MILITARY SPECIFICATION

CIRCUIT BREAKERS, REMOTE CONTROL, THERMAL, 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 triple pole, trip-free, thermal, remote control circuit breakers for use in electric systems conforming to MIL-STD-704. These remote control circuit breakers shall be capable of being remotely set or tripped and provide indication of the main contact position by use of a 0.5 ampere, push-pull, trip-free circuit breaker (not covered by this specification). These remote control circuit breakers include auxiliary contacts (see 6.5.4) and terminals for monitoring circuits. Hereinafter, a remote control circuit breaker will be referred to as an RCCB (see 6.9).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified, the following specifications and standards, of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

L-P-378	-	Plastic Sheet and Strip, Thin Gauge, Polyolefin.
NN-P-71	-	Pallet, 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	-	Box, Folding, Paperboard.
PPP-B-601	-	Boxes, Wood, Cleated-Plywood.
PPP-B-621	-	Box, Wood, Nailed and Locked-Corner
PPP-B-636	-	Boxes, Shipping, Fiberboard.
PPP-B-676	-	Boxes, Setup.

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MIL-M-14	-	Molding Plastics and Molded Plastic Parts, Thermosetting
MIL-P-116	-	Preservation, Methods of.
MIL-P-997	-	Plastic Material, Laminated, Thermosetting, Electrical Insulation: Sheets, Glass Cloth, Silicone Resin.
MIL-W-5086	-	Wire, Electric, Polyvinyl Chloride Insulated, Copper or Copper Alloy
MIL-T-5624	-	Turbine Fuel, Aviation, Grades Jp-4 And Jp-5.
MIL-L-7808	-	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to Electronic Support Division AFLC (2750 ABW/ES), Gentile AF Station, Dayton, OH 45444 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter

MIL-T-7928	-	Terminal, Lug Splices, Conductor, Crimp-Style, Copper, General Specification for.
MIL-A-8243	-	Anti-icing and Deicing-Defrosting Fluid.
MIL-P-11268	-	Parts, Materials, and Processed Used in Electronic Equipment
MIL-F-14256	-	Flux, Soldering, Liquid (Rosin Base)
MIL-P-15037	-	Plastic Sheet, Laminated, Thermosetting, Glass-cloth, Melamine-Resin.
MIL-S-19500	-	Semiconductor Devices, General Specification for
MIL-W-22759	-	Wire, Electric, Fluoropolymer Insulated, Copper or Copper Alloy.
MIL-L-23699	-	Lubricating Oil, Aircraft Turbine Engines, Synthetic Base.
MIL-C-87936	-	Cleaning Compound, Aircraft Exterior Surfaces, Water Dilutable.
MIL-M-38510	-	Microcircuits, General Specification for.
MIL-C-39029/1	-	Contacts, Electrical Connector, Pin, Crimp Removable, (For MIL-T-81714, Terminal Junction System).
MIL-I-81023	-	Inductor, 28 VDC, Laboratory Test, General Specification for
MIL-W-81381	-	Wire, Electric, Polyimide-Insulated, Copper and Copper Alloy.
MIL-C-83383/1	-	Circuit Breakers, Remote Control, ac-dc, Thermal, Trip-Free, Series Trip, Single Pole (5 to 100 Amperes).
MIL-C-83383/2	-	Circuit Breakers, Remote Control, ac-dc, Thermal, Trip-Free, Series Trip, Single Pole, Auxiliary Contacts (5 to 100 Amperes).
MIL-C-83383/4	-	Circuit Breakers, Remote Control, ac-dc, Thermal, Trip-Free, Series Trip, Triple Pole, Auxiliary Contacts (5 to 100 Amperes).
MIL-C-83383/7	-	Circuit Breakers, Remote Control, ac, Thermal, Trip-Free Series Trip, Single Pole, Auxiliary Contacts (5 to 25 Amperes).
MIL-C-83383/8	-	Circuit Breakers, Remote Control, dc, Thermal, Trip-Free Series Trip, Single Pole, Auxiliary Contacts (5 to 25 Amperes).

STANDARDS

FEDERAL

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

MILITARY

MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-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-461	-	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference.
MIL-STD-704	-	Aircraft, Electric Power, Characteristics.
MIL-STD-883	-	Test Methods and Procedures for Microelectronics
MIL-STD-889	-	Dissimilar Metals.
MIL-STD-1285	-	Marking of Electrical and Electronic Parts.
MIL-STD-1549	-	Common Termination System for Electrical and Electronic Parts.
MIL-STD-2073-1	-	DOD Materiel, Procedures for Development and Application of Packaging Requirements.
MIL-STD-45662	-	Calibration System 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).

2 1 2 Other Government drawings. The following other Government drawing forms a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

DEPARTMENT OF THE AIR FORCE

AS 1241A(USAF) - Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft.

(Application for copies should be addressed to the Society of Automotive Engineers, Incorporated, 400 Commonwealth Drive, Warrendale, PA 15096.)

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

2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

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 sheets, the latter shall govern.

3.2 Qualification. RCCB's furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time set for opening of bids (see 4.5 and 6.3).

3.3 Parts, materials, and processes. Unless otherwise specified (see 3.1), parts, materials, and processes shall be in accordance with MIL-P-11268. When a definite material is not specified, a suitable material shall be used that will enable the RCCB's 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 3.1 Metals. All metals used in the construction of circuit breakers shall be corrosion resistant or shall be suitably protected to resist corrosion. The use of dissimilar metals, especially contacts between brass, copper, or steel and aluminum or magnesium alloys, shall be avoided. Where contact between dissimilar metals is unavoidable, the metals shall be protected against electrolytic corrosion. Dissimilar metals are defined in MIL-STD-889. When thermostatic bimetals and trimetals are used, corrosion resulting from tests specified herein shall not adversely affect the performance of the breaker.

3.3.1.1 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 XII.

3.3 2 Plastics. Plastic materials exposed to arcing or surface creepage shall conform to MIL-P-997, MIL-P-15037, or MIL-M-14. Other types of plastic materials may be used provided the manufacturer submits satisfactory evidence to the activity responsible for qualification that the materials are suitable for the purpose intended. The plastic materials used shall neither support combustion nor give off noxious gases when subjected to arcs, such as those caused by interrupting heavy short circuit currents, or explosions of gaseous vapors to which the materials may be subjected in service. Plastic materials with cellulose fillers will not be permitted in parts that may be subjected to arcing or surface creepage.

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

3.3.4 Solder. Solder shall be in accordance with composition Sn60 or Sn63 of QQ-S-571. If cored solder is used, the flux core shall be type R or RMA.

3.3 5 Flux. Flux shall be a liquid flux conforming to MIL-F-14256 or a flux cored solder as specified in 3.3.4.

3.3.6 Electronic components. Electronic components shall be selected in accordance with the applicable requirements of MIL-STD-454. Components selected shall be such that the RCCB shall meet the performance requirements and product characteristics specified herein. After qualification, any change of parts or material shall be submitted to the Government qualifying activity.

3.3.6.1 Discrete semiconductor devices. Discrete semiconductor devices shall be selected in accordance with MIL-S-19500, level JAN, wherever possible. Components which cannot be selected in accordance with MIL-S-19500 shall be screened by the RCCB manufacturer to the extent which satisfies the performance requirements and product characteristics as specified herein for the RCCB.

3.3.6.2 Microcircuits. Monolithic microcircuits shall be selected in accordance with MIL-M-38510, class B of MIL-STD-883, wherever possible. Components which cannot be selected in accordance with MIL-M-38510 shall be screened by the RCCB manufacturer to the extent which satisfies the performance requirements and product characteristics as specified herein for the RCCB.

3.3.6.3 Electrostatic damage (ESD) protection Electronic components which are subject to ESD shall be protected against ESD during manufacture of the RCCB.

3.4 Design and construction. The RCCB shall be of the design, construction, weight, and physical dimensions specified (see 3.1). All poles of triple pole RCCB's shall be mechanically ganged together.

3.4.1 Trip-free feature. The RCCB shall be designed so that the circuit cannot be maintained closed when any pole is carrying overload currents that would normally automatically trip the circuit breaker to the open position.

3.4.2 Trip indication or warning label. The RCCB shall be designed to provide positive indication of the main contact position or a warning label shall be furnished with the RCCB (see 3.1). Electrical actuation of the indicator is not acceptable.

3.4.2.1 Remote trip indication The RCCB shall be so designed that when the circuit breaker contacts open automatically on overload, the RCCB shall cause the remote actuator to indicate the operation by moving to the "open" tripped position.

3.4.3 Attitude The RCCB shall be constructed to trip within maximum and minimum limits of the specified trip times (see 3.1, 6.5.1, and 6.5.2), when mounted in any of three mutually perpendicular axes (see 4.7.4).

