That the listed product(s) is still available from the listed plant, can be produced under the same conditions as originally qualified (i.e., same process, materials, construction, design, part numbers) and meets the requirements of the current issue of the specification. DD Form 1718, Certification of Qualified Products, shall be obtained from the qualifying activity and used for submission of this certification.

2. That the quality conformance sampling and inspection for the entire product line meets or exceeds the requirements of this specification.
3. That established UL listings (if any) have been maintained.

d. The qualifying activity has the option to require any or all of the tests of table II be performed at any time after the first 1 year interval when information is availabe to warrant such action.

4.5.4.3 Noncompliance. If a sample fails to pass retention of qualification inspection, the contractor shall take corrective action on the materials or processes, or both, as warranted, and on all units of product 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 product shall be discontinued until corrective action, acceptable to the Government has been taken. After the corrective action has been taken, retention of qualification inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the Government). Final acceptance shall be withheld until the retention of qualification inspection 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 Inspection of categories II and III breakers (items not covered by specification sheets). Inspection requirements for items not covered by specification sheets shall be performed by the contractor, after award of contract, and prior to production (see 6.2.2 and 6.2.3).

4.6.1 Category II circuit breakers. Additional tests to verify suitability of the variations from category I circuit breakers shall be as specified (see 6.2.2).

4.6.2 Category III circuit breakers. Unless otherwise specified (see 6.2.3), the inspection requirements shall be as specified in 4.5 through 4.5.2, inclusive.

4.7 Quality conformance inspection.

4.7.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A inspection.

4.7.1.1 Inspection lot. An inspection lot shall consist of all the circuit breakers covered by a single specification sheet produced under essentially the same conditions, and offered for inspection at one time. In addition, circuit breakers, similar in design and number of poles except for the presence of auxiliary contact terminals, may be combined to form a lot, provided that a proportional quantity of sample units with and without auxiliary contact terminals are incorporated into the sample.

4.7.1.2 Group A inspection. Group A inspection shall consist of the inspections specified in table III, in the order shown.

4.7.1.2.1 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 III. Major and minor defects shall be as defined in MIL-STD-105.

4.7.1.2.3 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out 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.

TABLE III. Group A inspection.

Inspection	Requirement paragraph	Test method paragraph	AQL (percent defective) max. acceptable	
			Major	Minor
Visual and mechanical inspections:				
Dimensions (2 sample units)	3.1, 3.5		1.0	4.0
Marking	3.26			
Workmanship	3.27			
Dielectric withstanding voltage	3.7	4.8.3	1.0	---
Insulation resistance	3.8	4.8.4		
Calibration (mounted in the vertical plane only)	3.9	4.8.5.2		

4.7.1.2.4 Disposition of sample units. Sample units which have passed all the group A inspection may be delivered on the contract or purchase order, if the lot is accepted and the sample units are still within specified electrical tolerances.

4.7.2 Inspection of packaging. Except when industrial packaging is specified, the sampling and inspection of the preservation and interior pack markings shall be in accordance with the group A and B quality conformance inspection requirements of MIL-P-116. The sampling and inspection of the packing and marking for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification and the marking requirements of MIL-STD-129. The inspection of industrial packaging shall be as specified in the contract or purchase order (see 6.2).

4.8 Methods of inspection and test.

4.8.1 Visual and mechanical inspection. Circuit breakers shall be examined to verify that dissimilar metals, design, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements. (See 3:1, 3.4 to 3.5.15 inclusive, 3. 26 through 3. 26.2 inclusive, and 3. 27.)

4.8.2 Solderability (see 3.6). Circuit breakers shall be tested in accordance with method 208 of MIL-STD-202. The following detail and exception shall apply:

a. Number of terminations to be tested - Six.
b. Examination of terminations - Method for evaluation of lugs and tabs shall apply.

4.8.3 Dielectric withstanding voltage (see 3.7). Circuit breakers shall be tested in accordance with method 301, MIL-STD-202. The following details shall apply:

a. Magnitude of test voltage - 1,000 volts (rms) plus twice the rated voltage of the circuit breaker, for points of application c 1, 2, and 3; 600 volts (rms), for points of application c 4 and 5.
Optional method - Use 120 percent of the test voltage above for 1 second with terminals not tied together.

b. Nature of potential - ac.

c. Points of application of test voltage:
   1. Between all main circuit breaker terminals tied together and ground (any exposed metal part except terminals, or if none, a metal mounting panel with the circuit breaker mounted thereon), with the circuit breaker main contacts in closed and open positions.
   2. Between all auxiliary contact terminals tied together and main circuit breaker terminals tied together with circuit breaker main contacts in closed and open positions.
   3. Between poles of multipole breakers with the line terminal of each pole tied to the corresponding load terminal of that pole, with circuit breaker main contacts in closed and open positions.
   4. Between all auxiliary contact terminals tied together and ground (any exposed metal part except terminals, or if none, a metal mounting panel with the circuit breaker mounted thereon), with the circuit breaker main contacts in closed and open positions.
   5. Between each open pair of auxiliary contact terminals, with circuit breaker main contacts in closed and open positions.

d. Measurement during test - Leakage current.

e. Examinations after test - Circuit breakers shall be examined for evidence of flashover, mechanical damage, arcing, and breakdown.

4.8.4 Insulation resistance (see 3.8). Circuit breakers shall be tested in accordance with method 302, MIL-STD-202. The following details shall apply:

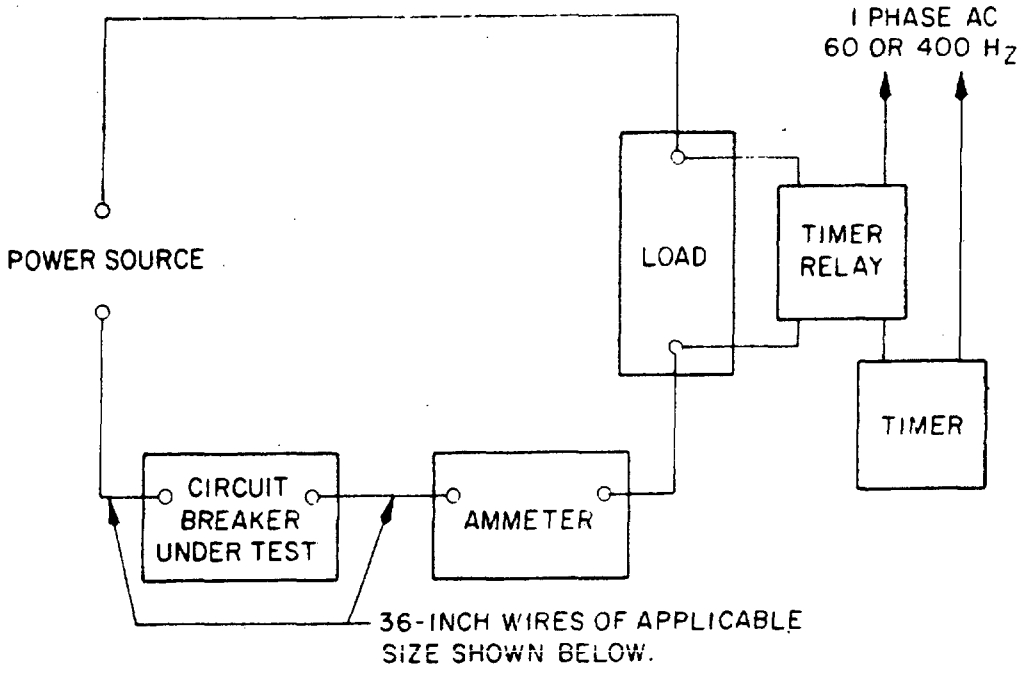
a. Test condition - B.

b. Point of measurement:
   1. Between all main circuit breaker terminals tied together or individually and ground (any exposed metal part except terminals, or if none, a metal mounting panel with the circuit breaker mounted thereon), with the circuit breaker main contacts in closed and open positions.
   2. Between all auxiliary contact terminals tied together or individually and main circuit breaker terminals tied together or individually with circuit breaker main contacts in closed and open positions.
   3. Between poles of multipole breakers with the line terminal of each pole tied to the corresponding load terminal of that pole or tested individually with circuit breaker main contacts in closed and open positions.
   4. Between all auxiliary contact terminals tied together or individually and ground (any exposed metal part except terminals, or if none, a metal mounting panel with the circuit breaker mounted thereon), with the circuit breaker main contacts in closed and open positions.
   5. Between each open pair of auxiliary contact terminals, with circuit breaker main contacts in closed and open positions.

