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 6.8).

2. APPLICABLE DOCUMENTS

2.1 Government specification 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-585	-	Box, Wood, Wirebound.
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: Air Force Acquisition Logistics Division, Electronic Support Division (AFALD-PTS), 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 And Splice, Crimp-Style, Copper.
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-25769	-	Cleaning Compound, Aircraft Surface, Alkaline Waterbase.
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-H-83306	-	Hydraulic Fluid, Fire Resistant, Phosphate Ester Base, Aircraft.
MIL-C-83383/1	-	Circuit Breakers, Remote Control, Thermal, Trip-Free, Series Trip, Single Pole (5 to 100 Amperes).
MIL-C-83383/2	-	Circuit Breakers, Remote Control, Thermal, Trip-Free, Series Trip, Single Pole, Auxiliary Contacts (5 to 100 Amperes).
MIL-C-83383/4	-	Circuit Breakers, Remote Control, Thermal, Trip-Free, Series Trip, Triple Pole, Auxiliary Contacts (5 to 100 Amperes).

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 on 40" x 48" Pallets.
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-794	-	Parts and Equipment, Procedures for Packaging and Packing of.
MIL-STD-1188	-	Commercial Packaging of Supplies and Equipment.
MIL-STD-1285	-	Marking of Electrical and Electronic Parts.
MIL-STD-1549	-	Common Termination System for Electrical and Electronic Parts.
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.
MS35206	-	Screw, Machine-pan Head, Cross-Recessed, Carbon Steel, Cadmium, Plated, UNC-2A.

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

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 qualified 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. Metals shall be of a corrosion-resistant type or shall be suitably plated or treated to resist corrosion (see 3.23). 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.

3.3.1.1 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. Critical semiconductor 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.

3.3.7 Discrete semiconductor devices (see table I). Critical 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.

3.3.8 Microcircuits (see table I). Monolithic microcircuits shall be selected in accordance with MIL-M-38510, class B of MIL-STD-883, wherever possible. Nonstandard microcircuits and hybrid devices may be used provided they meet the requirements as shown in table I.

3.3.9 Electrostatic damage (ESD) protection. Electronic devices subject to ESD shall be protected against ESD during manufacture of the RCCB.

TABLE I. Quality levels for semiconductors and microcircuits.

Circuits and components 1/		Screening levels
Discrete MIL		MIL-S-19500 JAN
Non-MIL		Screen to JANTX 2/
Sealed monolithic circuits	MIL	MIL-M-38510 class B level of MIL-STD-883
	Non-MIL	Screen to class B level of method 5004, MIL-STD-883 3/
Sealed hybrid circuits		MIL-STD-883, method 5008 class B 3/
All unsealed components/circuits		MIL-STD-883, method 5004 4/ 5/, class B 3/

1/ Circuit and component definitions in accordance with MIL-M-38510.

2/ Screen to JANTX or to the extent which satisfies the end item performance requirements and product characteristics.

3/ Screen to class B or to a suitable program previously submitted to the qualifying activity.

4/ Internal visual inspection in accordance with MIL-STD-883, method 2017, except delete constant acceleration and seal tests.

5/ Temperature cycling in accordance with MIL-STD-883 in unsealed components/circuits is not required provided the finished RCCB, with the device installed, is equivalently temperature cycled.

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 Altitude. 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 per 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 II). All poles of triple pole RCCB's shall trip under all "must trip" conditions.

3.8 Voltage drop. The voltage drop across the auxiliary contact terminals shall not exceed .250 volts. 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

TABLE II. 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	-54	No trip 3/
	150 5/		1 hour max
	100	+71	No trip 3/
	138		1 hour max
Unbalanced overload 4/	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/ Triple pole RCCB's only.

5/ Or 160 percent as specified (see 3.1).

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

4.1.1 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 4.6).

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

TABLE III. Materials inspection.

Material	Requirement paragraph	Applicable specification
Metal plating - - -	3.3.1	QQ-P-416 or QQ-Z-325
Plastics- - - - - -	3.3.2	MIL-M-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 IV. 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 IV. 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 IV, 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 IV. 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 a report at 36-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of the following:

a. 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.

b. A summary of the results of tests performed for periodic inspection (groups B and 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 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 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 V, 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 V. 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.

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 4.6.2.2.4), 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 VI, 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 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.