3.4.4 Controls.

3.4.4.1 Indicator/control unit (I/CU). The RCCB shall provide a remote actuation capability by means of an I/CU connected between a control terminal of the RCCB and supply ground (see 3 1) A load control switch or subsystem relay contact may be connected in series with the I/CU. The I/CU (not furnished under this specification) shall be a 0.5 ampere, trip-free circuit breaker, with trip times and internal impedance defined in the applicable specification sheet.

3.4 5 Electrical connections. Connections to external circuits shall be as specified (see 3.1)

3.4.5.1 Line and load terminals (see 6.5.3). The main line and load terminals shall be designed and mounted as specified (see 3.1). Each terminal shall be capable of carrying rated current and voltage per pole of the RCCB.

3.4.5.2 Control and auxiliary contact terminals (see 6.5.4). The control terminals and auxiliary contact terminals shall be contained in an integrated wire termination (IWT) module in accordance with MIL-STD-1549 to accept pin contact, part number M39029/1-100 or -101 in accordance with MIL-C-39029/1 Auxiliary contacts shall be of single pole, double throw configuration. The auxiliary contacts shall be arranged in a manner to insure (regardless of actuator position) that the normally open contacts are closed when the main contacts are closed, and the normally closed contacts are closed when the main contacts are open.

3.4.6 Threaded parts. Screw threads shall be in accordance with FED-STD-H28 and as specified (see 3.1). RCCB's shall be supplied with the specified hardware assembled in proper order.

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

3.4.8 Voltage rating. The RCCB shall have a maximum voltage rating per pole as specified (see 3.1).

3.4.9 Continuous current carrying capacity. The RCCB shall be capable of carrying the rated current as specified (see 3.1).

3.5 Dielectric withstanding voltage. When tested as specified in 4.7.2, the RCCB shall show no evidence of damage, arcing, or breakdown. The leakage current shall not exceed 0.5 milliampere.

3.6 Insulation resistance. When tested as specified in 4.7.3, the RCCB shall have an insulation resistance of not less than 100 megohms.

3.7 Calibration. When tested as specified in 4.7.4 1 (qualification or periodic inspection) or 4.7 4.2 (group A inspection), the tripping time (see 6.5.1) shall be as specified (see 3.1 and table I). All poles of triple pole RCCB's shall trip under all "must trip" conditions.

TABLE I. Tripping times for calibration tests.

Calibration tests	Percent rated current	Ambient temp °C ±5°C	Tripping time
Minimum ultimate trip 1/ 2/	115	+25	No trip 3/
Maximum ultimate trip 1/	138		1 hour max
Overload and trip-free	200 400 1000	At -54, +25, and +71	(See 3.1)
Ambient effect on calibration (ultimate trip limits)	115 150 4/ 100 138	-54 +71 	No trip 3/ 1 hour max No trip 3/ 1 hour max
Unbalanced overload 5/	200 400 1000	+25	Within maximum and 10% of minimum trip time limits (see 3.1)

1/ See 6.5.5 and 6.5.6.
2/ Temperature rise of the terminals shall not exceed 75°C during test.
3/ Test time shall be 1 hour, minimum.
4/ Or 160 percent as specified (see 3 1)
5/ Triple pole RCCB's only.

3.8 Voltage drop. The voltage drop across the auxiliary contact terminals shall not exceed .250 volt. When tested as specified in 4.7.5, the voltage drop across the line and load terminals of the RCCB shall not exceed the following limits per pole.

Rating (amperes)	Initial measurement	After endurance
5	.450	50
7.5	.360	.40
10	.347	.385
15-100	.225	.250

3.9 Response time When tested as specified in 4.7.6, the RCCB shall open within the specified time (see 3.1).

3.10 Power requirements and response time at minimum voltage. When tested as specified in 4.7.7a, b, and c, respectively, the RCCB shall:

a. Minimum opening voltage: Open automatically.

b. Standby current drain and actuation curent: Not to exceed 10 milliamperes ac and dc standby current. The opening and closing current shall not exceed the value specified (see 3.1).

c. Maximum operating time at minimum voltage· Open and close the main contacts within a maximum of 50 milliseconds after the corresponding opening and closing of the I/CU.

3.11 Overload cycling. When tested as specified in 4.7.8, the RCCB shall meet the 200 percent overload calibration requirement (see 3.7) during cycling; after cycling, the RCCB shall meet the minimum and maximum ultimate trip requirements (see 3.7).

3.12 Endurance. When tested as specified in 4.7.9, the RCCB shall not fail and shall show no evidence of mechanical damage or loosening of parts.

3.12.1 Electrical operation. In addition, the RCCB shall calibrate within the limits of 90 percent of the specified minimum ultimate trip current and 110 percent of the specified maximum ultimate trip current (see 3.7) and shall meet the voltage drop requirement (see 3.8).

3.13 Terminal strength. When tested as specified in 4.7.10, the RCCB shall show no evidence of 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.

3.14 Vibration. When tested as specified in 4 7.11, the RCCB main contacts shall not trip and there shall be no opening of the closed nor closing of the open main or auxiliary contacts in excess of 10 microseconds, nor shall there be any evidence of mechanical or electrical damage. The RCCB shall also meet the 200 percent overload calibration requirement (see 3 7).

3.14.1 Vibration scan. When tested as specified in 4.7.11.1 or 4.7.11.2, the RCCB main contacts shall not trip, and there shall be no opening of the closed nor closing of the open main or auxiliary contacts in excess of 10 microseconds, nor shall there be any evidence of mechanical or electrical damage. The RCCB shall also meet the 200 percent overload calibration requirements when tested at 25°C, mounted in the y-axis upon completion of the scan.

3.15 Moisture resistance. When tested as specified in 4.7.12, the RCCB shall show no evidence of breaking, cracking, spalling, excessive corrosion, or loosening of terminals. The RCCB shall also meet the following requirements when tested at 25°C.

a. 1000 percent overload calibration. The RCCB must trip within ±20 percent of the specified limits (see 3.7).

b. 400 percent trip-free calibration (see 3.7).

c. 200 percent overload calibration. The RCCB must trip within ±10 percent of the specified limits (see 3.7).

d Dielectric withstanding voltage (see 3.5).

3 16 Thermal shock. When tested as specified in 4 7.13, the RCCB shall show no evidence of mechanical damage.

3.17 Shock (specified pulse). When tested as specified in 4.7.14, the RCCB main contacts shall not trip. There shall be no closing of the open main or auxiliary contacts, nor opening of the closed main or auxiliary contacts in excess of 10 microseconds, nor shall there be any evidence of mechanical or electrical damage. The RCCB shall also meet the 200 percent overload calibration requirements (see 3.7).

3.18 Coordination. When tested as specified in 4.7.15, the RCCB with the higher rating shall not open, the RCCB with the lower rating shall open, and there shall be no electrical or mechanical malfunction.

3.19 Electromagnetic interference. When tested as specified in 4.7.16, the RCCB shall meet the requirements for class ID of MIL-STD-461.

3.20 Transient susceptibility. When tested as specified in 4.7.17, the RCCB shall not electrically or mechanically malfunction.

3.21 Explosion. When tested as specified in 4.7.18, the RCCB shall not ignite the explosive mixture outside the RCCB.

3.22 Sand and dust. When tested as specified in 4.7.19, the RCCB shall meet the 400 percent trip-free calibration requirement and the 200 percent overload calibration requirement (see 3.7).

3.23 Salt spray (corrosion). When tested as specified in 4.7.20, the RCCB shall show no evidence of excessive corrosion, warping, cracking, or other damage. The RCCB shall also trip within ±20 percent of the specified limits for 200 percent overload calibration (see 3.7).

3.24 Interrupting capacity. When tested as specified in 4.7 21, the RCCB shall trip automatically and provide indication by tripping the I/CU. The RCCB shall be resettable within 10 minutes after each test. The RCCB shall also meet the following requirements:

a. Dielectric withstanding voltage (see 3.5).

b. 200 percent overload calibration. The RCCB must trip within ±20 percent of the specified limits (see 3.7).

3.25 Resistance to solvents. When RCCB's are tested as specified in 4.7.22, the marking shall remain legible.

3.26 Operation. When tested as specified in 4.7.23, the following conditions shall result for each corresponding subparagraph.

a. Paragraphs a through e: RCCB main contacts shall close when the I/CU is closed and open when the I/CU is opened.

b. Paragraph f RCCB main contacts shall remain open.

c. Paragraph g RCCB main contacts shall close.

3.27 Trip-free calibration. When tested as specified in 4 7 24, the RCCB shall not close in on the overload current or be capable of resetting until the ground is removed and reconnected.

3.28 High temperature cycling. When the RCCB is cycled as specified in 4 7.25, the main contacts shall close and remain closed, and open and remain open when the I/CU is closed and opened.

