SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS5692

Issued 2004-10

ARC Fault Circuit Breaker (AFCB), Aircraft, Trip-Free Single Phase 115 VAC, 400 Hz - Constant Frequency

FOREWORD

Thermal circuit breakers are designed to react to the heating effect of current carried by wire; and to protect the wire insulation from thermal damage. These protective devices are not designed to detect or react to the short duration of arcing faults that typically occur outside (before approaching) the defined trip region, or Time versus Current curve, of the thermal circuit breakers.

In addition, arc impedance can reduce low voltage fault current magnitudes appreciably. AFCBs combine active arc fault detection with thermal overload protection into one package. Supplemented with the arc fault detection, the AFCB provides an equivalent level of thermal protection of existing thermal circuit breakers (typically qualified under AS58091), with the added ability to detect and react to arc fault conditions, thereby mitigating damage that will occur to the wiring system by protracted arcing events.

It is important to note that the primary purpose of the AFCB as stated above is to mitigate damage to the aircraft wiring from the circuit breaker to the first serial load element (examples: LRU, transformer, ballast, rectifier, or connected equipment, etc.). In doing so, the potential of igniting surrounding materials is reduced, but not eliminated. Use of AFCBs for hazard mitigation/prevention beyond its intended function of mitigating damage to the aircraft wiring should be carefully analyzed and evaluated.

NOTE: AS58091 was used as the base document for this AFCB specification as such the tables comprehend future amp rating expansion from 1 to 100A.

TO PLACE A DOCUMENT ORDER:
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1. SCOPE:

The primary function of this specification is to cover the general requirements for manual reset trip-free arc fault/thermal circuit breakers for use in aircraft electrical systems conforming to MIL-STD-704. As a secondary function, this specification may possibly cover the general requirements for AFCBs for use in primary vehicles, other than aircraft, when mounted directly to the structure.

1.1 Classification:

AFCBs shall be the Thermal Type, and classified into different styles. Variations from the basic style of each AFCB shall be indicated by the part number from the appropriate specification sheet (see 3.1).

1.1.1 Styles: AFCB styles shall consist of all part numbers covered by one Aerospace Standard or specification sheet. For example:

a. All part numbers of AS5692/1 shall be the same style.

b. All part numbers of AS5692/2 shall be the same style.

The same style classification applies to all Aerospace Standards and specification sheets covered by this specification.

1.1.2 Part Number: The part numbers for AFCBs in accordance with this specification shall conform to part number scheme below. Alphanumeric characters shall be used to designate variations from the basic style of each circuit breaker.

Example of part number scheme

AS56921/1-DA5VL

|	|	| | | |	_____	Pushbutton	(1.2.4)
|	|	|	|	_____	High Vibration Capability	(1.2.6)
|	|	| |		_____	Auxiliary Terminals	(1.2.5)
|	|	|		_____	Amperage Rating	(1.2.3)
|	|	_____			Random Vibration Capability	(1.2.6)
|	_____					Basic part style AS5692/1	(1.2.1)

1.1.2 (Continued):

When a designator for a variation is not applicable it shall be omitted from the part number. Not all letters are applicable for every specification sheet. Refer to the latest specification sheet and QPL for available and qualified configurations.

1.1.3 Amperage Ratings: The amperage rating designator shall be a number specified in each specification sheet to indicate the nominal amperage rating for overload protection.

1.1.4 Pushbuttons: The AFCB pushbutton shall be designated as follows. Standard length pushbutton, as specified in the specification sheet shall have no designator letter.

L - Extra length pushbutton (see 6.3.8)

1.1.5 Auxiliary Switch Terminals: The use of auxiliary switch terminals when allowed by the specification sheet shall be designated as follows. AFCBs with standard terminals only, as specified in the specification sheet, shall have no designator letter.

A - Auxiliary switch terminals

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

V - High Level sine capabilities (see 4.7.11.3).

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

1.1.7 Mounting Configurations: Unless otherwise specified, the AFCB mounting configuration shall be designated as follows. Standard bushing mounted circuit breakers shall have no designator.

P - Cover-plate mount.

2. APPLICABLE DOCUMENTS:

2.1 Government Specifications, Standards and Handbooks:

2.1.1 The following specifications, standards and handbooks form a part of this specification to the extent specified herein.