4.8.5 Calibration (see 3.9).

4.8.5.1 Method I.

a. Circuit breakers shall be mounted in the normal vertical mounting position by their normal mounting means (see 3.5.5). Unless otherwise specified (see 3.1), the following shall apply: With leads and terminals (if required) attached in accordance with figure 1. Circuit breakers shall be subjected to the following percentages of applied rated current (ac or dc) (see 3.1) and tripping times noted with respect to specified values (125 or 150, see 3.1) and 200, 400, 600, and 800. Circuit breakers rated for high inrush (see 3.1) shall be subjected to a half wave of a 60 Hz waveform for 60 Hz devices and a half wave of 400 Hz waveform for dc and 400 Hz devices. The peak value of the half wave shall be as specified (see 3.1). Poles rated as voltage sensitive (see 3.1) shall be subjected to 80 percent of the minimum voltage ± 3 percent and 100 percent of the maximum voltage ± 3 percent for each frequency.



Circuit breaker capacity (amperes) 1/	Wire size (AN designation)	Uninsulated terminal lug (MS part no.) 2/	Insulated terminal lug (MS part no.) 2/
1 and below	20	MS20659 3/	MS25036 3/
2 to 6 incl	18	MS20659 3/	MS25036 3/
7 to 10 incl	16	MS20659 3/	MS25036 3/
11 to 15 incl	14	MS20659 3/	MS25036 3/
16 to 20 incl	12	MS20659 3/	MS25036 3/
21 to 25 incl	10	MS20659 3/	MS25036 3/
26 to 40 incl	8	MS20659 3/	MS25036 3/
41 to 55 incl	6	MS20659 3/	MS25036 3/
56 to 70 incl	4	MS20659 3/	MS25036 3/
71 to 80 incl	3	MS20659 3/	MS25036 3/
81 to 100 incl	2	MS20659 3/	MS25036 3/

1/ For circuit breakers between steps, use the AN wire of the next larger physical wire size.
2/ Test lead wires and terminals shall conform to MIL-W-5086 and MIL-T-7928, respectively.
3/ Use appropriate dash number for current rating and stud size."

FIGURE 1. Calibration-test circuit.

b. AC tests shall be conducted at the specified frequency (see 3.1). Normally, tests shall also be conducted within the rated operating voltage (see 3.5.12). However, if the inherent resistance or impedance of the circuit breaker precludes attaining the required percentage of overload current at the rated operating voltage to determine tripping times, the voltage shall be increased, as necessary, up to a maximum of 40 percent. If the specified overload current cannot be obtained with a maximum increase in voltage of 40 percent, tests of these particular overload levels shall be omitted. There shall be sufficient time (not less than 10 minutes) between each application to permit proper cooling of the circuit breaker. Each section of multipole breakers shall be subjected to the overload calibration current specified with remaining pole or poles passing no current.

4.8.5.2 Method II. Circuit breakers shall be tested as specified in 4.8.5.1, except that only 125 or 150, (see 3.1) and the 200 percent levels of rated current (see 3.1) shall be applied.

4.8.6 Resistance or impedance (see 3.10). With the circuit breakers mounted in their normal vertical mounting position the resistance or impedance shall be measured between main terminals of each pole at 100 percent rated current, and applicable frequency (see 3.1), using the voltmeter-ammeter method. These measurements shall be made and recorded after the circuit breaker has been subjected to these conditions for 1 hour. Auxiliary contact resistance shall be measured using the voltmeter-ammeter method with a 20 volt ac or dc source with limiting resistance to 1 ampere. Both the normally open and normally closed contacts shall be measured. The voltage sensitive poles shall be measured using the volt-ammeter method using a 20 volts minimum ac or dc source with limiting resistance to 100 milliamperes. All measurements herein shall comply with the requirements of 3.10.

4.8.7 Actuator (see 3.11).

4.8.7.1 Actuator strength (lever type). Circuit breakers shall have the specified load (see 3.1) applied to the tip of the actuator lever for 1 minute under each of the following conditions:

a. Normal to the lever axis in the plane of lever travel at each extreme position of the lever.
b. Normal to the lever axis and normal to the plane of lever travel at each extreme position of the lever.
c. Coaxial with the lever axis toward the lever pivot throughout the entire range of lever travel.
d. Coaxial with the lever axis away from the lever pivot throughout the entire range of lever travel.

Circuit breakers shall be examined for evidence of mechanical damage.

4.8.7.2 Actuator strength (push-pull type) (see 3.11.1). A specified force (see 3.1) shall be applied for 1 minute in each of the two directions of movement along the line of pushbutton travel. With the pushbutton in the fully extended position, a specified force (see 3.1) shall be applied at the extreme end for 1 minute in two mutually perpendicular directions, each normal to the line of pushbutton travel. Circuit breakers shall then be examined for evidence of mechanical damage.

4.8.7.3 Actuator operating force (lever type) (see 3.11.2). The force necessary to operate the actuator, shall be applied in both directions at the tip of the lever. The force shall be applied normally to the lever axis and in the plane of lever travel. The magnitude of the operating forces shall be measured to determine compliance with 3.11.2.

4.8.8 High- and low-temperature operation (see 3.12) (when specified (see 3.1)). Circuit breakers shall be conditioned for 2 hours at -40° ±2°C at which temperature the calibration test shall be performed in accordance with 4.8.5.1 plus an additional test at the 100-percent level. During these tests the auxiliary contacts shall be monitored for proper operation. While still maintained at the -40°C low temperature extreme, the insulation resistance test shall be performed in accordance with 4.8.4. Circuit breakers shall then be conditioned for 2 hours at 85° ±2°C at which temperature the calibration test shall be performed in accordance with 4.8.5.2, plus an additional test at the 100-percent level. During these tests the auxiliary contacts shall be monitored for proper operation. While still maintained at the 85°C high temperature extreme, the dielectric withstanding voltage and insulation resistance tests shall be performed in accordance with 4.8.3 and 4.8.4, respectively. Circuit breakers shall be examined for evidence of mechanical damage.

4.8.9 Endurance (see 3.13). Unless otherwise specified (see 3.1), circuit breakers shall be subjected to 10,000 mechanically performed make and break operations; (6,000 operations with the circuit breaker energized at rated current, voltage, and frequency (see 3.1) and 4,000 operations without power), at a rate not to exceed six operations per minute. Half of the sample units shall be tested with the specified inductive load and half with the specified resistive load (see 4.8.9.1). Each pole of multipole breakers shall be simultaneously subjected to the required load. (Voltage sensitive poles (see 3.1) shall be subjected to 33 electrical operations at the maximum operating voltage for each frequency). The rate of operation shall not exceed one operation per minute. Wiring connections shall be in accordance with figure 2. When applicable, the auxiliary contacts shall also make and break the maximum rated 60 Hz voltage and current (see 3.1). Except for voltage sensitive poles, an operating cycle is defined as the mechanical closing and opening of the breaker, and the ratio of "on" time to "off" time shall be less than 1 to 5. The mechanical operation shall simulate manual operation of the breaker, including overtravel, if any (see 6.5.4). All metal parts of the circuit breaker outside the normal mounting panel shall be connected through a circuit breaker or a normal slow blow fuse as shown on figure 2. Their rating shall be 5 percent of the test load or 100 mA, whichever is greater. Where the polarity of the breaker is not specified, the power source shall be connected to one side of the breaker for half of the operations and to the other side of the breaker for the remaining operations. The grounding fuse of circuit breaker shall be observed during the test to determine if failure occurs prior to conclusion of the test. Circuit breakers shall be examined for evidence of mechanical damage or loosening of parts. Following the test, circuit breakers shall be subjected to the following tests:

a. Dielectric withstanding voltage (see 4.8.3).
b. Insulation resistance (see 4.8.4).
c. Calibration (see 4.8.5.2).
d. Resistance or impedance (see 4.8.6).

4.8.9.1 Loads. For ac inductive loads, the power factor shall be 0.75 to 0.80. For ac resistive loads, the power factor shall be between 0.90 and unity. For dc inductive loads, the time constant (L/R ratio) shall be 0.02 to 0.03.