3.29 Marking (see 3.1).

3.29.1 Identification marking. The following information shall be marked on the RCCB in accordance with method I of MIL-STD-1285:

a Military part number (see 3.1).

b. Current rating, voltage, and operating frequency (see 3.1).

c Contractor's name, trademark, or code and date code.

d. Circuit schematic (see 3.1).

3.29.2 Other marking. The "on" position of integral actuators (see 3.4.4.1); the line and load terminals; the terminal identification on integrated wire termination module, the pole identification, when specified (see 3.1), the position indication, and when specified (see 3.1), "ac only" or "dc only" shall be clearly and permanently marked on each RCCB, as specified (see 3.1). For dc RCCB's, the line terminal shall be marked +.

3.30 Workmanship. RCCB's 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 Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements

4.1 1 Responsibility for compliance All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Test equipment and inspection facilities. 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 6)

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

TABLE II. Materials inspection

Material	Requirement paragraph	Applicable specification
Metal plating - - -	3.3 1	QQ-P-416 or QQ-Z-325
Plastics- - - - - -	3 3 2	MIL-H-14, MIL-P-997, or MIL-P-15037
Fungus resistance -	3.3.3	MIL-STD-454
Solder- - - - - - -	3.3.4	QQ-S-571
Flux- - - - - - - -	3.3.5	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 twice the specified load current. A dc power supply shall have no more than 5 percent voltage ripple. An ac power supply shall be within 1 percent of the specified frequency and shall be sinusoidal with a form factor between 0 95 and 1.25. The ac or dc power supply shall be capable of simulating the normal and abnormal power conditions described in MIL-STD-704, with the following exceptions.

4.4.1.1 AC power exception. The steady state voltage shall be 104 to 122 volts.

4.4.1.2 DC power exception. The steady state voltage shall be 18 to 32 volts.

4.5 Qualification inspection. 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. Unless otherwise specified (see 3.1), 20 sample RCCB's for each specification sheet for which qualification is sought, shall be submitted for testing in accordance with table III. If qualification is sought for less than the entire family of ratings, the total qualification lot size shall be kept at 20 samples to insure coverage of all test conditions specified in table III. No failures shall be allowed in the 20 sample units.

4 5.2 Inspection routine. The sample units shall be subjected to the inspections specified in table III, in the order shown.

4 5.3 Failures. One or more failures shall be cause for refusal to grant qualification approval

4.5.4 Extent of qualification Qualification of RCCB's with auxiliary contacts will also grant qualification to RCCB's that are identical without auxiliary contacts.

TABLE III Qualification inspection 1/ 2/

Inspection	Requirement paragraph	Method paragraph	5	7 5	10	15	20	25	35	40	50	60	75	80	100 amperes or highest rating being qualified							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Visual and mechanical inspection 3/	3.1, 3 3 to 3.4.9 incl., 3.29, and 3 30	4 7 1	Top line above represents RCCB current rating and second line represents the test sample number																			
			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dielectric withstanding voltage	3.5	4 7 2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Insulation resistance	3.6	4.7.3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Calibration	3.7	4.7 4.1	4	4	4	4	4	4	4	4	4	4	4	4	4							4
Voltage drop	3.8	4.7 5	6	5	6	5	5	6	5	5	6	5	5	5	5	4	4	4	4	4	4	5
Response time	3.9	4 7 6	7				6															
Power requirements and response time at minimum voltage	3.10	4.7 7	8								7				6							
Overload cycling	3.11	4.7 8											6									
Endurance 4/ 5/	3.12	4 7 9																				
AC resistive	3.12	4.7 9 1a													7							
DC resistive	3.12	4.7 9 2a														5						
AC motor load	3.12	4.7 9 1c															5					
DC motor load	3.12	4 7 9 2c																5				
AC inductive	3.12	4 7 9 1b																	5			
DC inductive	3.12	4.7 9 2b																		5		
Lamp load ac or dc 6/ 7/	3.12	4.7 9 1d or																			5	
	3.12	4.7 9 2d																				
Terminal strength	3.13	4.7 10	9									6										
Vibration	3.14	4 7 11			7						8			6								
Moisture resistance	3.15	4.7.12					10															
Thermal shock	3.16	4.7 13		7			8	7								7						
Shock	3.17	4.7 14				6	9															7
Coordination	3 18	4.7 15	5		5			5			5											6
Electromagnetic interference	3.19	4.7.16							6													
Transient susceptibility	3.20	4.7 17								6												
Explosion	3.21	4.7 18							7				7									
Sand and dust	3.22	4.7 19				7																
Salt spray	3.23	4.7 20												8								
Interrupting capacity 1/ 5/	3.24	4.7 21																				
AC capacity A/G	3.24	4.7 21	10									7										
AC capacity B/H	3.24	4 7.21		6									8									
DC capacity C	3.24	4.7 21				8								7								
DC capacity D	3.24	4.7 21					7								8							
AC capacity E	3.24	4.7 21						8														8
DC capacity F	3.24	4 7.21								7						6						
Resistance to solvents	3.25	4.7 22	11	8	9																	
Operation	3.26	4.7 23								8												
Trip-free calibration	3.27	4.7.24								9												

1/ A new sample unit may be chosen to avoid conducting interrupting capacity and coordination tests on the same unit. If a new sample unit is chosen, it shall be used for the coordination test with calibration in accordance with 4 7 4 and 3 7 performed before and after the coordination test.

2/ In the event less than 13 current ratings are being qualified, 20 sample units are still required. The additional sample units shall be of the highest current rating being qualified

3/ Dimensional measurement shall be made on two sample units only

4/ In the event of any design change between the lowest and highest rated circuit breaker, other than the tripping element, modifications to this table may be required Contact the qualifying activity

5/ For three phase RCCB's, dc tests are not required

6/ This test may be waived if the highest lamp load rating is at 50 amperes and a 100-ampere rated device is tested for motor load.

7/ For single phase RCCB's, perform dc lamp load tests and for three phase RCCB's, perform ac lamp load.

4.5.5 Retention of qualification. To retain qualification, the contractor shall forward two reports to the qualifying activity. The qualifying activity shall establish the initial reporting dates. The first report shall be forwarded at 12-month intervals and shall include the following

A summary of the results of 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. The results of tests of all reworked lots shall be identified and accounted for. Also, a summary of the results of tests performed for periodic inspection (group B), including the number and mode of failures. The summary shall include results of all periodic inspection tests performed and completed during the 12-month period. 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.

The second report shall be forwarded at 36-month intervals and shall include the following:

A summary of the results of tests performed for periodic inspection (group C), including the number and mode of failures. The summary shall include results of all periodic inspection tests performed and completed during the 36-month period. 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.

Failure to submit the report within 30 days after the end of each 12/36-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 12/36-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 his qualified products to testing in accordance with the qualification inspection requirements and the reason for no production.

4.6 Quality conformance inspection.

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

4.6.1.1 Inspection lot. An inspection lot shall consist of all the RCCB's covered by a single specification sheet produced under essentially the same conditions within a period not to exceed 1 month, and offered for inspection at one time.

4.6.1.1.1 Group A inspection. Group A inspection shall consist of the inspections specified in table IV, in the order shown.

4.6.1.1.1.1 Sampling plan. The entire lot shall be subjected to the inspections of group I. Statistical sampling and inspection for group II shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality level (AQL) shall be as specified in table IV. Major and minor defects shall be as defined in MIL-STD-105.

4.6.1.1.2 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.

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

TABLE IV. Group A inspection.

Inspection	Requirement paragraph	Method paragraph	AQL (% defective maximum acceptable)	
			Major	Minor
Group I 1/				
Visual and mechanical inspection.				
Dimensions 2/	3.4	4.7.1	Not applicable (100% inspection)	
Workmanship	3.30	4.7.1		
Dielectric withstanding voltage	3.5	4.7 2		
Insulation resistance	3.6	4.7.3		
Voltage drop	3.8	4.7.5		
Group II				
Visual and mechanical inspection:				
Marking	3.29	4.7 1	1 0	4 0
Calibration	3.7	4.7.4.2	1.0	---
High temperature cycling	3.28	4.7.25	1.0	---

1/ Failure of this test does not constitute lot failure; the RCCB shall be removed from the inspection lot and reworked or replaced and resubjected to all inspections.

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

4.6.2 Periodic inspection. Periodic inspection shall consist of groups B and C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.6.2.2 3), delivery of products which have passed group A shall not be delayed pending the results of these periodic inspections.

4.6.2.1 Group B inspection. Group B inspection shall consist of the inspections specified in table V, in the order shown. Group B inspection shall be made on sample units selected from inspection lots which have passed group A inspection.

TABLE V. Group B inspection.