MIL-I-24768/17	Insulation, Plastic, Laminated, Thermosetting, Glass-Cloth, Silicone-Resin (GSG)
MIL-DTL-81381	Wire, Electric, Polyimide Insulated, Copper or Copper Alloy
MIL-E-17555	Electronic and Electrical Equipment, Accessories, and Provisioned Items (Repair Parts); Packaging of
MIL-HDBK-454	General Guidelines for Electrical Equipment
MIL-I-24768/1	Plastic Sheet, Laminated, Thermosetting, Glass cloth Melamine Resin
MIL-STD-104	Limit for Electrical Insulation Color
MIL-STD-1285	Marking of Electrical and Electronic Parts
MIL-STD-1916	DOD Preferred Methods for acceptance of Product
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-704	Aircraft Electrical Power Characteristics
MIL-STD-810	Environmental Engineering Considerations and Laboratory Tests
MIL-STD-889	Dissimilar Metals
MIL-W-5086	Wire, Electric, Polyvinyl Chloride Insulated, Copper or Copper Alloy

2.1.1 (Continued):

MIL-W-81044 Wire, Electric, Crosslinked Polyalkene, Cross linked Alkane-Imide Polymer, or Polyarylene, Insulated, Copper or Copper Alloy

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

2.2 Other Publications:

The following document(s) form a part of this specification to the extent specified herein.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 635 Plastics, Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

ASTM D 5948 Molding Compounds, Thermosetting

(Copies available from ASTM, 100 Barr Harbor, West Conshohocken, PA 19428-2959.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

AS4373 Test Methods for Insulated Electric Wire

ARP4754 Certification Consideration for Highly Intergrated or Complex Aircraft Systems

ARP4761 Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment

AS7928 Terminals, Lug and Splice, Crimp Style, Copper, General Specification for

AS8879 Screw Threads, Standard, Optimum Selected Series, General Specification for

AS22759 Wire, Electric, Fluoropolymer Insulated, Copper or Copper Alloy

AS22759/34 Wire, Electric, Fluoropolymer Insulated, Copper or Copper Alloy

AS25036 Terminal, Lug, Crimp Style, Copper, Insulated, Ring Tongue, Bell Mounted, Type II, Class 1

AS27212 Terminal Strip

2.2 (Continued):

AS50881	Wiring Aerospace Vehicle
AS58091	Circuit Breakers, Trip-Free, Aircraft General Specification For

(Copies available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

OTHER

A-A-52080 through A-A-52084	Tape, Lacing and Tying
AIA/NAS NASM 25027	Nut, Self-Locking, 250 deg. F, 450 deg. F, and 800 deg. F
ANSI/ASC (Z1.4)	Procedure and Tables for Inspection by Attributes
DOD/MIL-STD-100	Engineering Drawing Practices
ISO 10012-1	Calibration Laboratories and Measuring Test Equipment – General Requirement
ANSI/NCSL Z540-1	Calibration Laboratories and Measuring Test Equipment – General Requirement
RTCA/DO-160D	Environmental Conditions and Test Procedures for Airborne Equipment
RTCA/DO-178B	Software Consideration in Airborne Systems and Equipment Certification
RTCA/DO-254	Design Assurance Guidance for Electronic Hardware

Copies of DOD adopted non-Government Standards are available to Military activities through the DOD Single Stock Point, Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

(Military activities may obtain copies of non-DoD adopted documents from the sponsoring Industry Association Non-military activities may obtain copies of non-Government standards and publications from the American Society of Quality Control, P.O. Box 3066, Milwaukee, WI 53201-3066 and the American National Standards Institute, 1430 Broadway, New York, NY 10018, as appropriate.)

ANSI – National Conference of Standard Labs, 1800 30th Street, Suite 305B, Boulder, Colorado 80310.

2.2 (Continued):

RTCA Inc. – 1828 L Street, NW, Suite 805, Washington, DC 20036.

ISO – International Organization for Standardization Case, Postale 56, Geneva Switzerland.

2.3 Order of Precedence:

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

3. REQUIREMENTS:

3.1 Specification Sheets:

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

3.2 Qualification:

The AFCBs furnished under this specification shall be products that are authorized by the Qualifying Activity for Listing on the applicable Qualified Products List (see 4.5 and 6.2).

3.2.1 First Article Inspection: AFCBs furnished under this specification not covered by specification sheets or not qualified at the time of set for opening bid shall be subjected to the tests specified in 4.5.