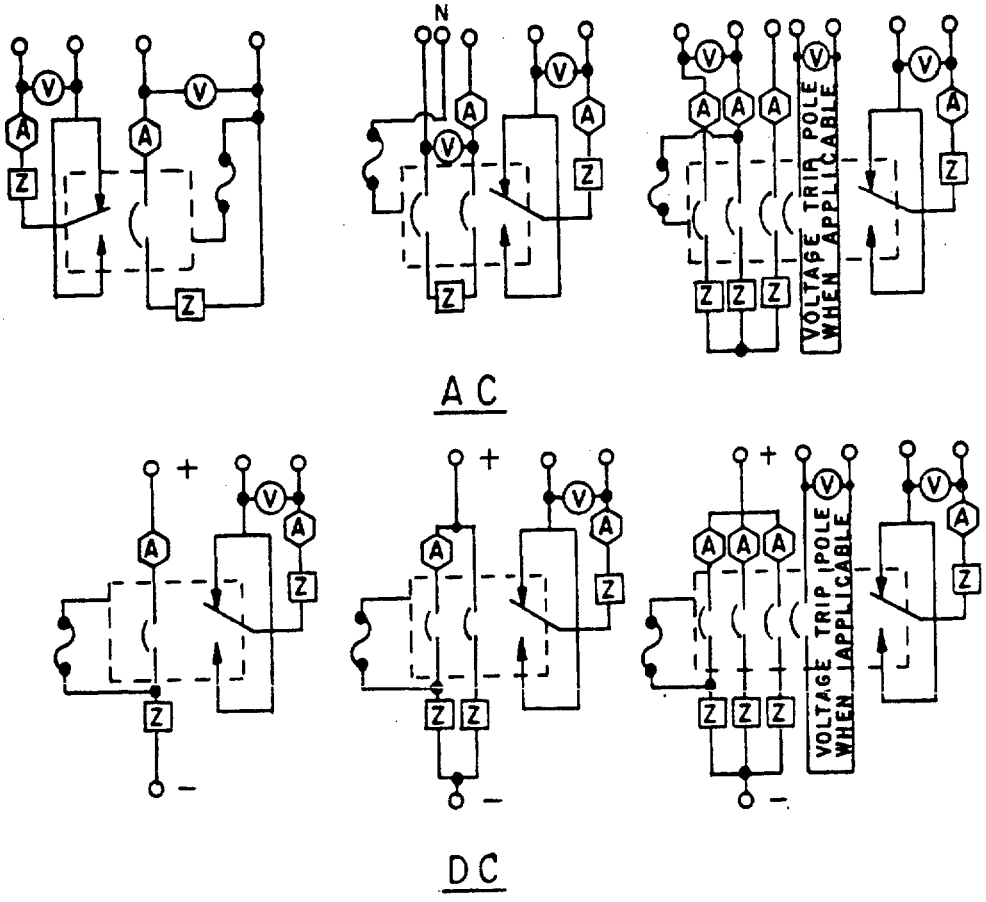


FIGURE 2. DC endurance circuit wiring diagrams.

4.8.10 Terminal strength (see 3.14). Circuit breakers shall be tested in accordance with method 211, MIL-STD-202. The following details and exceptions shall apply:

a. Other than screw-type terminals - Test condition A.
   1. Applied force - As specified (see 3.1). Two pounds for auxiliary terminals.
   2. Direction of applied force - Perpendicular to the mounting plate or mounting surface.
b. Screw-type terminals only - Test condition E.
   1. Applied torque - See table IV to each terminal.
c. Examinations after test - To verify compliance with 3.14.

TABLE IV. Terminal strength.

Screw size	Pull (lbs)	Torque (lbs-in)
8	25	15
10	30	22
1/4	30	35
5/16	70	80

4.8.11 Mounting strength (see 3.15). The axial load specified in table V shall be applied to the mounting means for a period of 1 minute, using hardened steel screws. The torque specified in table V shall then be applied to the screw head about the thread axis for 1 minute without damage to the mounting means. For single hole mounted circuit breakers, this test shall be conducted with the mounting nut assembled on the threaded bushing of the breaker. The torque for bushing-mounted circuit breakers shall be 25 pound-inches.

TABLE V. Mounting strength.

Screw size	Axial loads (lbs)	Torque (lbs-in)
6	30	10
8	35	20

4.8.12 Vibration (see 3.16). Circuit breakers shall be tested in accordance with method 204 of MIL-STD-202. The following details and exception shall apply:

a. Tests and measurements prior to vibration - Not applicable.
b. Test condition - A.
c. Mounting method - Normal mounting means.
d. Electrical-load conditions - Half of the circuit breakers shall be tested with the main contacts closed, while energized at 100 percent rated current and at the applicable frequency (see 3.1). The other half of the circuit breakers shall be tested with the main contacts open and unenergized.
e. Measurements during vibration - Each circuit breaker shall be monitored to determine opening or closing of contacts in the "on" and "off" position.
f. Examination after vibration - Circuit breakers shall be examined for evidence of mechanical and electrical damage.

4.8.13 Moisture resistance (see 3.17). Circuit breakers shall be tested in accordance with method 106, MIL-STD-202. The following details and exceptions shall apply:

a. Mounting - Mounted horizontally on a panel.
b. Initial measurements - Immediately following the initial drying period, resistance or impedance shall be measured as specified in 4.8.6.
c. Electrical-load conditions - During the first 2 hours of steps 1 and 4, circuit breakers shall be energized at rated current, and at the applicable frequency (see 3.1).
d. Steps 7a and 7b are not applicable.
e. Final measurements - Upon completion of the 10th cycle and while still in the humidity chamber, insulation resistance and resistance or impedance shall be measured as specified in 4.8.4 and 4.8.6, respectively. After the 24-hour drying period, insulation resistance shall again be measured as specified in 4.8.4.
f. Examination after test - Examine for evidence of breaking, cracking, spalling or loosening of terminals.
g. Tests after moisture resistance test - Circuit breakers shall be subjected to the following tests:
   1. Dielectric withstanding voltage (see 4.8.3).
   2. Calibration (see 4.8.5.1) (except that tests at 400, 600, 800 percent at rated current shall not be performed).

4.8.14 Thermal shock (see 3.18). Circuit breakers shall be tested in accordance with method 107, MIL-STD-202. The following details shall apply:

a. Mounting - Normal mounting means with at least 1 inch of free air space around each circuit breaker.
b. Test condition - A.
c. Examination after cycling - Circuit breakers shall be examined for evidence of mechanical damage.

4.8.15 Shock (see 3.19). Circuit breakers shall be tested in accordance with method 213, MIL-STD-202. The following details shall apply:

a. Mounting method - Normal mounting means.
b. Test condition - I (unless otherwise specified (see 3.1)).
c. Electrical-load conditions and measurements - Of the three shocks in each direction required, two shocks shall be performed with the circuit breaker energized at 100 percent rated current, and at the applicable frequency (see 3.1), except that for the directions with the operating lever pivot up (table mount) and the operating lever pivot down (ceiling mount), no voltage or current shall be applied. Each energized shock shall be monitored to determine opening of the main and, when applicable, auxiliary contacts. The remaining shock in each direction shall be performed with the circuit breaker contacts open and unenergized and shall be monitored to determine closing of the main and, when applicable, of the open auxiliary contacts.
d. Examination after shock - Circuit breakers shall be examined for evidence of mechanical and electrical damage.

4.8.16 Trip-free calibration (see 3.20). The circuit breaker actuator shall be physically held in the closed position and the breaker subjected to the calibration tests in accordance with 3.9 and 4.8.5.2.

4.8.17 Salt spray (corrosion) (see 3.21). Circuit breakers shall be tested in accordance with method 101, MIL-STD-202. The following details shall apply:

a. Test condition - B.
b. Examination after exposure - Applicable hardware shall be removed at the conclusion of the test. Circuit breakers shall be examined for corrosion or evidence of mechanical and electrical damage.
c. Tests after salt spray test - None.

4.8.18 Explosion (see 3.22) (when specified). Circuit breakers shall be tested in accordance with method 109, MIL-STD-202. The following details shall apply:

a. Mounting method - Normal mounting means.
b. Electrical loading - Rated load as specified (see 3.1).

All sample units may be tested together in the explosion chamber.

4.8.19 Temperature rise (see 3.23). One hundred percent rated current (see 3.1) shall be applied to circuit breakers for 1 hour. Circuit breakers shall not trip and the temperature rise of the terminals shall be determined by using a thermocouple with a 0.0100-inch diameter (No. 30 AWG) or smaller wire. The thermocouple shall be cemented to the terminals using minimum quantity of cement.