Inspection	Requirement paragraph	Test paragraph
Dielectric withstanding voltage	3.5	4.7.2
Insulation resistance	3.6	4.7.3
Overload calibration 1/	3.7	4.7 4.1c
Voltage drop	3.8	4.7.5
Endurance 2/	3.12	4.7.9
Vibration scan	3.14.1	4.7 11.1

1/ Overload calibration shall be run at 200 percent and 1000 percent only at 25°C ±5°C. Each time this test is run, a different axis shall be used.

2/ Endurance testing shall be run on a rotational basis, i e , switch between ac and dc resistive, motor and inductive loads.

4.6.2.1.1 Sampling plan. One RCCB shall be selected after 100 units have been produced in a quarter. If production exceed 1000 units in a quarter, one RCCB shall be selected from each subsequent 1000 units. If no RCCB's are selected in one year based on the above, two units will be selected at the end of that year If these two units represent more than 1 percent of production, testing is not required. The endurance and vibration testing specified in table V shall only be carried out on the highest ampere rated device produced, excluding the bimetal (see 6.5.10). The sampling plan as specified, shall be based on the number of all devices which are similar.

4.6.2.1.2 Failure criteria. When one or more RCCB's fail to pass group B inspection, further acceptance shall be withheld until the cause of failure is determined. In the event of a single isolated failure on group B testing, and if the failed RCCB has satisfactorily completed 50 percent of the specified minimum cycles on the particular load being tested, the manufacturer, at his option, may have two additional RCCB's selected for the same group B testing. If the two RCCB's pass, the lot shall be accepted, and production and testing resumed. In the event of an additional failure on the two samples, acceptance shall be withheld and corrective action will be necessary. After corrective action has been taken, production and acceptance testing may be resumed. For production reasons, group A tests may be continued pending the investigation of group B failure.

4.6.2.1.3 Disposition of sample units. Sample units which have been subjected to group B inspection shall not be delivered on the contract.

4.6.2.2 Group C inspection. Group C inspection shall consist of the inspections specified in table VI, in the order shown. Group C inspection shall be made on sample units selected from lots which have passed group A inspection.

4.6.2.2.1 Sampling plan. Fourteen sample units shall be selected from those covered by a single specification sheet, 36 months after the date of notification of qualification, and after each subsequent 36 month period. The sample units shall consist of one sample per current rating manufactured, except that for the highest current rating manufactured, two samples shall be chosen. If all current ratings are not manufactured, tests which are scheduled for these devices must be run on RCCB's which are manufactured, or on the highest current rated device if additional units are needed to complete all tests. A test plan showing these exceptions must be submitted to the qualifying activity prior to the start of testing. The endurance testing shall be run at the highest ampere rating being qualified. The various types of endurance tests (resistive, inductive, motor and lamp loads) shall be covered on a rotating basis, i.e., for each 3-year retention of qualification period, a different type of endurance test shall be performed. If there is no production of RCCB's covered by a single specification sheet within a 36 month period, the qualifying activity shall be notified, and the sample units for group C inspection shall be selected and tested from the first inspection thereafter.

4.6.2.2.2 Disposition of sample units. Sample units which have been subjected to group C inspection shall not be delivered on the contract.

4.6.2.2.3 Noncompliance. If a sample fails to pass group B or C inspections, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and take corrective action on the parts, materials, or processes, as warranted, and on all units of the product which can be corrected and which were manufactured with essentially the same parts, materials, and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken, group B or C inspections shall be repeated on additional sample units (all inspections, or the inspection which the original sample failed, at the option of the qualifying activity). Group A inspection may be reinstitued; however, final acceptance and shipment shall be withheld until the group B or C inspections have shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

TABLE VI. Group C inspection

Inspection	Requirement paragraph	Method paragraph	5 1	7.5 2	10 3	15 4	20 5	25 6	35 7	40 8	50 9	60 10	75 11	80 12	100 13	100 14
			Top line represents RCCB current rating and second line represents the test sample number.													
Visual and mechanical inspection 1/	3 1, 3.3 to 3 4.9 incl., 3 29 and 3.30	4.7.1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dielectric withstanding voltage	3.5	4 7.2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Insulation resistance	3.6	4.7.3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Calibration 2/	3.7	4.7.4 1d	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Voltage drop	3.8	4.7.5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Overload cycling	3.11	4.7.8													6	
Endurance cycling 3/	3.12	4.7.9														5/ 6
AC resistive load	3.12	4.7.9.1a.														
DC resistive load	3.12	4.7.9.2a.														
AC inductive load	3.12	4.7.9.1b.														
DC inductive load	3.12	4.7.9.2b.														
AC motor load	3.12	4.7.9.1c.														
DC motor load	3.12	4.7.9.2c.														
Lamp load ac or dc 4/	3.12 3.12	4.7.9.1d. or 4.7.9.2d.														
Terminal strength	3.13	4.7.10	7													
Vibration	3 14.1	4.7.11.2			7											
Moisture resistance	3.15	4.7.12										7				
Interrupting capacity 3/	3.24	4.7.21														
AC capacity A/G	3.24	4.7.21		6		6									7	
AC capacity B/H	3.24	4.7.21	6							6						
DC capacity C	3.24	4.7.21			6						6					
DC capacity D	3.24	4.7.21							6			6				
AC capacity E	3.24	4.7.21					6						6			
AC capacity F	3.24	4.7.21						6						6		
Thermal shock	3.16	4.7.13								7						

1/ Dimensional measurements are to be made on two samples only.
2/ For overload calibration, testing shall be run at 200 percent and 1000 percent at -54°C and +71°C All calibration testing shall be run in only one axis.
3/ For three phase RCCB's, dc tests are not required
4/ This test may be waived if the highest lamp load rating is at 50 amperes and a 100 ampere rated device is tested for motor
d
5/ is test is performed on a rotating basis, see 4.6.2.2.1.

4.6.3 Inspection of packaging. The sampling and inspection of the preservation and interior pack marking 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

4.7 Methods of inspection.

4.7.1 Visual and mechanical inspection. RCCB's shall be inspected to verify that dissimilar metals, design, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3 to 3.4.9 inclusive, 3.29 and 3.30).

4.7 2 Dielectric withstanding voltage (see 3.5). RCCB's shall be tested in accordance with method 301 of MIL-STD-202. The following details shall apply:

a. Magnitude of test voltage: 1500 volts (rms).

b. Nature of potential: AC.

c. Points of application. Between mutually insulated parts. NOTE: The control terminals and the line terminal(s) are electrically interconnected through a solid state module and must be shorted together during test.

d. Measurement during test: Leakage current.

e. Inspections after test: RCCB's shall be inspected for evidence of flashover, mechanical damage, arcing, and breakdown

4.7.3 Insulation resistance (see 3.6). RCCB's shall be tested in accordance with method 302 of MIL-STD-202. The following details shall apply·

a Test condition: B.

b. Points of measurement. Between mutually insulated parts. NOTE The control terminals and the line terminal(s) are electrically interconnected through a solid state module and must be shorted together during test.

4.7.4 Calibration (see 3.7). RCCB's shall be connected as shown on figure 1 and subjected to the applicable calibration tests specified in 4.7 4.1 or 4.7.4.2. For triple pole RCCB's, each pole (remaining poles passing no current) and all poles shall be subjected to the test current specified.

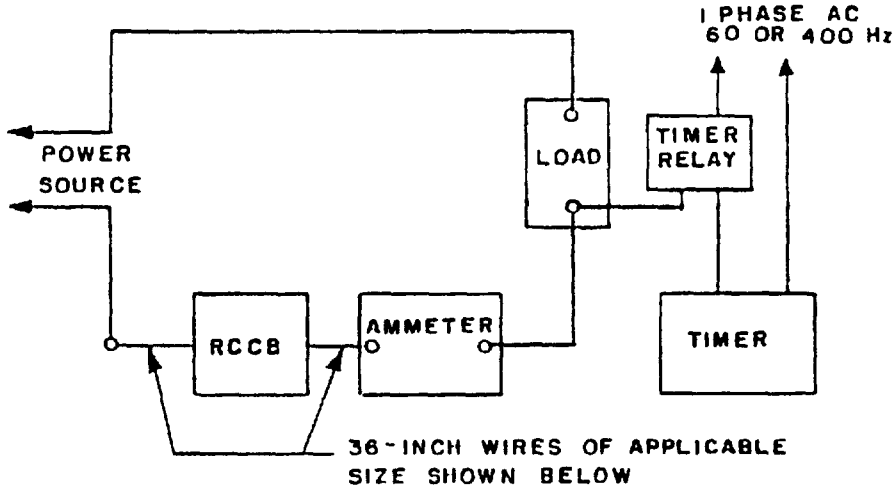
4.7.4.1 Qualification and periodic inspection.

a. Minimum limit of ultimate trip The RCCB shall be subjected to an overload of 115 percent of rated current at 25°C ±5°C for a minimum of 1 hour and the tripping time shall be measured. The temperature rise of the RCCB terminals shall be obtained by the use of a suitable thermocouple attached to the terminals outside, but adjacent to the RCCB case.

b. Maximum limit of ultimate trip: The RCCB shall be subjected to an overload of 138 percent of rated current at 25°C ±5°C and the tripping time shall be measured.

c Overload calibration. The RCCB shall be subjected to overloads of 200, 400, and 1000 percent of rated current at -54°C ±5°C, 25°C ±5°C and 71°C ±5°C, and the tripping times shall be measured. During this test, the RCCB shall be tested with each major axis held in the vertical plane and in any other position likely to cause malfunctioning.

d Ambient effect on calibration: The RCCB shall be subjected to overloads of 115 and 150 percent unless otherwise specified (see 3 1), of rated current at -54°C ±5°C, 100 and 138 percent of rated current at 71°C ±5°C, and the tripping times shall be measured. At 100 and 115 percent of rated current, the current shall be applied for a minimum of 1 hour.