3.3 Materials:

Suitable materials shall be used that will enable the AFCBs to conform to the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guarantee of the acceptance of the finished product.

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

3.3.2 Metal: All metals used in the construction of AFCBs shall be corrosion resistant or shall be suitably protected to resist corrosion. The use of dissimilar metals, especially contacts between brass, copper, 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 AFCB.

3.3.3 Plastics: Plastic materials used in the housing, insulator base, and any internal parts exposed to arcing or surface creepage shall conform to ASTM D 5948 or equivalent and shall not exhibit any deleterious impact on AFCB performance during normal operation or qualification testing. Plastic materials used by the manufacturer must exhibit evidence of satisfactory performance 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 (as defined on the specification sheet or specification sheet), or explosions of gaseous vapors to which the materials may be subjected in service. Plastic materials with cellulose fillers will not be permitted in parts that may be subjected to arcing or surface creepage. Plastic materials used shall be certified to exhibit a minimum ignition time of 90 seconds and a maximum extinguishing time of 90 seconds when tested for flammability in accordance with ASTM D 635.

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

3.3.5 Selection of Materials: Specifications and standards for all materials, parts and Government certification and approval of processes and equipment, which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with MIL-STD-970.

3.3.6 Cleaning prior to final assembly: The circuit breakers shall be thoroughly cleaned of loose, spattered, or excessive solder, metal chips, and other foreign material. Burrs, sharp edges and resin flash shall be removed.

3.3.7 Electronic Components: Electronic components selected shall be such that the AFCB shall meet performance requirements and product characteristics specified herein.

3.4 Design and Construction:

3.4.1 General: AFCBs shall conform to the applicable specification sheet.

3.4.2 If the design of the arc fault circuit breakers contains software or complex hardware, as a minimum, the software and hardware shall be developed in accordance with RTCA/DO-178B, level C and RTCA/DO-254, level C, respectively.

3.4.3 Mounting Means: The AFCB shall be provided with a suitable mounting means as shown on the applicable specification sheet. If self-locking nuts are used, they shall meet the performance requirements of AIA/NAS NASM 25027. AFCBs that utilize a mounting nut and lockwasher are generally supplied with the mounting nut and lockwasher. AFCBs that utilize a mounting faceplate are generally supplied without the associated mounting screw.

3.4.4 Actuator of Push-Pull AFCBs: The portion of the actuator visible when the AFCB is in the closed position shall be colored in accordance with the specification sheet and shall expose a white band when in the open or thermally tripped position. If a secondary indication for an arc fault trip condition is provided, it shall be in accordance with the specification sheet. The exterior portion of the actuator shall be insulated from all current-carrying parts. The actuator shall not work out to an intermediate position, give a false trip indication, or be removable from the AFCB. An intermediate position is a position where the white band of the actuator is partially or fully exposed yet the circuit breaker remains in the ON (closed) position. Push-pull AFCBs shall be designed to permit manual opening of the circuit breaker by pulling out the actuator.

3.4.5 Terminals: Terminal construction shall be as specified on the applicable specification sheet and shall be designed for use with terminal lugs conforming to AS25036 and AS7928.

3.4.5.1 Terminal Hardware: Lockwashers captive to the terminal screws shall be supplied only when specified on the applicable specification sheet. AFCBs may be supplied without terminal hardware, with terminal hardware supplied in bulk, or packaged separately, according to customer instructions.

3.4.6 Housing: The AFCB mechanisms shall be enclosed in a housing securely attached to the insulator base and to the mounting plate when one is used. The housing may be integral with the insulator base.

3.4.7 Ratings: The ratings of push-pull AFCBs shall be as specified on the applicable specification sheet. Ratings of ½ amp shall be clearly indicated, i.e. 7 ½ or 7.5, not 7 (where the ½ or 0.5 would be implied) unless specified on the specification sheet.

3.4.8 Trip Indication and Reset: The AFCBs shall be so designed that when the AFCB contacts open automatically on fault condition (thermal overload or arc fault trip), the actuator shall indicate the operation by moving to the tripped position, as shown on the applicable specification sheet. The white color specified on the applicable specification sheet for the trip indicator on a push-pull shall conform to Class 1 of MIL-STD-104. AFCBs shall have an indication to distinguish between a thermal overload and an arc fault trip when required by the specification sheet.