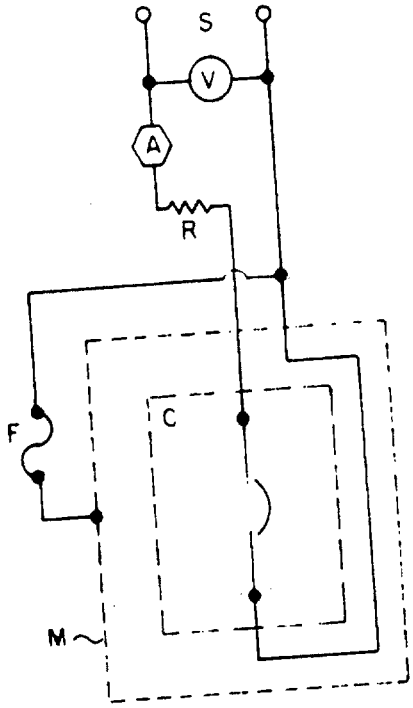
4.8.20 Interrupting capacity (see 3.24). Circuit breakers shall be connected to the power source with leads consisting of insulated wires of the size corresponding to the current rating of the circuit breaker; leads are not to be more than 4 feet in length. The applicable rupture current specified (see 3.1) at the corresponding open-circuit voltage and frequency specified shall be measured at the power source with the circuit breaker and its test leads replaced by temporary connections having negligible impedance compared to the test circuit. The test leads and terminals shall be as specified on figure 1.

For ac operation, unless otherwise specified (see 3.1), the circuit breakers shall be tested with essentially a resistive load. Single pole breakers shall be subjected to three operations (duty cycle) as shown on figure 3. The operation for multipole circuit breakers shall follow the pattern of operation as shown for two pole and three pole circuit breakers on figures 4 and 5, respectively.

For dc operation, the circuit breakers shall be tested with direct current using a test circuit having a resistive load. The circuit and operations (duty cycle) of the tests shall be as shown on figures 6, 7, and 8, respectively.

During interrupting capacity tests, after each operation, the open-circuit voltage specified shall be maintained across the breaker for a minimum of 5 seconds. There shall be sufficient time between each operation (not less than 10 minutes) to permit proper cooling of the circuit breaker. Circuit breakers that are not capable of being mechanically reset within 10 minutes shall be rejected. The 30 ampere fuse connected to the mounting plate shall not be ruptured during the tests. When applicable (see 3.1), a suitable method shall be employed to test the auxiliary contacts (see 3.5.8.2). The circuit breakers shall be observed for automatic tripping and satisfactory operation of the auxiliary contacts. Following the last operation (of the duty cycle) circuit breakers shall be subjected to the following tests:

a. Dielectric withstanding voltage (see 4.8.3).
b. Calibration at 200 percent rated current (see 4.8.5.2).
c. Resistance or impedance, main contacts only (see 4.8.6).



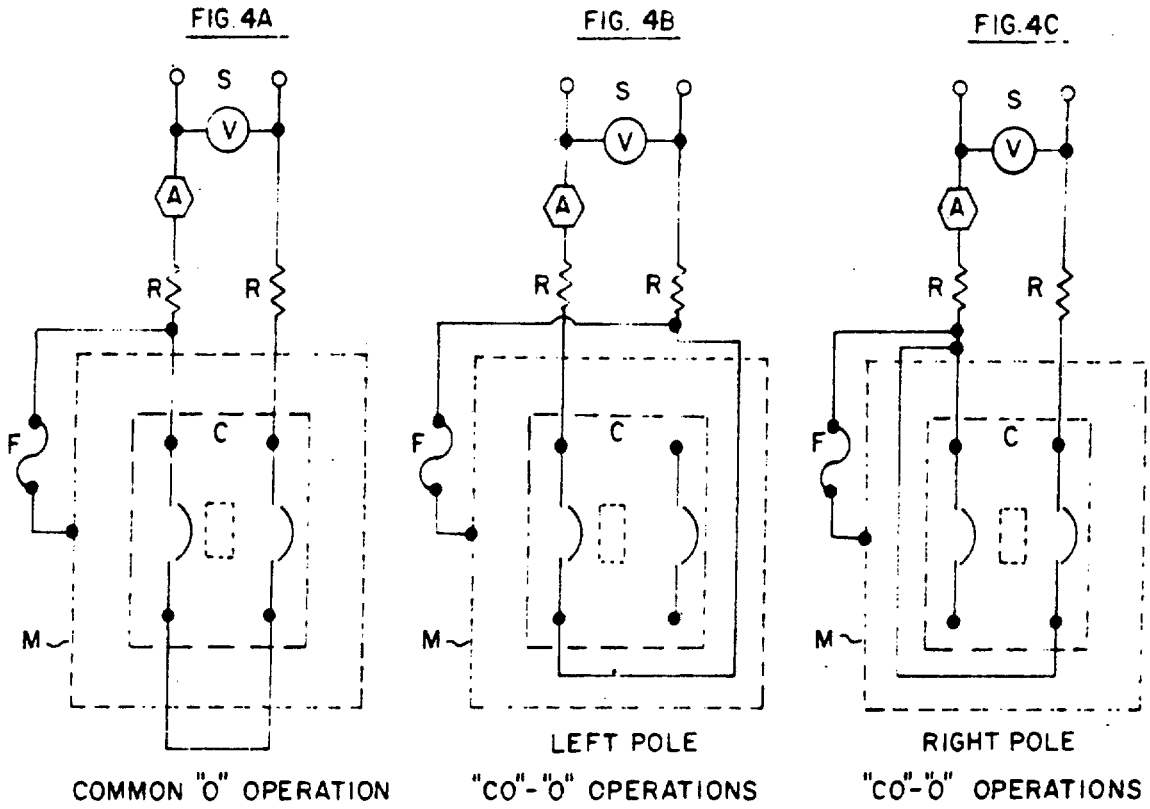
LEGEND

S - SUPPLY
V - VOLTMETER
A - RECORDING CURRENT ELEMENT
R - RESISTORS LIMITING CURRENT TO SPECIFIED VALUES
C - TEST CIRCUIT BREAKER
M - MOUNTING PLATE
F - 30 AMPERE FUSE

"O"-"CO"-"O" OPERATIONS
1-POLE CIRCUIT BREAKER TEST

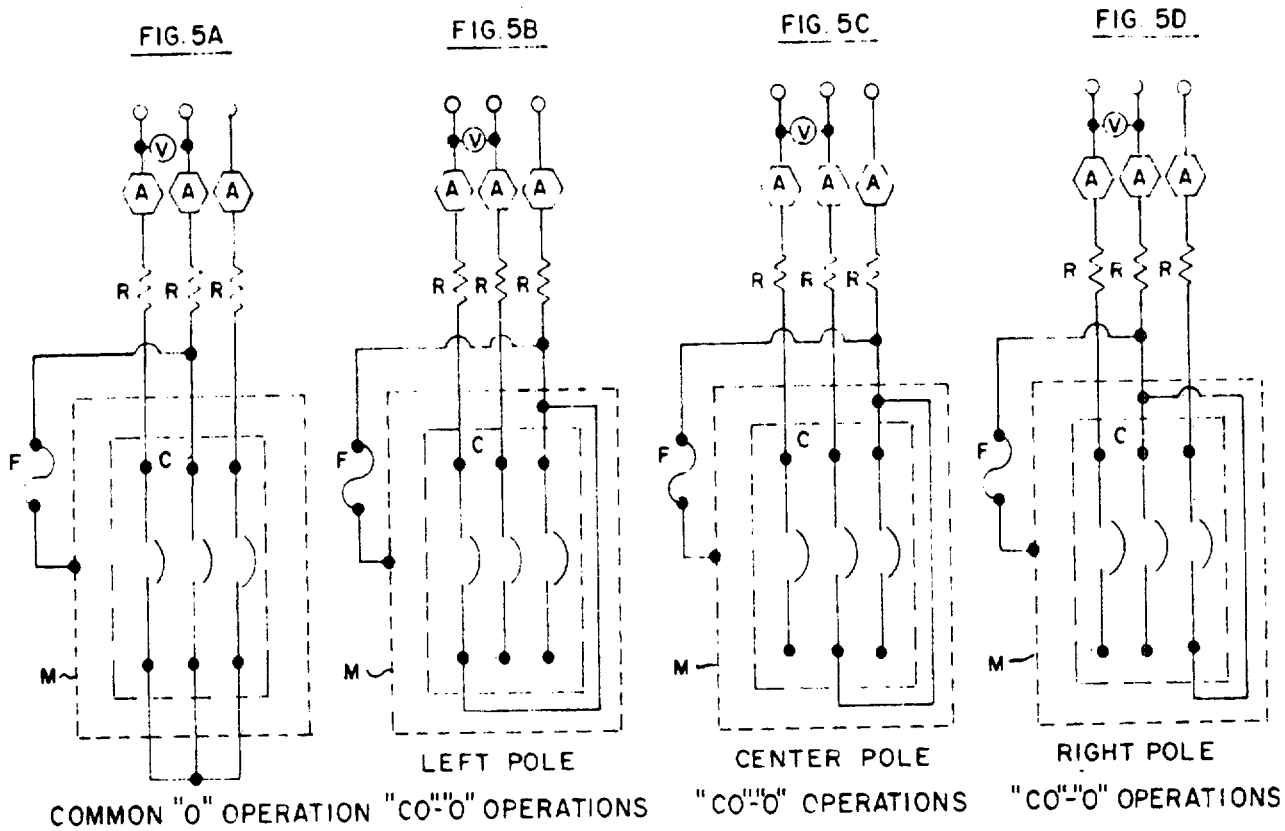
NOTES:
1. "O" - Circuit breaker is closed, then fault initiated.
2. "CO" - Circuit breaker closed into existing fault.
3. Interrupting current shall be measured by a current transformer or shunt "A" and suitable recording oscillograph. The voltage across the breaker shall be recorded simultaneously with rupture current. (Not shown)
4. For test circuit calibration see 4.8.20.