Circuit breaker capacity (amperes)	Wire size AWG
5	22
7 to 10 inclusive	18
11 to 15 inclusive	16
16 to 20 inclusive	14
21 to 25 inclusive	12
26 to 40 inclusive	10
41 to 50 inclusive	8
51 to 60 inclusive	8
61 to 90 inclusive	6
91 to 120 inclusive	4

NOTES:
1. Test lead wires shall conform to MIL-W-5086, MIL-W-81381, or MIL-W-22759.
2. Terminals shall conform to MIL-T-7928. Terminals of the appropriate wire size and stud size shall be selected from MS20659 or MS25036.

FIGURE 1. Calibration test circuit.

4.7.4.2 Group A inspection.

a. Minimum limit of ultimate trip: The RCCB shall be subjected to an overload of 115 percent of rated current at 25°C ±5°C on all poles for a minimum of 1 hour and the unit must not trip (see table I). At the manufacturer's option, this test may be substituted for by another minimum limit of ultimate trip test when a correlation between the two test methods can be substantiated to the satisfaction of the qualifying activity.

b Maximum limit of ultimate trip: The RCCB shall be subjected to an overload of 138 percent of rated current at 25°C ±5°C, and it must trip within 1 hour (see table I).

c Overload calibration: The RCCB shall be subjected to an overload of 200 percent of rated current at 25°C ±5°C, and the tripping times for each pole shall be measured (see table I or 3.1).

4.7.5 Voltage drop (see 3.8). RCCB's shall break and then make rated current for 10 consecutive operations prior to measurement. With the RCCB carrying rated current, the voltage drop from the line terminal(s) to the load terminal(s) shall be measured. The voltage drop across the auxiliary contact shall be measured at the terminals of the integrated wire termination module using the pin contact specified (see 3 4.5 2), or equivalent.

4.7.6 Response time (see 3.9). RCCB's shall be closed and carrying rated current. The power shall be removed and the I/CU opened. The power shall be reapplied and the opening time of the RCCB measured.

4 7.7 Power requirements and response time at minimum voltage (see 3.10).

a. Minimum opening voltage: With the RCCB stabilized at -54°C ±5°C, 25°C ±5°C, and 71°C ±5°C and the I/CU closed, monitor main contact position and apply power and an overload such that with 2 1/2 volts (dc or ac, 400 Hz) (see 3.1) at the line terminal(s), the RCCB should open automatically. No back-up power shall be applied.

b. Standby current drain and actuation current. With the RCCB stabalized at room temperture, apply the specified back-up voltage (see 3.1) to the appropriate IWT module terminal. Close the I/CU and measure the standby current drain, remove back-up power and repeat measurement after applying the specified line voltage (see 3 1), then open and close the I/CU and monitor the actuating current at each voltage.

c Maximum operating time at minimum voltage· With no back-up power and the maximum specified voltage (see 3.1) at the line terminal(s), "open" then "close" the I/CU and measure the corresponding opening and closing times of the RCCB main contacts.

4.7.8 Overload cycling (see 3.11). RCCB's shall be subjected to a 200 percent rated current resistive load for 100 cycles of normal openings and the tripping times shall be measured. This test shall be conducted at rated voltage and, unless otherwise specified (see 3.1), at a cycling rate of 2 to 3 minutes per operation. Following this test, RCCB's shall be subjected to the minimum and maximum ultimate trip calibration tests specified in 4.7 4. Triple pole RCCB's are to carry minimum and maximum ultimate trip currents on all three poles simultaneously.

4.7.9 Endurance (see 3.12). RCCB's shall be subjected to the number of cycles of make and break operation specified (see 3.1), with the RCCB's energized at rated current, voltage, and frequency (see 3.1, 4.7.9.1, and 4.7.9.2) throughout the cycling period with a duty cycle specified in table VII. Each pole of triple pole RCCB's shall be simultaneously subjected to the required load. Auxiliary contacts shall also make and break the specified load (see 3.1 and 3.4.5.2). The same type of load shall be applied to the auxiliary contacts as is applied to the main RCCB, except when the motor load is applied to the RCCB, the auxiliary contact shall be subjected to the inductive load. Electrical operation of the RCCB shall be by use of the I/CU or other contact in series with the I/CU. RCCB's shall be inspected for evidence of mechanical damage or loosening of parts. Following the test, RCCB's shall be subjected to the following tests:

a. Minimum ultimate trip calibration (see 4.7.4). Triple pole RCCB's are to carry minimum and maximum ultimate trip currents on all three poles simultaneously.

b Maximum ultimate trip calibration (see 4.7.4): Triple pole RCCB's are to carry minimum and maximum ultimate trip currents on all three poles simultaneously.

c. Voltage drop (see 3.8).

TABLE VII. Duty cycle for endurance tests (seconds).

Resistive ac or dc		Inductive ac or dc		Motor 1/ ac or dc		Lamp 2/ ac or dc	
ON	OFF	ON	OFF	ON	OFF	ON	OFF
3.0 ±.5	3.0 ±.5	1.0 ±.05	4.0 ±.1	.5 ±.09	4.5 ±.1	2 ±.05	15 ±2

1/ Duration of the specified inrush current shall be 0.07 ±0.02 second, after which it shall be reduced to its rated motor load for the remainder of the "ON" period.

2/ Duration of the specified inrush current shall be 0.015-0.020 second, after which it shall be reduced to its rated lamp load for the remainder of the "ON" period.

4 7.9.1 AC loads. During the ac endurance tests, the voltage shall be 120 ±5 volts and the frequency shall be 400 ±20 Hz.

a. Resistive load: Testing shall be accomplished at rated load with a power factor between .9 and unity.

b. Inductive load: Testing shall be accomplished at rated load with a 0.7 ±0.05 lagging power factor.

c. Motor load: The RCCB shall make five times rated load and break rated load.

d. Lamp load: Lamp operation shall make 12 times rated load and break the rated load.

4.7.9.2 DC loads. During the dc endurance tests, the voltage shall be 30 ±2 volts.

a. Resistive load: Resistive operation shall be accomplished at rated load

b. Inductive load: Inductive operation shall be accomplished at rated load. Inductive dc load shall use MIL-I-81023 inductors.

c. Motor load. Motor operation shall make six times rated load and break rated load.

d. Lamp load: Lamp operation shall make 12 times rated load and break rated load.

4.7.10 Terminal strength (see 3.13). RCCB's shall be tested in accordance with method 211 of MIL-STD-202. The following details and exceptions shall apply:

a. Test conditions. A and E The tensile load specified in table VIII shall be applied to each terminal and to the mounting nut in the X and Y axes (see figure 2) for a period of 1 minute; then the torque value specified in table VIII shall be applied in a clockwise direction to the nut or screw head about the thread axis for a period of 1 minute.

b Inspection after test: Verify compliance with 3.13.

TABLE VIII. Terminal strength forces.

Stud or screw size (inch)	Tensile load (pounds)	Design torque (inch-pounds)	Recommended installation torque (inch-pounds)
.164	25	15	9
.190	30	30	18
.250	30	60	36

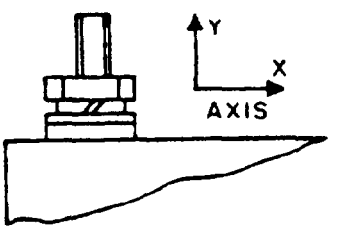


FIGURE 2. Terminal strength test.