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

3.4.9 Arc Fault Trip Free Mechanism: If an arc fault trip indication is required by the specification sheet, the mechanism for arc fault trip indication shall be so designed that retaining the indicator in the closed position after automatic tripping occurs shall not adversely affect subsequent performance of the AFCB.

3.4.10 Position: AFCBs shall operate satisfactorily when mounted in any axis or plane.

3.4.11 Mounting Screw Clearance: The mounting screws shall be capable of being screwed into the AFCB a minimum depth, as shown on the applicable specification sheet. The mounting nuts shall be backed or provided with other means to prevent mounting screws of excess length from interfering with the operation of the circuit breaker. Screws of excess length shall not fracture the housing or the explosion-preventative seal.

3.4.12 Creepage and Clearance Distance: The minimum creepage path and the minimum clearance between current-carrying parts and any part of the current breaker other than insulating materials, and also between current-carrying parts of opposite polarity, shall be 3/16 and 1/8 inch respective.

3.4.13 Tamper-Proof Calibration: AFCBs shall be so constructed that tampering with the calibration is not possible without dismantling the device or breaking a seal.

3.4.14 Ambient Temperature: Unless otherwise specified (see 3.1), AFCBs shall be designed to provide thermal protection within one of the following continuous ambient temperature conditions:

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

The electronics of the AFCB shall comply with RTCA/DO-160 as specified herein or per the applicable specification sheet.

Condition C -55 to 85 °C

3.4.15 Grounding: AFCBs shall be grounded as required per the specification sheet. The AFCB shall meet all specification requirements with 2 ohms or greater resistance to ground unless otherwise specified in the applicable specification sheet.

3.4.16 Bonding: AFCBs shall provide a provision for bonding and verification as required by the specification sheet.

3.5 Interchangeability:

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

3.6 Screw Threads:

Screw threads on removable or replaceable threaded parts shall be as specified in MIL-S-8879. Threading of non-metallic parts is not permitted.

3.7 Performance:

The AFCBs shall perform satisfactorily when subjected to tests specified in Section 4, and there shall be no breakage, malfunction, or evidence of any damage that would impair the ability of the AFCBs to meet the requirements of the specification.

3.7.1 Examination of Product: The AFCBs shall show no evidence of defects when examined in accordance with 4.7.1.

3.7.2 Dielectric Withstanding Voltage: The AFCBs shall exhibit no evidence of breakdown or subsequent malfunction when tested in accordance with 4.7.2, 4.7.2.1, and 4.7.2.2.

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

3.7.4 Strength of Actuator: AFCB actuators shall not show evidence of breaking, cracking or jamming when tested in accordance with 4.7.4.1 or 4.7.4.2. The AFCB shall also meet the perforance requirements defined when tested in accordance with 4.7.4.3.

3.7.5 Strength of Threaded Parts: The threaded parts of the AFCB shall be tested in accordance with 4.7.5. Upon completion of the test, the threaded parts of the AFCB shall not be damaged.

3.7.6 Operating Force: The force necessary for operation of the AFCB shall be within the limits specified on the applicable specification sheet when tested in accordance with 4.7.6. The minimum operating force shall not be less than 15 percent of the specified maximum value unless otherwise specified on the applicable specification sheet.

3.7.7 Calibration: The AFCB's thermal overload and arc fault trip performance shall be within the limits specified on the applicable specification sheet, and 4.7.7, when tested and calibrated in accordance with 4.7.7.

3.7.8 Endurance: The AFCB shall make and break the specified current without failure as defined in the applicable specification sheet when tested in accordance with 4.7.8.

3.7.9 Overload and Arc Fault Cycling: The AFCB shall make and break the test cycles specified without failure, when tested in accordance with 4.7.9.

3.7.10 Reclosing: Manual reset AFCBs shall remain open after being tripped automatically for one hour showing no electrical continuity when tested in accordance with 4.7.10.

3.7.11 Vibration: The AFCBs shall be tested in accordance with 4.7.11 with the vibration levels and test conditions specified in the applicable specification sheet. If no vibration level is specified in the applicable specification sheet, the sine vibration with test condition A shall be performed (see 4.7.11.2). The AFCB main contacts shall not trip or show any electrical discontinuity in excess of 10 microseconds, nor shall the arc fault circuit cause a trip. Upon completion of the vibration test, AFCBs shall show no evidence of physical damage and shall meet the requirements of the 200% overload calibration test performed at 25 °C in accordance with 4.7.7.3, the guillotine test in accordance with 4.7.7.6.1, Source A, Circuit 2, and the dielectric withstanding voltage test in accordance with 4.7.2.