FIGURE 3. AC interrupting capacity test operations (duty cycle) and circuit wiring.



NOTE: See figure 3 for legend and notes.

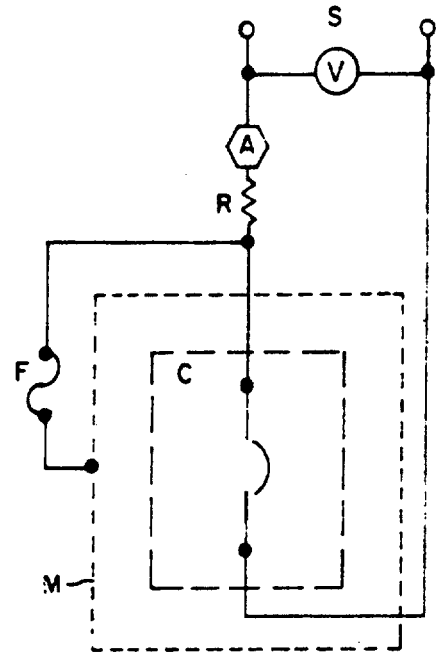
FIGURE 4. AC interrupting capacity test operations (duty cycle) and circuit wiring.



3 - POLE CIRCUIT BREAKER TEST

NOTE: See figure 3 for legend and notes.

FIGURE 5. AC interrupting capacity test operations (duty cycle) and circuit wiring.

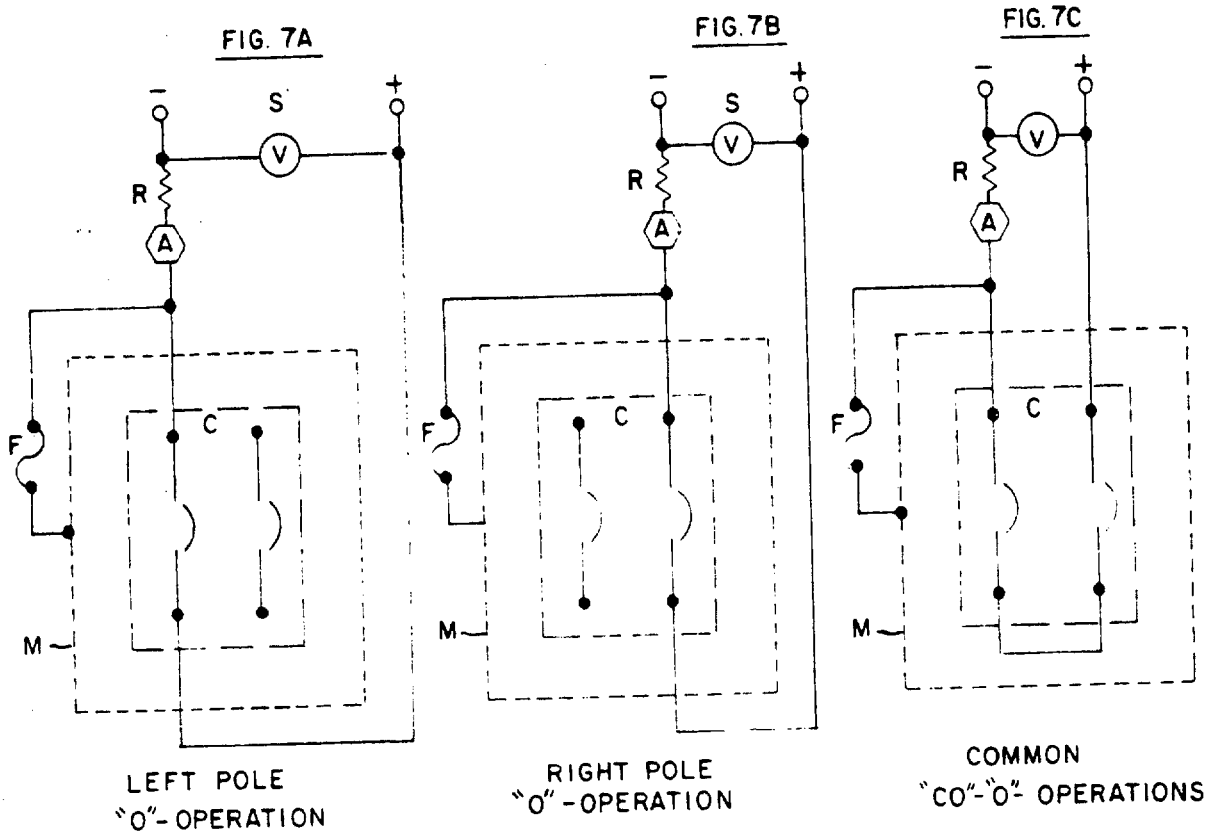


"O"-"CO"-"O" OPERATIONS

1-POLE CIRCUIT BREAKER TEST

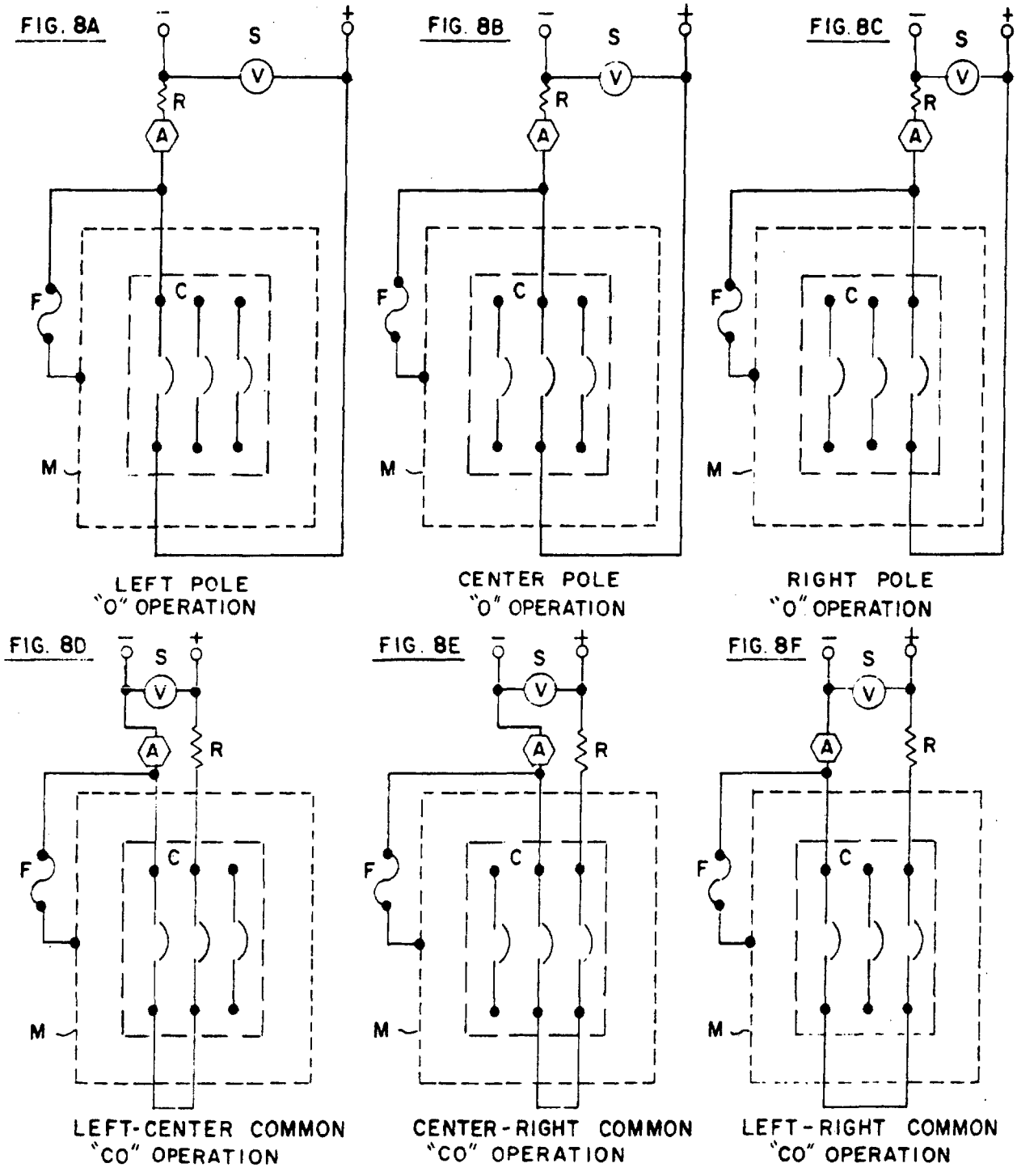
NOTE: See figure 3 for legend and notes.