4 7 11 Vibration (see 3 14). RCCB's shall be tested in accordance with method 204 of MIL-STD-202. The following details and exceptions shall apply:

a. Mounting Normal mounting means.

b. Temperature: Each test shall be repeated three times, once at 25°C ±5°C, and at the applicable high and low operating temperatures (see 3.1).

c. Electrical load conditions. One of the RCCB's shall be tested in the open position. The remainder of the RCCB's shall be tested in the closed position carrying no current and then with all poles carrying rated current (90 percent rated current at high temperature) during and 30 minutes prior to testing.

d. Test condition. C.

e. Measurements during vibration: When testing with contacts carrying current, monitor for trip indication only. When testing without current, RCCB's shall be monitored as specified in test condition A, test circuit B, method 310 of MIL-STD-202 to determine opening of closed main contacts (and auxiliary contacts, as applicable) and closing of open main contacts (and auxiliary contacts, as applicable).

f. Inspection after vibration: RCCB's shall be inspected for evidence of mechanical and electrical damage and shall be subjected to the 200 percent overload calibration test (triple pole RCCB's shall be subjected to 200 percent overload on all three poles simultaneously at 25°C) (see 4.7 4).

4 7.11.1 Vibration scan for group B inspection (see 3.14.1). Vibration testing shall consist of two scans of the vibration levels specified for method 204 of MIL-STD-202, test condition C. Both scans shall be performed at 25°C. The scans shall consist of:

a. The RCCB closed and carrying rated current to check for trip

b. The RCCB open to check for contact closures in excess of 10 X 10^{-6} seconds

Each time the test is run, the RCCB shall be mounted in a different axis from the previous test.

4.7.11.2 Vibration scan for group C inspection (see 3.14.1). Vibration testing shall consist of two scans of the vibration levels specified for method 204 of MIL-STD-202, test condition C. The scans shall consist of:

a. The RCCB closed and carrying rated current to check for trip

b. The RCCB open to check for contact closures in excess of 10 X 10^{-6} seconds

The RCCB shall be vibrated in this manner in each of the three mutually perpendicular axes. Each time group C inspection is run, a different ambient temperature shall be used (i.e., -54°C the first time, +25°C the second time, and +71°C the third, then repeat cycle).

4 7 12 Moisture resistance (see 3.15) RCCB's shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply·

a. Initial measurements: Not applicable.

b. Electrical load conditions: RCCB's shall be closed with no power applied.

c. Step 7b: Vibration is not required.

d Final measurements: On removal from the chamber, the RCCB shall be manually shaken to remove excess water and then permitted to stabilize at room temperature for 45 minutes. RCCB's shall be subjected to the following series of tests.

(1) 1000 percent overload calibration at 25°C (see 4.7.4).

(2) Stabilize for 1 hour at room temperature.

(3) Trip-free calibration at 25°C (see 4.7.24) except use 400 percent overload.

(4) Stabilize for 2 hours at room temperature.

(5) 200 percent overload calibration at 25°C (see 4.7.4).

(6) Stabilize for 4 hours at room temperature.

(7) Dielectric withstanding voltage (see 4.7.2)

4.7.13 Thermal shock (see 3.16). RCCB's shall be tested in accordance with method 107 of MIL-STD-202. The following details and exceptions shall apply.

a. Test condition: A-1 (except that cycling shall be continuous and the high temperature shall be 71°C ±5°C).

b. Inspection after cycling: RCCB's shall be inspected for evidence of mechanical damage.

4.7.14 Shock (specified pulse) (see 3.17). RCCB's shall be tested in accordance with method 213 of MIL-STD-202. The following details shall apply

a. Mounting method: Normal mounting means.

b. Test condition· J (except peak value shall be 25 g's).

c Electrical load conditions· The RCCB shall be subjected to three separate shocks in each of two directions in each of the three principle axes for each of the following conditions

(1) With the RCCB in the closed position and carrying rated current for 30 minutes prior to and during the test.

(2) With the RCCB in the closed position with no load

(3) With the RCCB in the open position.

d. Measurements during shock: When testing with contacts carrying rated current, monitor for false trip only. When testing without current, RCCB's shall be monitored as specified in test condition A, test circuit B, method 310 of MIL-STD-202, to determine opening of closed main contacts (and auxiliary contacts, as applicable) and closing of open main contacts (and auxiliary contacts, as applicable).

e. Inspection after shock: RCCB's shall be inspected for evidence of mechanical and electrical damage and shall be subjected to the 200 percent overload calibration test (triple pole RCCB's shall be subjected to 200 percent overload on all three poles simultaneously at 25°C) (see 4.7.4).

4.7.15 Coordination (see 3.18). RCCB's shall be tested in two phases at specified below to verify compliance with 3.18.

a. Coordination at overload conditions: The pairs of RCCB's specified in table IX shall be connected in series and subjected to overloads of 400, 1000, and 2000 percent of the current rating of the lower rated RCCB.

b. Coordination at interrupt currents: The pairs of RCCB's specified in table IX shall be connected in series and subjected to the maximum interrupt current for each voltage rating. The test for each combination shall consist of applying the fault current three successive times with a minimum period of 10 minutes allowed between applications of current.

TABLE IX Coordination test pairs.

Lower rating (amperes)	Higher rating (amperes)	Frame size (amperes)
5	10	100
25	50	
50	100	
5	10	25
10	20	

4.7.16 Electromagnetic interference (see 3.19). RCCB's shall be tested in accordance with MIL-STD-461, class ID. The following exceptions shall apply:

a. Test requirements CS02, RE02, and RS03: The frequency range shall be 14 kHz to 400 MHz.

b. Test ~~requirement (T)RS04 and CE05: Not required~~.

4.7.17 Transient susceptibility (see 3.20). RCCB's shall be subjected to a discharge across the line and load terminals from a 1-microfarad capacitor charged to 600 volts. This shall be done when the RCCB is in the closed position carrying rated current and in the open position. A 50-ohm resistor shall be connected in series with the capacitor to act as a source impedance during the discharge cycle. The line source impedance may not exceed 50 ohms. This procedure shall be repeated four times within 1 minute with the capacitor connected in one polarity and then repeated four times within 1 minute with the capacitor connected in the opposite polarity.

4.7.18 Explosion (see 3.21). RCCB's shall be tested in accordance with method 109 of MIL-STD-202. The following details and exception shall apply

a Mounting method. Normal mounting means.

b Electrical loading. RCCB's shall be energized with rated voltage and current and be operated for 30 operations.

c. Testing: The test shall be conducted at sea level only and all sample units may be tested together in the explosion chamber

4.7.19 Sand and dust (see 3.22). RCCB's shall be tested in accordance with method 110 of MIL-STD-202. The following details shall apply:

a. Mounting method: RCCB's shall be mounted by normal means on a dummy panel.

b. Test condition: A.

c. Electrical loading: RCCB's shall be in the set position.

d. Measurements: RCCB's shall be subjected to the 400 percent trip-free calibration test and the 200 percent overload calibration test at 25°C (triple pole RCCB's shall carry 200 percent overload on all three poles simultaneously) (see 4.7.4).

4 7.20 Salt spray (corrosion) (see 3 23). RCCB's shall be tested in accordance with method 101 of MIL-STD-202. The following details shall apply:

a. Test condition: B.

b. Measurements after exposure: Within 10 minutes after the test, the RCCB shall be washed for 5 minutes with running water not warmer than 37.8°C accompanied by a slight brushing and dried for 6 hours in a forced-air oven at approximately 57°C. RCCB's shall be subjected to and shall satisfactorily clear a 200 percent of rated current overload and shall then be subjected to the 200 percent overload calibration test at room ambient temperature (see 4.7 4) (triple pole RCCB's shall carry 200 percent overload on all three poles simultaneously).

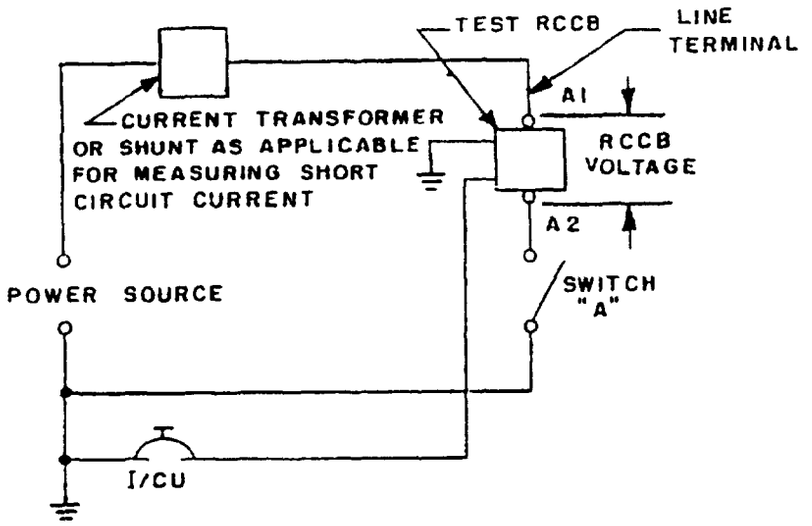
4.7.21 Interrupting capacity (see 3.24). For the interrupting capacity tests, the RCCB shall be so connected to the power source that the currents specified (see table X) are provided at the RCCB terminals. The test circuit of figure 3 shall be used. The open circuit voltage before application of the interrupting current and the open circuit recovery voltage shall be the value specified in table X. Oscillographic records of current, voltage, and time shall be obtained. The RCCB shall be subjected to the interrupting capacity tests in table X as specified (see 3.1) and shall close on and open with the interrupting currents and voltages specified. After each interruption, the open circuit voltage specified in table X shall be maintained across the RCCB for a minimum of 5 seconds. There shall be sufficient time to permit proper cooling and reset between each cycle of operation. Under no circumstances shall an interrupting test be repeated within 5 minutes of the previous test.