3.7.12 Mechanical Shock: The AFCB main contacts shall not change state when tested in accordance with 4.7.12. Upon completion of the test, the device under test (DUT) shall meet the requirements of 200% overload calibration of 4.7.7.3 at 25 °C, and the guillotine test when tested in accordance with 4.7.7.6.1, Source A, Circuit 2.

3.7.13 Acceleration: The AFCB main contacts shall not change state when tested in accordance with 4.7.13. Upon completion of the test, the DUT shall meet the requirements of 200% overload calibration of 4.7.7.3 at 25 °C, and the guillotine test when tested in accordance with 4.7.7.6.1, Source A, Circuit 2.

3.7.14 Interrupting Capacity: The AFCB performance shall be as specified in the applicable specification sheet when tested in accordance with 4.7.14 and 4.7.14.1. During the interrupting capacity tests the AFCB may fail safe. For the purpose of this test, an AFCB that has failed safe is a device that is unable, because of electrical damage, to carry a continuous current or an electrical load. In addition, for an AFCB that has failed safe, with the AFCB in the closed or reset position, the leakage current between the load and line terminal(s) shall be less than 1 milliamp at 300 VAC, unless otherwise specified by the individual specification sheet. Unless the DUT enters a fail-safe condition, following the last operation of this test, the circuit breaker shall meet the requirements for dielectric withstanding voltage (4.7.2) and 200% overload calibration at 25 °C per 4.7.7.3, the allowable circuit breaker tripping time shall be within 120% of the upper limit specified the applicable specification sheet, and there shall be no dielectric breakdown. The DUT shall also meet the requirements of the guillotine test when tested in accordance with 4.7.7.6.1, Source A, Circuit 2. NOTE: The ground connection must be restored for post testing after testing to 4.7.14.1.

3.7.14.1 In the case that an AFCB has failed safe, the design of the fail safe point cannot affect other performance characteristics, such as higher level overloads specified on the applicable specification sheet, to the extent that the device does not meet other performance requirements of this specification or the applcable specificaiton sheet.

3.7.15 Sand and Dust: The AFCB performance shall be as specified in this specification when tested in accordance with 4.7.15. At the conclusion of this test, the circuit breaker shall be held in at 500% of rated load, thus causing the DUT to trip free. Failure to trip within 10 seconds shall constitute failure. The DUT shall meet the requirements for 200% overload calibration at 25 °C when tested in accordance with 4.7.7.3. The DUT shall also meet the requirements of the guillotine test when tested in accordance with 4.7.7.6.1, Source A, Circuit 2.

3.7.16 Corrosion: The AFCB performance shall be as specified in this specification when tested in accordance with 4.7.16. At the conclusion of this test, the DUT shall be held in at 500% of rated load, thus causing the DUT to trip free. Failure to trip within 10 seconds shall constitute failure. The DUT shall then meet the requirements for 200% overload calibration, per 4.7.7.3, at 25 °C, except that the tripping time shall be within 80% of the lower limit and 120% of the upper limit specified. All hardware shall be removable without damage to the DUT or hardware. The DUT shall also meet the requirements of the guillotine test when tested in accordance with 4.7.7.6.1, Source A, Circuit 2.

3.7.17 Moisture Resistance: The AFCB performance shall be as specified in this specification when tested in accordance with 4.7.17.

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

3.7.19 Voltage Drop: Voltage drop across the AFCB greater than that specified on the applicable specification sheet shall constitute failure when tested in accordance with 4.7.19. Voltage drop shown on the specification sheet is a beginning of life value, unless otherwise indicated on the specification sheet.

3.7.20 Transit Drop: The AFCB performance shall be as specified in this specification when tested in accordance with 4.7.20. Upon completion of the test there shall be no damage to the DUT through handling and manipulation of the breaker as detected by visual inspection that compromises device performance (including but not limited to chips or cracks in the circuit breaker housing; while cosmetic damage may be deemed as acceptable). In addition, each DUT shall be tested in accordance with and meet the requirements of 4.7.2, 200% overload calibration at 25 °C of 4.7.7.3, and guillotine testing per 4.7.7.6.1, Source A, Circuit 2, of this specification.