FIGURE 6. DC interrupting capacity test operations (duty cycle) and circuit wiring.



NOTE: See figure 3 for legend and notes.

FIGURE 7. DC interrupting capacity test operations (duty cycle) and circuit wiring.



NOTE: See figure 3 for legend and notes.

FIGURE 8. DC interrupting capacity test operations (duty cycle) and circuit wiring.

4.8.21 Panel seal (see 3.25) (when specified, see 3.1). Circuit breakers shall be secured by their normal mounting means to a suitable test jig. A suggested test jig is shown on figure 9. The test jig shall be immersed in a water-filled glass container containing a wetting agent, with the circuit breaker completely submerged. An air pressure of 15 pounds per square inch gage shall be applied to the test jig for approximately ½ hour. The circuit breaker and connection to the test jig shall be observed for any visible air bubbles indicative of leakage, either in the form of a continuous stream, or as bubbles emanating at regular intervals. The test shall then be repeated by applying air pressure in the opposite direction by reversing the cover.

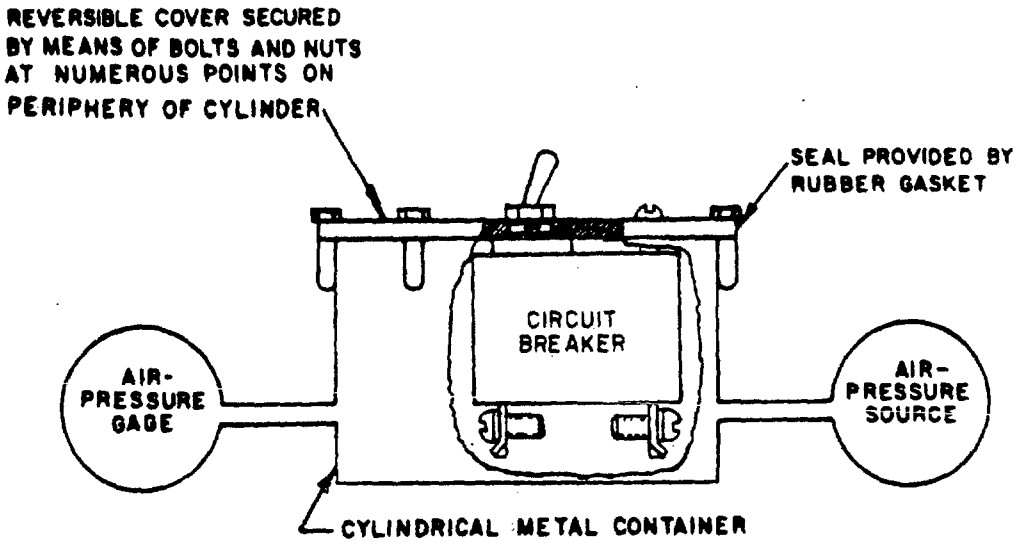


FIGURE 9. Suggested test jig for panel-seal test.

5. PACKAGING

5.1 Preservation. Preservation shall be level A or C, or as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Circuit breakers shall be cleaned in accordance with MIL-P-116, process C-1.

5.1.1.2 Drying. Circuit breakers shall be dried in accordance with MIL-P-116.

5.1.1.3 Preservation application. Preservatives shall not be used.

5.1.1.4 Unit packs. Unless otherwise specified (see 6.2), each circuit breaker shall be individually unit packed in accordance with MIL-P-116, submethod IA-8 insuring compliance with the applicable requirements of that specification. Each circuit breaker shall be placed in a supplementary container conforming to PPP-B-566 or PPP-B-676.

5.1.1.5 Intermediate packaging. Not required.

5.1.2 Level C. The level C preservation for circuit breakers shall conform to the requirements of MIL-STD-794.

5.2 Packing. Packing shall be level A, B, or C, or as specified (see 6.2).

5.2.1 Level A. The packaged circuit breakers shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistance, style optional, special requirements. In lieu of the closure and waterproofing requirement in the appendix of PPP-B-636, closure and waterproofing shall be accomplished by sealing all seams, corners, and manufacturer's joint with tape, 2 inches minimum width, conforming to PPP-T-60, class 1 or PPP-T-76. Banding (reinforcement requirements) shall be applied in accordance with the appendix to PPP-B-636 using nonmetallic or tape banding only.

5.2.2 Level B. The packaged circuit breakers shall be packed in fiberboard containers conforming to PPP-B-636, class domestic, style optional, special requirements. Closures shall be in accordance with the appendix thereto.

5.2.3 Level C. The level C packing for circuit breakers shall conform to the requirements of MIL-STD-794.

5.2.4 Unitized loads. Unitized loads, commensurate with the level of packing specified in the contract or order, shall be used whenever total qualtities for shipment to one destination equal 40 cubic feet or more. Quantities less than 40 cubic feet need not be unitized. Unitized loads shall be uniform in size and quantities to the greatest extent practicable.

5.2.4.1 Level A. Circuit breakers, packed as specified in 5.2.1, shall be unitized on pallets in conformance with MIL-STD-147, load type I, with a fiberboard cap (storage aid 4) positioned over the load.

5.2.4.2 Level B. Circuit breakers, packed as specified in 5.2.2, shall be unitized as specified in 5.2.4.1, except that the fiberboard caps shall be class domestic.

5.2.4.3 Level C. Circuit breakers, packed as specified in 5.2.3, shall be unitized as specified in MIL-STD-794.

5.3 Marking. In addition to any special or additional identification marking required by the contract or purchase order (see 6.2), each unit pack, supplementary and exterior containers, and unitized load shall be marked in accordance with MIL-STD-129.

5.4 General.

5.4.1 Exterior containers. Exterior containers (see 5.2.1, 5.2.2, and 5.2.3) shall be of a minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent practicable.

5.4.2 Packaging inspection. The inspection of these packaging requirements shall be in accordance with 4.7.2.

5.4.3 Army procurements.

5.4.3.1 Level A unit packs. MIL-P-116 submethod IC-1 shall be used in lieu of submethod IA-8. Supplementary containers shall either be overwrapped with waterproof barrier materials or conform to PPP-B-566 or PPP-B-676, variety (see 5.1.1.4 and 6.2).

5.4.3.2 Level A and B packing. For level A packing the fiberboard containers shall not be banded but shall be placed in a close fitting box conforming to PPP-B-601, overseas type; PPP-B-621, class 2 style 4 or PPP-B-585, class 3, style 2 or 3. Closure and strapping shall be in accordance with applicable container specification except that metal strapping shall conform to QQ-S-781, type I finish A. When the gross weight exceeds 200 pounds or the container length and width is 48 x 24 inches or more and the weight exceeds 100 pounds, 3 x 4 inch skids (laid flat) shall be applied in accordance with the requirements of the container specification. If not described in the container specification, the skids shall be applied in a manner which will adequately support the item and facilitate the use of material handling equipment. For level B packing, fiberboard boxes shall be weather resistant as specified in level A and the containers shall be banded (see 5.2.1 and 5.2.2).

5.4.3.3 Level A and B unitization. For level A and B unitization, softwood pallets conforming to NN-P-71, type IV, size 2 shall be used. Weather resistant fiberboard caps shall also be used for level B unitization. The loads for both levels shall be bonded to the pallets by strapping conforming to QQ-S-781, type I, finish A or shrink film (see 5.2.4.1 and 5.2.4.2).

5.4.3.4 Industrial packaging. Industrial packaging (including preservation, packing, and marking) shall be in accordance with MIL-STD-1188.