Following the last operation of each test, the RCCB at room ambient shall be subjected to the dielectric withstanding voltage test (see 4.7.2) and the 200 percent overload calibration test (see 4.7.4); triple pole RCCB's shall carry 200 percent overload on all three poles simultaneously. Each pole of triple pole RCCB's in turn shall be subjected to this test while the other poles are carrying rated current. For triple pole RCCB's, one operation shall be performed for each test altitude specified. Upon completion, the RCCB shall again be subjected to this test while each of the poles are simultaneously carrying 60 +10, -0 percent of the single phase fault current specified (see 3.1).

TABLE X. Interrupting capacity test procedures

Test designation	Test description 1/	Operations 2/	System	Open circuit voltage (volts)	Calibrated fault current (amperes)	Transient rms voltage after calibrated fault current interruption (volts)
A	Available current short circuit interruption (ac)	2 CO at sea level 2 CO at 50,000 feet	'Y' connected 400 Hz 115/200 volts	120 ±5	Current specified (see 3.1) in 10 to 25 cycles after fault initiation Power factor .4 to .5 lagging	120 within 3 cycles 150 within 6 cycles 165 maximum
B	Available current close-in interruption (ac)	2 OCO at sea level 2 OCO at 50,000 feet				
C	Available current short circuit interruption (dc)	2 CO at sea level 2 CO at 50,000 feet	28 V dc	30 ±2	Current specified (see 3.1) in 0.01 to 0.03 second after fault initiation	28 within 0.002 second 50 maximum
D	Available current close-in interruption (dc)	2 OCO at sea level 2 OCO at 50,000 feet				
E	Instantly available intermediate current interruption (ac)	1 CO at 50,000 feet 3/ 1 OCO at sea level 3/	'Y' connected 400 Hz 115/200 volts	120 ±5	20 x rated current 1000% 750% 500%	120 within 3 cycles 165 maximum
F	Instantly available intermediate current interruption (dc)	1 CO at 50,000 feet 3/ 1 OCO at sea level 3/	28 V dc	30 ±2		28 within 0.002 second 50 maximum
G	Available current short circuit (ac) for 3-pole RCCB's only	1 CO at sea level 1 CO at 50,000 feet	'Y' connected 400 Hz 115/200 volts	Single phase 120 ±5	Current specified (see 3 1) in 10 to 25 cycles after fault initiation. Power factor .4 to .5 lagging	120 within 3 cycles 150 within 6 cycles 165 maximum
		1 CO at sea level 1 CO at 50,000 feet		3-phase 205 ±5		205 within 3 cycles 255 within 6 cycles 280 maximum
H	Available current close-in interruption (ac) for 3-pole RCCB's only	1 OCO at sea level 1 OCO at 50,000 feet		Single phase 120 ±5		120 within 3 cycles 150 within 6 cycles 165 maximum
		1 OCO at sea level 1 OCO at 50,000 feet		3-phase 205 ±5		205 within 3 cycles 255 within 6 cycles 280 maximum

1/ See 6.5 7, 6.5.8, and 6.5.9.
2/ CO is an operation in which the RCCB is closed before initiation of the fault.
OCO is an operation in which the fault is initiated, and the RCCB is closed to complete the fault.
3/ For each value of fault current specified



AC or dc short interrupt test
Connect terminals A1 and A2 together and close switch "A".
Adjust the current to the specified value (see table XI).
Open switch "A" and connect the RCCB between terminals A1 and A2.
Close the I/CU (thereby closing the RCCB).
Close switch "A".

AC or dc close-in interrupt test
Connect terminals A1 and A2 together and close switch "A".
Adjust the current to the specified value (see table XI).
Open switch "A" and connect the RCCB between terminals A1 and A2.
Open the I/CU (RCCB open).
Close switch "A".
Close the I/CU (thereby closing the RCCB).

NOTE. Interrupt current shall be measured by a current transformer or shunt as indicated and suitable recording oscillograph. The voltage across the RCCB shall be recorded simultaneously with interrupt current and at the point indicated.

FIGURE 3. Interrupting capacity test circuit.

4.7.22 Resistance to solvents (see 3.25). RCCB's shall be tested in accordance with method 215 of MIL-STD-202. The following detail and exception shall apply.

a Portion to be brushed All marking areas

b Solvent solutions. The solvent solutions used in this test shall be in accordance with table XI

TABLE XI. Resistance to solvents.

Solvent	Test fluid	Solvent	Test fluid
1	MIL-L-7808	7	Solvent (a) specified in method 215 of MIL-STD-202
2	MIL-L-23699		
3	AS 1241A(USAF)	8	Solvent (b) specified in method 215 of MIL-STD-202
4	MIL-A-8243 (or ethylene glycol)		
5	MIL-C-87936 (diluted for cleaning)	9	Solvent (c) specified in method 215 of MIL-STD-202
6	MIL-T-5624		

4.7.23 Operation. Power shall be applied to the RCCB and operated by the I/CU as specified below The main contact position shall be continuously monitored for operation as specified in 3.26

Applicable to ac-dc RCCB's.

a. Apply 115 volts, 400 Hz to single pole and 200 volts line to line 400 Hz, 3 phase grounded neutral to three pole RCCB line terminals and 28 V dc to back-up terminals, then manually close and open the I/CU.

b. Remove line power then manually close and open the I/CU.

c. Reapply line power and remove back-up power, then manually close and open the I/CU.

d. Single pole RCCB's only: Apply 28 V dc to line terminal and 115 volts, 400 Hz to back-up terminal, then manually close and open the I/CU.

e. Three pole RCCB's only. Disconnect back-up power and connect 115 volts, 400 Hz to one phase then manually close and open the I/CU

f Remove all power, then manually close the I/CU.

g. Reapply all power.

Applicable to ac or dc only RCCB's:

Perform test as specified in a. through g above, except use the same voltage and phase for both line and back-up power.

4.7 24 Trip-free calibration (see 3 27). With the I/CU terminal connected directly to the ground, the RCCB shall be subjected to the maximum limit of ultimate trip calibration test. The ground shall remain connected for a minimum of 10 minutes after tripping of the RCCB occurs

4 7.25 High temperature cycling (see 3 28) (Group A inspection only, see table IV). The RCCB shall be stabilized at 71°C ±5°C for 1 hour. The RCCB shall then be closed and opened fifty times via the I/CU at a rate of 3 ± 5 seconds Mechanical closing and opening of the RCCB shall be monitored via the main contacts.

5 PACKAGING

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

5.1.1 Level A.

5 1.1.1 Cleaning RCCB's shall be cleaned in accordance with MIL-P-116, process C-1

5.1.1.2 Drying. RCCB's shall be dried in accordance with MIL-P-116.

5.1.1.3 Preservative application. Contact preservatives shall not be used.

5.1.1.4 Unit packs. Each RCCB shall be individually unit packed in accordance with the submethod of IA-8 of MIL-P-116 insuring compliance with the applicable requirements of that specification. Each unit pack shall be placed in a supplementary container conforming to variety 2 of PPP-B-566 or PPP-B-676

5.1.1.5 Intermediate packs. Intermediate packs are not required.

5.1.2 Level B. The requirements for level B shall be as specified for level A except that submethod IC-1 or IC-3 of MIL-P-116 shall be substituted for submethod IA-8 and any variety of the supplementary container specified may be used (see 5.1.1.4).

5.1 3 Level C. The level C preservation for RCCB's shall conform to the MIL-STD-2073-1 requirements for this level

5.2 Packing. Packing shall be level A, B, or C, as specified (see 6 2).

5.2.1 Level A. RCCB's, preserved as specified in 5.1, shall be packed in wood boxes conforming to PPP-B-601, overseas type or PPP-B-621, class 2. Closure and strapping shall be in accordance with the applicable container specification except that metal strapping shall conform to QQ-S-781, type I, finish A. The requirements for level B packing shall be used when the total quantity of a stock numbered RCCB for a single destination does not exceed a packed volume of 1 cubic foot (0.0283 cubic meter).

5.2.2 Level B. RCCB's, preserved as specified in 5.1, shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistant, style optional, special requirements. The requirements for box closure, waterproofing, and reinforcing shall be in accordance with method V of the PPP-B-636 appendix.

5 2.3 Level C RCCB's, preserved as specified in 5.1, 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.