3.7.21 Temperature and Pressure: The AFCB performance shall be as specified in this specification when tested in accordance with 4.7.21.1, 4.7.21.2, 4.7.21.3 and 4.7.21.4.

3.7.22 Magnetic Effect: The AFCB performance shall be as specified in this specification when tested in accordance with 4.7.22.

3.7.23 Electromagnetic Compatibility: The AFCB shall not trip or otherwise malfunction when tested in accordance with 4.7.23. After signal injection, but prior to first removal of power, each DUT shall be tested in accordance with and meet the requirements of guillotine testing per 4.7.7.6.1, Source A, Circuit 2.

3.7.24 Maximum Power: The AFCB performance shall be within the limits specified on the applicable specification sheet when tested in accordance with 4.7.24.

3.7.25 Power Quality and Interruptions: The AFCB performance shall be as specified in this specification when tested in accordance with 4.7.25.

3.7.26 Reverse Installation: The AFCB performance shall be as specified in the applicable specification sheet when tested in accordance with 4.7.26.

3.8 Markings:

All AFCBs shall be permanently and legibly marked as shown on the applicable specification sheet. The markings shall remain legible during and after all the tests specified in this specification.

3.8.1 Push-Pull Actuators: The exposed end of the push-pull actuator shall be marked with a white, raised or depressed, number indicating the applicable current rating of the AFCB as shown on the applicable specification sheet.

3.8.2 Terminals: The line and load terminals shall be clearly and permanently marked or identified "LINE" or "1," and "LOAD" or "2," adjacent to the terminals, when shown on the applicable specification sheet. A ground point or ground connection shall be clearly and permanently marked or identified "GND" or neutral identified "N." Refer to the specification sheet for other detailed terminal marking instructions.

3.9 Identification of Product:

Each AFCB shall be permanently and legibly marked for identification as follows:

- Part No. (see 1.2.3)
- Manufacturer's name or trademark
- Date code (YYWW) (0212 = week 12 of 2002)

3.10 Workmanship:

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

4. QUALITY ASSURANCE PROVISIONS:

Throughout this section, Device Under Test (DUT) refers to a single phase 115 VAC, 400 Hz AFCB.

4.1 Responsibility for Inspection:

Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the manufacturer may use their own or another facilities' equipment suitable for the performance of the inspection requirements specified herein, unless disapproved by the qualification authority. The qualification authority reserves the right to perform any of the inspections set forth in the specification where such inspections 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 manufacturer's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the manufacturer of the responsibility of assuring that all products or supplies submitted to the qualification authority for acceptance comply with all requirements of the specification. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the qualification authority to accept defective material.

4.1.2 Test Equipment and Inspection Facilities: The manufacturer shall establish and maintain a calibration system in accordance with ISO 10012-1, ANSI/NCSL Z540-1.

4.2 Classification of Inspections:

The inspections specified herein are classified as follows:

- Materials inspection (4.3)
- Qualification (4.5)
- Quality conformance inspection (4.6)

4.3 Materials Inspection:

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

4.4 Inspection Conditions:

Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the General Requirements of MIL-STD-202. If the temperature tolerance is not specified in test conditions, the tolerance shall be ±5 °C. Room temperature is defined as 25 °C ± 2 °C.

4.4.1 Calibration: Calibration tests shall be performed at a temperature specified on the applicable specification sheets with the temperature maintained at a constant value. Test sample units with leads and terminals attached shall be maintained at the specified ambient temperature for 1 hour prior to application of the specified current during all calibration tests. Test circuit may be in accordance with Figure 1. Calibration tests shall be conducted at all voltages and frequencies shown on the specification sheet where applicable.

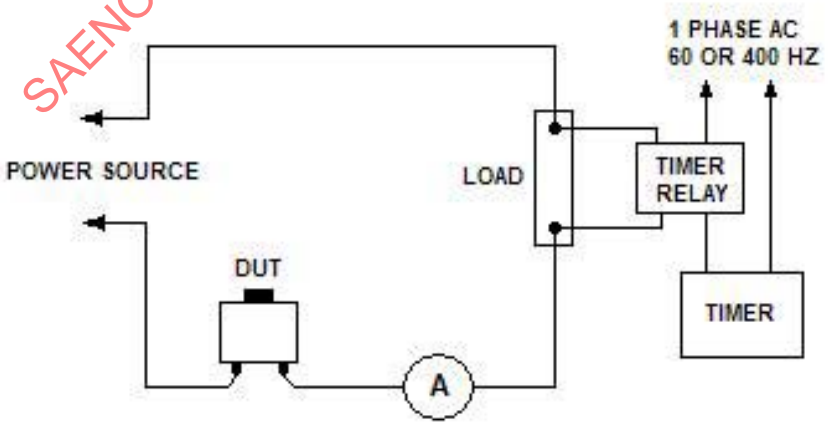


FIGURE 1 – Calibration Test Circuit

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

4.4.2 Thermal Overload: Tests of the thermal overload may be conducted using alternating current at commercial frequencies.