6. NOTES

6.1 Intended use. Circuit breakers covered by specification sheets 1 through 12 and 20 through 22 are intended primarily for use in the protection of electronic circuits, and should be used where moderate but unprolonged starting overloads may be expected and where the optional speed of response provided can be matched to the characteristics of the equipment to be protected. These circuit breakers should not be used in circuits, such as primary power circuits of electric systems, whose rupture current potential is greater than the interrupting capacity of the breaker, unless the circuit is properly protected by other means. Circuit breakers covered by specification sheets 13 through 19 are physically larger than the other breakers covered by this specification; however, they offer higher current ratings and interrupt capacities, and may be used in primary power circuits providing their interrupting capacity is not exceeded. Many of the specification sheets now include high-inrush features that provide tolerance for short duration of high inrush or transient currents without decreasing steady-state protection.

6.2 Ordering data. Procurement documents should specify the following:

6.2.1 Category I circuit breakers (items covered by specification sheets, see 3.2.1).

a. Title, number, and date of this specification.
b. Title, number, and date of the applicable specification sheet, and the part number.
c. Inspection of industrial packaging (see 4.7.2).
d. Levels of preservation and packing required (see 5.1 and 5.2).
e. Method of preservation, if other than submethod IA-8 (see 5.1.1.4 and 5.4.3.1).
f. Special or additional identification marking is required, as applicable (see 5.3).

6.2.2 Category II circuit breakers (qualified circuit breakers with modification, see 3.2.2).

a. Title, number, and date of this specification.
b. Title, number, and date of applicable specification sheet for similar circuit breaker.
c. Military part number of similar qualified circuit breaker.
d. Manufacturer's part number of modified circuit breaker.
e. Details of the variations from the specification sheet.
f. Inspection requirements (to verify variations from category I circuit breakers) (see 4.6):
   1. Tests to be performed (if any).
   2. The laboratory at which inspection is to be performed.
   3. Samples and submission of data, if other than that specified.
g. Inspection of industrial packaging (see 4.7.2).
h. Levels of preservation and packing required (see 5.1 and 5.2).
i. Method of preservation, if other than submethod IA-8 (see 5.1.1.4 and 5.4.3.1).
j. Special or additional identification marking is required, as applicable (see 5.3).

NOTE: A copy of the drawing furnished to cover the description of the variations from the specification sheet, should be sent to the preparing activity as listed on the individual specification sheet.

6.2.3 Category III circuit breakers (items not covered by specification sheets, see 3.2.3). For circuit breakers not covered by specification sheets, the procurement document should specify the following:

a. Title, number, and date of this specification.
b. Design, construction, physical dimensions, and tolerances (see 3.5).
c. Tripping-time delay and tripping time (see 3.5.3, 3.5.1, and 3.9).
d. Actuator type (see 3.5.4).
e. Mounting means (type, size, quantity and physical dimensions) (see 3.5.5).
f. Terminal and mounting hardware, as applicable (see 3.5.6).
g. Line and load terminals (design, mounting, location, and quantity). Location of line terminal in relation to the actuator for toggle-lever types (see 3.5.8.1).
h. Auxiliary contact terminals (design, location, and quantity (see 3.5.8.2).
i. Solder terminal shape, if required (see 3.5.8.3).
j. Maximum voltage rating and frequency (see 3.5.12).
k. Continuous current carrying capacity (see 3.5.13).
l. Circuit diagram (see 3.5.14).
m. Panel cutout dimensions. Boot type, if panel sealing is required (see 3.5.15).
n. Resistance or impedance values (see 3.10).
o. Actuator strength (see 3.11.1).
p. Actuator operating force (see 3.11.2).
q. High and low temperature (see 3.12).
r. Calibration test requirements if other than specified in 4.8.5.
s. Endurance (number of operations if other than 10,000 at a rate not exceeding six operations per minute) (see 4.8.9).
t. Terminal strength (see 4.8.10).
u. Shock (test condition letter if other than I (sawtooth, 100 G's, 6 ms) (see 4.8.15).
v. Interrupting capacity rating at specified voltage and frequency (see 4.8.20).
w. Inspection of industrial packaging (see 4.7.2).
x. Levels of preservation and packing required (see 5.1 and 5.2).
y. Method of preservation, of other than submethod IA-8 (see 5.1.1.4 and 5.4.3.1).
z. Special or additional identification marking required, as applicable (see 5.3).

6.3 Qualifications. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable qualified products list whether or not such products have actually been so listed by the date. The attention of the contractor is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the U.S. Army Electronics Research and Development Command, Fort Monmouth, N J 07703; however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center, Dayton, Ohio 45444 (attention DESC-EQ).

6.3.1 Copies of SD-6, "Provisions Governing Qualificaiton" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

6.4 Intermetallic contact. The finishing of metallic areas to be placed in intimate contact by assembly presents a special problem, since intermetallic contact of dissimilar metals results in electrolytic couples that promote corrosion through galvanic action. To provide the required corrosion protection, intermetallic couples are restricted to those permitted by table VI. Table VI shows metals and alloys (or plates) by groups that have common electromotive forces (EMF) within 0.05 volt when coupled with a saturated calomel electrode in sea-water at room ambient temperatures. All members of a group are considered as completely compatible, one with the other. Compatible couples between groups have been specified in table VI based on a potential difference of 0.25 volt maximum. To simplify any arithmetic involed, table VI shows, in addition to EMF against a calomel electrode, a derived "anodic index" with group 1 (gold, etc) as "0" and group 18 (magnesium, etc.) as 175. Subtraction of a lower group anodic index gives the EMF difference in hundredths of a volt.

6.4.1 Groups. Table VI sets up 18 primary groups. It may be noted that neither the metallurgical similarity or dissimilarity of metals is the parameter for selection of compatible couples. All members within a group, regardless of metallurgical similarity, are considered inherently nonsusceptible to galvanic action when coupled with any member within the group; for example, such dissimilar metals as platinum and gold. Similarly, such basically dissimilar alloys as austenitic stainless steel, silver-solder, and low brass (all members of group 5) are inherently nonsusceptible when coupled together.

6.4.2 Compatibility graphs. Permissible couple series are shown in table VI by the graphs at the right. Members of groups connected by lines will form permissible couples. A "O" indicates the most cathodic member of each series, a "●" an anodic member, and the arrow indicates the anodic direction.

6.4.3 Selection of compatible couples. Proper selection of metals in the design of equipment will result in fewer intermetallic contact problems. For example, for sheletered exposure, neither silver nor tin require protective finishes. However, since silver has an anodic index of 15 and tin 65, the EMF generated as a couple is 0.50 volt, which is not allowable by table VI. In this case, other metals or plates will be required. It should be noted that in intermetallic couples, the member with the higher anodic index is anodic to the member with the lower anodic index and will be susceptible to corrosion in the presence of an electrolytic medium. If the surface area of the cathodic part is significantly greater than that of the anodic part, the corrosive attach on the contact area of the anodic part may be greatly intensified. Material selection for intermetallic contact parts therefore, should establish the smaller part as the cathodic member of the couple, whenever practicable.

6.4.4 Plating. When base metals intended for intermetallic contact form couples not allowed by table VI, they are to be plated with those metals that will reduce the potential difference to that allowed by table VI.

6.5 Definitions.

6.5.1 Auxiliary contacts (see 1.1 and 3.5.8.2). Auxiliary contacts are those mechanically interlocked with and operated by the main contacts of the circuit breaker, and intended for use in monitoring circuits for signaling, electrical interlocking or other purposes.

6.5.2 Line terminal (see 3.5.8.1). The terminal attached to the isolated stationary main contact of the circuit breaker with the breaker in the open or tripped position is considered the line terminal. If both main contacts of a circuit are isolated, only one terminal is to be designated the line terminal.

6.5.3 Multipole circuit breaker (see 3.5.4). A multipole circuit breaker has two or more poles controlled by a single actuating member.

6.5.4 Overtravel (see 4.8.9). Overtravel is the distance between the normal operating "on" and "off" positions of the actuating lever and the extreme positions to which the lever may be moved in either direction.

6.5.5 Tripping time delay (see 3.5.3) Tripping time delay is the delay factor purposely designed into the tripping time of a circuit breaker.

6.5.6 Tripping time (see 3.9). Tripping time is the total interval of elapsed time from the instant of applying a given overcurrent to the circuit breaker to the completion of the interruption of the circuit.

6.5.7 Major design set. Limited to a basic circuit breaker design. Three major design sets are herein represented by specification sheets as follows:

a. 1 through 6
b. 7 through 12 and 20 through 22 (when the electrical operating mechanisms are identical).
c. 13 through 19

6.5.8 Product line. A product line consists of all units of a type, series, style, or family of items.

6.6 Warning. Potentially hazardous situations are inherent in some of the test procedures specified in this specification. Precautions should therefore be taken to insure that test personnel are adequately protected and observe the necessary safety measures at all times.