4.6.2.1.1 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 VI 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 VII, in the order shown. Group C inspection shall be made on sample units selected from lots which have passed group A inspection.

TABLE VI. 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.

4.6.2.2.1 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.

4.6.3 Inspection of packaging. The sampling and inspection of the preservation and interior pack marking shall be in accordance with the groups 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.

TABLE VII. 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 load.
5/ This test is performed on a rotating basis, see 4.[illegible]1.

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 in 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.

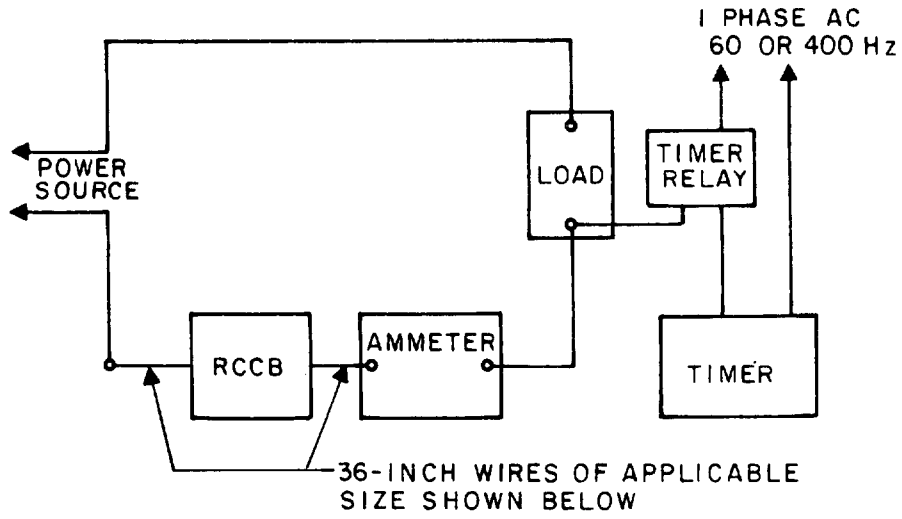
4.7.4.1 Qualification and periodic inspection.

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 incl.	18
11 to 15 incl.	16
16 to 20 incl.	14
21 to 25 incl.	12
26 to 40 incl.	10
41 to 50 incl.	8
51 to 60 incl.	8
61 to 90 incl.	6
91 to 120 incl.	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 II). 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 II).

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 II 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 VIII. 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).

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.

TABLE VIII. 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.

4.7.10 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 IX 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 IX 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 IX. Terminal strength forces.

Stud or screw size (inch)	Tensile load (pounds)	Torque (pound-inches)
.164	25	15
.190	30	30
.250	30	60

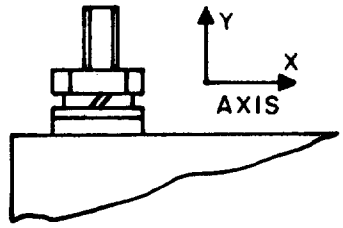


FIGURE 2. Terminal strength test.

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 10×10^{-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 10×10^{-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 energized at rated current, voltage, and frequency (see 3.1).

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 X 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 X 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 X. 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 XI) 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 XI. Oscillographic records of current, voltage, and time shall be obtained. The RCCB shall be subjected to the interrupting capacity tests in table XI 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 XI 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).

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:

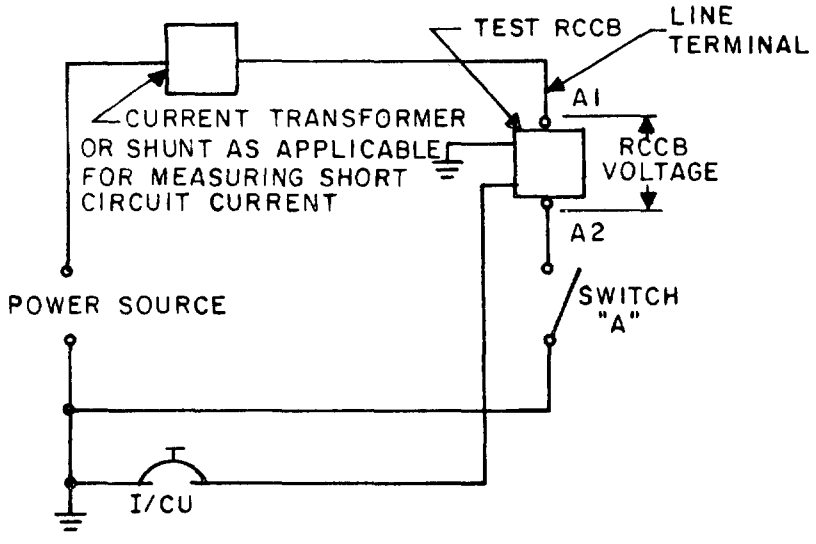
a. Portion to be brushed: All marking areas.