4.5 Qualification Inspection:

Qualification inspection shall be performed at a laboratory acceptable to the qualification authority (6.2) on sample units produced with equipment and procedures normally used in production.

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

4.5.2 Test Routine: The qualification and test samples shall be subjected to the tests specified in Table 2. All sample units shall be subjected to Test Group I then divided as indicated into the various remaining test groups. At the option of the qualifying activity, the environmental tests consisting of vibration, mechanical, shock, acceleration, sand and dust, corrosion and moisture resistance (4.7.11, 4.7.12, 4.7.13, 4.7.15, 4.7.16, and 4.7.17) may be omitted when qualifying additional ratings under a specification sheet provided that two amperage ratings of the same sample style have previously completed these tests satisfactorily. Qualification of additional circuit breaker styles or amperage ratings by similarity to circuit breakers previously qualified may be determined by the qualifying activity.

NOTE: 36 inches minimum of appropriate gage wire with lugs per Table 1 shall extend from each terminal of the DUT.

TABLE 2 – Calibration Test Circuit Components

(a) AFCB capacity (amperes)	Wire Size (AWG designation)	(b)Insulated terminal lug (MS Part Number)
1 and below	20	AS25036-103
2 to 6 included	18	AS25036-103
7 to 10 included	16	AS25036-108
11 to 15 included	14	AS25036-108
16 to 20 included	12	AS25036-112
21 to 25 included	10	AS25036-112
26 to 40 included	8	AS25036-115
41 to 50 included	6	AS25036-119
51 to 60 included	6	AS25036-121
61 to 90 included	4	AS25036-124
91 to 120 included	2	AS25036-127
121 to 150 included	0	AS25036-133
151 to 200 included	00	AS25036-136

NOTE: Test wires shall conform to AS22759, MIL-W-81044, MIL-DTL-81381, or MIL-W-5086. Test terminals shall conform to AS7928. Ammeter: Accuracy within 0.5% at full scale.

(a) For a DUT with nominal amperage ratings between steps of the above Table 1, use the wire of the next large physical wire size.

(b) For Group A or B quality conformance test terminal lead lugs may be spade or electrical spring clamp type provided the electrical resistivity and thermal conductivity are equivalent to AS25036 ring type terminals.

TABLE 2 - Requirements Test Traceability Matrix

Tests and Sample 33 Units	Requirement Paragraph	Test Paragraph
Test Group I – 33 sample units		
Examination of product	3.7.1	4.7.1
Dielectric withstanding voltage	3.7.2	4.7.2
Insulation resistance	3.7.3	4.7.3
Minimum limit of ultimate trip	3.7.7	4.7.7.1
Maximum limit of ultimate trip	3.7.7	4.7.7.2
Overload calibration	3.7.7	4.7.7.3
Guillotine-Source A, Circuit 2	3.7.7	4.7.7.6.1
Test Group II – 1 sample unit		
Voltage drop	3.7.19	4.7.19
Temperature/altitude dielectric strength	3.7.2	4.7.2.2
Trip-free calibration	3.7.7	4.7.7.4
Strength of threaded parts	3.7.5	4.7.5
Mechanical cycling (endurance)	3.7.8	4.7.8.3
Operating force	3.7.6	4.7.6
Test Group III – 1 sample unit		
Voltage drop	3.7.19	4.7.19
Reclosing	3.7.10	4.7.10
Overload & arc fault cycling	3.7.9	4.7.9
Vibration	3.7.11	4.7.11
Corrosion	3.7.16	4.7.16
Test Group IV – 1 sample unit		
Ambient effect on calibration	3.7.7	4.7.7.5
Trip-free calibration	3.7.7	4.7.7.4
Acceleration	3.7.13	4.7.13
Sand and dust	3.7.15	4.7.15
Test Group V – 1 sample unit		
Magnetic Effects	3.7.22	4.7.22
Endurance – Inductive Load (ac)	3.7.8	4.7.8.1.1
Operating force	3.7.6	4.7.6
Test Group VI – 1 sample unit		
Endurance – Resistive load (ac)	3.7.8	4.7.8.1.2
Operating force	3.7.6	4.7.6
Test Group VII – 1 sample unit		
Mechanical shock	3.7.12	4.7.12
Moisture resistance	3.7.17	4.7.17
Operating force	3.7.6	4.7.6
Impact force on push button	3.7.4	4.7.4.3
Strength of actuator	3.7.4	4.7.4