5.2.4 Unitized loads Unitized loads, commensurate with the level of packing specified in the contract or order, shall be used whenever total quantities for shipment to one destination equal 40 cubic feet (1.1328 cubic meters) 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. RCCB's, packed as specified in 5.2.1, shall be unitized on pallets in conformance with MIL-STD-147, load type I, with a wood cap (storage aid 5) positioned over each load

5.2.4.2 Level B. RCCB's, packed as specified in 5.2.2, shall be unitized as specified in 5.2.4.1 except that weather resistant fiberboard caps (storage aid 4) shall be used in lieu of wood caps.

5 2.4 3 Level C. RCCB's, packed as specified in 5.2.3, shall be unitized as specified in 5.2.4.2, except that the fiberboard caps shall be class domestic.

5.3 Marking. In addition to any special or other identification marking required by the contract (see 6.2), each unit, supplementary and exterior container, and unitized load shall be marked in accordance with MIL-STD-129. The complete military or contractor's type or part number, as applicable (including the CAGE), shall be marked on each unit and supplementary pack in accordance with the identification marking provisions of 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 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 4.6.3.

5.4.3 Army acquisitions.

5.4.3.1 Levels A and B packing. When the gross weight exceeds 200 pounds (90.72 kilograms) or the container length and width is 48 by 24 inches (121.92 by 60.96 centimeters) or more and the weight exceeds 100 pounds (45.36 kilograms), 3 by 4 inches (7.62 by 10.16 centimeters) skids (laid flat) shall be applied in accordance with the requirements of the container specification. Unitization shall be required when the containers specified in 5.2.1 and 5.2.2 do not require skids; quantities per destination exceed either a total of 250 pounds or 113.4 kilograms (excluding the pallet) or a volume of 20 cubic feet (0.5664 cubic meter); and the container size permits use of one of the pallet patterns of MIL-STD-147. A quantity of containers, packed as specified except that container strapping may be omitted, shall be placed on a pallet, load type I, conforming to MIL-STD-147. For level B, unit containers which meet these requirements may be palletized without further packing. The pallet shall conform to NN-P-71, type IV, group I or II woods. The load shall be bonded to the pallet by strapping conforming to QQ-S-781, type I, finish A, or shrink film conforming to L-P-378, type IV. Stretch wrap in accordance with MIL-STD-147 is authorized for shipments within the continental United States and for containerized shipments.

6. NOTES

6.1 Intended use.

6.1.1 RCCB's. RCCB's combine the basic features of a relay (contactor) and circuit breaker. This design permits RCCB's to be located adjacent to the load or power source and controlled and monitored from a remote location such as from a cockpit or flight deck. Control wiring can be of light gauge thereby eliminating the need for long runs of heavy cable.

6.1.2 Packaging requirements. The preservation, packing, and marking specified herein are intended for direct shipments to the Government. Unless otherwise designated, the level C packaging provisions herein are also intended for the preparation of these RCCB's for shipment from the parts manufacturer to non-Government activities.

6.2 Ordering data. Acquisition documents should specify the following.

a. Title, number, and date of this specification.

b. Title, number, and date of the applicable specification sheet, and the complete part number.

c. Levels of preservation and packing required (see 5.1 and 5.2).

d. If special or other identification marking is required (see 5.3).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, 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 Air Force Acquisition Logistics Division, Electronic Support Division, AFALD-PTS, however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center, Dayton, OH 45444 (ATTN: DESC-EQ). Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

6.4 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 XII. Table XII 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 XII based on a potential difference of 0.25 volt maximum. To simplify any arithmetic involved, table XII 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 XII 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 XII by the graphs at the right. Members of groups connected by lines will form permissible couples. The "0" indicates the most cathodic member of each series, the "8" 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 sheltered 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 XII. In this case, other metals or plates will be required. It should be noted that, in intermetallic couples, the member with the high 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 attack 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 XII, they are to be plated with those metals that will reduce the potential difference to that allowed by table XII.

6 5 Definitions.

6.5 1 Tripping time (see 3 4.3 and 3 7). Tripping time is the total interval of elapsed time from the instant of applying a given overcurrent to the RCCB to the completion of the interruption of the circuit.

TABLE XII 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 alloy; 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.

6 5.2 Tripping time delay (see 3.4 3) Tripping time delay is the delay factor purposely designed into the tripping time of an RCCB

6.5.3 Line terminal (see 3.4.5.1). The terminal attached to the isolated stationary main contact of the RCCB 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

6.5.4 Auxiliary contacts (see 3.4.5.2). Auxiliary contacts are those mechanically interlocked with and operated by the main contacts of the RCCB, and intended for use in monitoring circuits for signaling, electrical interlocking, or other purposes.

6.5.5 Ultimate trip current (see 3.7). Ultimate trip current is the smallest value of current that will cause tripping of the RCCB under a given set of ambient conditions.

6.5.6 Ultimate trip limits (see 3.7). The specified limits of ultimate trip currents are maximum ultimate trip current and minimum ultimate trip current. At the maximum specified ultimate trip current, the RCCB will open within the specified time, and at the minimum specified ultimate trip current the RCCB will not open.

6.5 7 Available short circuit and close-up interrupt capacity tests. Tests using a voltage regulated circuit in which the calibrated fault current is obtained after the regulator has provided maximum excitation.

6 5 8 Instantly available short circuit and close-in interrupt capacity tests. Tests during which the calibrated fault current is essentially constant from fault application to interruption. This type of test is generally conducted with a fixed excitation power supply.

6.5.9 Instantly available intermediate short circuit close-in interrupt capacity tests. Tests in which the fault current is limited by resistance and is essentially constant from fault application to interruption.

6.5.10 Bimetal. Two metals, each having a different temperature coefficient of expansion, attached together to form a bending motion with a change of temperature.

6.5.11 Discrete semiconductor. Those semiconductor devices having a single functional characteristic; i.e., diode transistor, SCR, FET, etc., and are acquired in conformance to specified performance criteria.

6.5.12 Monolithic microcircuit (or integrated circuit). A microcircuit consisting exclusively of elements formed in situ on or within a single semiconductor substrate with at least one of the elements formed within the substrate.

6.5.13 Hybrid microcircuit. A microcircuit consisting of elements which are a combination of the film microcircuit type (see 6.5.14) and the semiconductor types (see 6.5.11 and 6 5.12) or a combination of one or both of the types with discrete parts.

6.5.14 Film microcircuit (or film integrated circuit). A microcircuit consisting exclusively of elements which are films formed in situ upon an insulating substrate.

6.6 Conditions for use of level B preservation. When level B preservation is specified (see 5.1.2), this degree of protection should be used for the acquisition of RCCB's for resupply worldwide under known favorable handling, transportation, and storage conditions.

6.7 Warning.

6.7.1 Potential test procedure hazards. 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.

6.7.2 Aircraft and equipment maintenance hazards. The standard safe response time is 12 milliseconds maximum (see 3.9). Some of the slash sheets have a response time in excess of 12 milliseconds up to a maximum of 50 milliseconds. On these devices, extra precaution should be taken to protect maintenance personnel from shock For example, if maintenance proceeds under power-down conditions and the I/CU lines are being manipulated, maintenance personnel can suddenly be exposed to electrical shock for up to 50 milliseconds if power-up occurs. This exceeds the accepted maximum industry standard of 12 milliseconds.

6 8 Application note Coordination between devices supplied by different manufacturers should be verified by the user.

6.9 Operating principle. The RCCB is basically the marriage of a relay and a circuit breaker and allows the utilization of each identity singularly or in combination. The RCCB is normally located in the most direct line possible between the source and load. It operates in conjunction with I/CU which is a small 1/2 ampere device which can be located convenient to operating personnel. When the RCCB trips from an overload, a current pulse in turn trips the I/CU. To reset the RCCB, the I/CU is manually closed. The I/CU is normally located some distance from the RCCB and connected via light gauge wire, thereby eliminating long runs of heavy wire. The line impedance plus the I/CU impedance must not exceed 7.5 ohms. The RCCB can be operated as a relay via the manual operation of the I/CU. Back-up control power can be used to operate the RCCB in the event of loss of main power. NOTE: The I/CU is not furnished with the RCCB.

6 10 Changes from the previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

6.11 Subject (key word) listing.

Remote control
Circuit breakers
Remote control circuit breaker
Thermal
Trip-free

CONCLUDING MATERIAL

Custodians
Army - ER
Navy - AS
Air Force - 85

Review activities.
Army - ME
Air Force - 99
DLA - ES

User activities:
Army - AT, AV, MI

Preparing activity:
Air Force - 85

Agent
DLA - ES

(Project 5925-0195)

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(See Instructions – Reverse side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-C-83383C	CIRCUIT BREAKERS, REMOTE CONTROL, THERMAL, TRIP-FREE

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

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording

c. Reason/Rationale for Recommendation

6. REMARKS

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

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