b. Solvent solutions: The solvent solutions used in this test shall consist of the following:

TABLE XI. 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 seconds after fault initiation	28 within 0.002 seconds 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 seconds 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 Circuit 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.

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	MIL-H-83306	8	Solvent (b) specified in method 215 of MIL-STD-202
4	MIL-A-8243 (or ethylene glycol)		
5	MIL-C-25769 (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 one hour. The RCCB shall then be closed and opened five 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 6.1).

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. RCCB's shall be individually unit packed in accordance with the submethods of MIL-P-116 specified herein insuring compliance with the applicable requirements of that specification.

5.1.1.4.1 Single pole RCCB's. Single pole RCCB's shall be preserved in accordance with submethod IA-8. Each unit pack shall be placed in a supplementary container conforming to PPP-B-566 or PPP-B-676.

5.1.1.4.2 Triple pole RCCB's. Triple pole RCCB's shall be preserved in accordance with submethod IIc. Each unit pack shall be placed in a supplementary container conforming to PPP-B-636.

5.1.1.5 Intermediate packs. Intermediate packs are not required.

5.1.2 Level C. The level C preservation for RCCB's shall conform to the MIL-STD-794 requirements for this level.

5.2 Packing. Packing shall be level A, B, or C, or as specified (see 6.1).

5.2.1 Level A. The packaged RCCB's shall be packed in wood boxes conforming to PPP-B-601, overseas type; PPP-B-621, class 2 or PPP-B-585, class 3. Closure and strapping shall be in accordance with the applicable container specification.

5.2.2 Level B. The packaged RCCB's 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. The level C packing for RCCB's shall conform to the MIL-STD-794 requirements for this level.

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 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 MIL-STD-794 except that conformance to MIL-STD-147 is not required.

5.3 Marking. In addition to any special or other identification marking required by the contract (see 6.1), 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 (including the FSCM), as applicable, shall be marked on all unit and intermediate packs in accordance with the identification marking provisions of MIL-STD-129. Bar code markings are also required.

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 4.6.3.

5.4.3 Army acquisitions.

5.4.3.1 Level A supplementary containers. All supplementary containers shall be either weather (or water) resistant or overwrapped with waterproof barrier materials (see 5.1.1.4.1 and 5.1.1.4.2).

5.4.3.2 Level A packing. In addition to that specified in 5.2.1, 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.

5.4.3.3 Level A and B unitization. Palletization shall be necessary when skids are not required (see 5.4.3.2), when quantities per destination exceed either a total of 250 pounds (excluding the pallet), or when the volume equals 20 cubic feet or more and the container size permits the use of one of the pallet patterns of MIL-STD-147. A quantity of containers, packed as specified in 5.4.3.2, except that the container strapping may be omitted, shall be placed on a pallet, load type I, conforming to MIL-STD-147. The pallet shall conform to NN-P-71, type IV, using group I or II woods. The loads 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 all containerized shipments.

6. NOTES

6.1 Intended use. 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 gage thereby elimination the need for long runs of heavy cable.

6.1.1 Packaging. The preservation, packing and marking specified herein are intended for direct shipments to the government. However, this specification may also be used for the preparation of RCCB's for shipment from the parts contractor to the original equipment manufacturer.

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).

6.3.1 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 "●" 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.

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.

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 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.

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.

6.6 Warning.

6.6.1 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.

6.6.2 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.

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

6.8 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 gage 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.

6.9 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.

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

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

User activities:
Army - MI, AV, AT

Agent:
DLA - ES

Preparing activity:
Air Force - 85

(Project 5925-0150)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE

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

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)*

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

DD FORM 82 MAR 1426 PREVIOUS EDITION IS OBSOLETE