6.7 High-inrush feature. This feature, also referred to as inertial delay or transient suppression, allows the breaker to pass short duration current pulses without nuisance tripping. The amplitude of these pulses may be many times the rated current of the circuit breaker.

TABLE VI. Compatible couples (see 6.4) 1/

Group No.	Metallurgical category	EMF (volt)	Anodic index (0.01 v)	Compatible couples
1	Gold, solid and plated; gold-platinum alloys; wrought platinum (most cathodic)	+ 0.15	0	
2	Rhodium plated on silver-plated copper	+ 0.05	10	
3	Silver, solid or plated; high silver alloys	0	15	
4	Nickel, solid or plated; monel metal, high nickel-copper alloys	- 0.15	30	
5	Copper, solid or plated; low brasses or bronzes; silver solder; German silver; high copper-nickel alloys; nickel-chromium alloys; austenitic corrosion-resistant steels	- 0.20	35	
6	Commercial yellow brasses and bronzes	- 0.25	40	
7	High brasses and bronzes; naval brass; Muntz metal	- 0.30	45	
8	18 percent chromium type corrosion-resistant steels	- 0.35	50	
9	Chromium, plated; tin, plated; 12 percent chromium type corrosion-resistant steels	- 0.45	60	
10	Tin-plate; terneplate; tin-lead solder	- 0.50	65	
11	Lead, solid or plated; high lead alloys	- 0.55	70	
12	Aluminum, wrought alloys of the duralumin type	- 0.60	75	
13	Iron, wrought, gray, or malleable; plain carbon and low alloy steels, armco iron	- 0.70	85	
14	Aluminum, wrought alloys other than duralumin type; aluminum, case alloys of the silicon type	- 0.75	90	
15	Aluminum, cast alloys other than silicon type; cadmium, plated and chromated	- 0.80	95	
16	Hot-dip-zinc plate; galvanized steel	- 1.05	120	
17	Zinc, wrought; zinc-base die-casting alloys; zinc, plated	- 1.10	125	
18	Magnesium and magnesium-base alloys, cast or wrought (most anodic)	- 1.60	175	

1/ Compatible couples - potential difference of 0.25 volt maximum between groups.

2/ The combination of tin-lead solder and copper is acceptable.

6.8 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.

Custodians:
Army - ER
Navy - EC
Air Force - 85

Review activities:
Army - ME, AR, MI
Navy - AS, OS
Air Force - 17, 99
DLA - ES

User activities:
Army - AV
Navy - MC
Air Force - 19

Preparing activity:
Army - ER

Agent:
DLA - ES

(Project 5925-0131)

APPENDIX

PROCEDURE FOR QUALIFICATION INSPECTION

10. SCOPE

10.1 Scope. This appendix details the procedure to submit samples, with related data, for qualification inspection of circuit breakers covered by this specification. The procedure for extending qualification of the required sample to other circuit breakers covered by this specification is also included.

20. SUBMISSION

20.1 Sample for specification sheets 1 through 12 (tripping time delays A through S). Unless otherwise specified, 42 sample circuit breakers for each specification sheet for which qualification is sought, shall be submitted. When qualification is sought for two circuit breakers covered by two specification sheets that are identical, except that one covers circuit breakers with auxiliary contact terminals and the other covers circuit breakers without auxiliary contact terminals, the former shall be submitted. The 42 sample units shall be composed of six groups of seven units each (see 20.1.2).

Two of the 7-unit groups shall be of the highest current rating and one 7-unit group shall be of the lowest current rating. The other three 7-unit groups may be composed of the highest or lowest current rating at the option of the contractor; however, the sample units within each 7-unit group shall be either all of the highest current rating or all of the lowest current rating. Each 7-unit group shall be composed of one each circuit breaker of the seven voltage-frequency-time delay combinations, A through G or K through S (see 30.1). No failures will be allowed in the 42 sample units.

(Tripping time delays, H, I, and J.) When qualification already exists for characteristics A through G, six circuit breakers shall be submitted for qualification to characteristics H, I, and J. They shall consist of two circuit breakers (one in the minimum and one in the maximum current rating) in each of the three characteristics. The sample units shall be of the greatest number of poles for which qualification is sought. Circuit breakers qualified with auxiliary contacts will convey qualification to specification sheets without auxiliary contacts. Tests to be conducted are: Calibration, resistance or impedance (all units); high- and low-temperature operation (2 units); vibration (2 units); and shock (2 units). No failures will be allowed in the six sample units.

When qualification currently exist for specification sheets 1 through 6 in tripping time delays A through G, qualification for the high-inrush feature (tripping time delays K through S) may be gained by submitting six poles represented by the lowest and highest current rating in each tripping time delay L, N, and R. Tests and sequence to be conducted are: Three high current sample units; shock, salt spray, calibration (high inrush, 125 or 150 percent (see 3.1) and 1,000 percent). Three low current sample units; vibration, high and low temperature, and while being held at each temperature, perform high inrush, 125 or 150 percent (see 3.1) and 800 percent calibration.

20.1.1 Sample, for specification sheets 13 through 19. Unless otherwise specified, (see 4.5.2.1) 18 circuit breakers, as follows, shall give complete qualification for this major design set. Six circuit breakers in each frequency rating consisting of two breakers (one in the minimum current and one in the maximum current rating) in each of the tripping time delays. One half of the sample units shall be in the front mounted design with auxiliary contacts (7 three pole and 2-four pole units) and the other half to be in the 3-pole back mounted design. The sample units shall be divided into three subsets of dc, 60, and 400 Hz units, each subset represented by the longest, medium, and fastest time delays. NOTE: For multipole circuit breaker designs not assembled from single-pole devices, contact the qualifying activity for sampling plan. In the event less than complete qualification is desired, contact the qualifying activity.

20.1.2 Sample for specification sheets 20 through 22. Qualification for MIL-C-55629/20 through /22 may be gained as defined in 20.1 using the same criteria as for specification sheets 7 through 12. When the operating mechanism, except for the handle and actuating linkage are identical in both mounting designs, the 42 sample units may be divided equally between the standard mounting style and the panel seal design, i.e., 21 sample units of MIL-C-55629/8 and 21 sample units of MIL-C-55629/20 successfully passing qualification will gain qualification for both MIL-C-55629/7, /8, and /20.

In the event qualification currently exist for specification sheets 7 through 12 and is sought

for 20 through 22 and the operating mechanism, except for the handle and actuating linkage are identical to the previously qualified designs, one sample unit of the one, two, and three pole design shall be submitted with time delays L, N, and R represented by two poles each. The one and two pole sample units shall be the lowest current and the three pole the highest current rating for which qualification is sought.

Tests to be conducted on the sample units are: one and two pole sample units; shock, high- and low-temperature, and while being held at each temperature, perform high inrush, 125 or 150 percent (see 3.1) and 800 percent calibration.

Three pole sample unit; vibration, high inrush, 125 or 150 percent (see 3.1) and 1,000 percent calibration.

All sample units; dielectric withstanding voltage, actuator strength, actuator operating force, and panel seal. No failures will be allowed in the three sample units.

20.2 Test data. When examinations and tests are to be performed at a Government laboratory prior to submission, all sample units shall be subjected to all of the examinations and tests indicated as nondestructive in table II. Each submission shall be accomplished by the test data obtained from these examinations and tests. The performance of the destructive tests by the contractor on a duplicate set of sample units is encouraged, although not required. All test data shall be submitted in duplicate.

20.3 Certification of material. When submitting samples for qualification, the contractor shall submit certification, in duplicate, that the materials used in his components are in accordance with the applicable specification requirements.

20.4 Description of items. The contractor shall submit a detailed description of the circuit breakers being submitted for qualification, including materials used for the envelope.

30. EXTENT OF QUALIFICATION

30.1 Extent of qualification. The current rating range included in the qualification of circuit breakers covered by any one specification sheet will be between the two extreme current ratings (highest and lowest) that pass the required qualification inspection. Qualification of circuit breakers with auxiliary contact terminals will also grant qualification to circuit breakers that are identical without auxiliary contact terminals. Qualification is extended to any combination of poles with current ratings between the two extremes qualified and in the time delay curves qualified. For specification sheets 1 through 6, qualification to time delays K, L, M, N, P, R, and S will also grant qualification to time delays A through G.

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DOCUMENT IDENTIFIER *(Number)* AND TITLE MIL-C55629B CIRCUIT BREAKERS, MAGNETIC, UNSEALED OR PANEL SEAL, TRIP-FREE

NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

☐ VENDOR ☐ USER ☐ MANUFACTURER

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