Tests and Sample Units	Requirement Paragraph	Test Paragraph
Test Group VIII – 1 sample unit		
Interrupting capacity (available current short circuit ac)	3.7.14	4.7.14 Table VII-A
Dielectric withstanding voltage	3.7.2	4.7.2
Test Group IX – 1 sample unit		
Interrupting capacity (available current close-in ac)	3.7.14	4.7.14 Table VII-B
Dielectric withstanding voltage	3.7.2	4.7.2
Test Group X – 1 sample unit		
Interrupting capacity (available intermediate current interrupting ac)	3.7.14	4.7.14 Table VII-C
Dielectric withstanding voltage	3.7.2	4.7.2
Test Group XI – 8 sample unit*		
Unwanted Tripping & Operation Inhibition	3.7.7	4.7.7.7
Transit Drop Test	3.7.20	4.7.20
Test Group XII – 1 sample unit		
Interrupting capacity (available current close-in ac)	3.7.14	4.7.14 Table VII-B
Dielectric withstanding voltage	3.7.2	4.7.2
Test Group XIII – 3 sample units		
Strength of actuator	3.7.4	4.7.4
Impact force on push button	3.7.4	4.7.4.3
Test Group XIV – 3 sample unit*		
Reverse Installation	3.7.26	4.7.26
Loose Terminal	3.7.7	4.7.7.6.3
Inductively Coupled Cross Talk Immunity	3.7.7	4.7.7.8
Common Source Feedback Imunity	3.7.7	4.7.7.9
Temperature Pressure Circuit Functionality	3.7.21	4.7.2.2
Electromagnetic Compatability	3.7.23	4.7.23
Maximum Power	3.7.24	4.7.24
Power Quality	3.7.25	4.7.25
Test Group XV – 2 sample unit*		
Guillotine-Source B, Circuit 2	3.7.7	4.7.7.6.1
Guillotine-Source A, Circuit 1	3.7.7	4.7.7.6.1
Guillotine-Source B, Circuit 1	3.7.7	4.7.7.6.1
Test Group XVI – 2 sample unit		
Wet Arc Source A, Circuit 2	3.7.7	4.7.7.6.2
Wet Arc Source B, Circuit 1	3.7.7	4.7.7.6.2

Tests and Sample Units	Requirement Paragraph	Test Paragraph
Test Group XVII – 1 sample unit* Interrupt Capacity – Under Loss of Ground (available intermediate current interrupting ac)	3.7.14	4.7.14.1 Table VII-C
Test Group XVIII – 2 sample units Explosion (ac)	3.7.18	4.7.18.1
Test Group XIX – 1 sample units* Interrupt Capacity – under loss of ground (available current short circuit ac)	3.7.14	4.7.14.1 Table VII-A
Test Group XX – 1 sample unit Interrupt capacity – under loss of ground (available current close-in ac)	3.7.14	4.7.14.1 Table VII-B
Test Group XXI – extra sample units These AFCBs may be used for repetition of any tests considered advisable by the qualification activity		

4.5.3 Retention of Qualification: To retain qualification, the manufacturer shall forward at 36 month intervals to the qualifying activity a summary report of the results of Group A and B tests, indicating as a minimum the number of lots which passed and the number of lots which failed, however a complete test report of Group C tests, including the number and type of failures is required by the qualifying activity. The summary shall include those tests performed during the 36-month period. If the summary of the test results indicate nonconformance with the specification requirements, action shall be taken to remove the failing product from the Qualified Products List. Failure to submit the summary shall result in loss of qualification for that product. In addition to the periodic submission of inspection data, the supplier shall immediately notify the qualifying activity, through the local Government representative, at any time during the 36-month period that the inspection data indicates failure of the qualified product to meet the requirements of the specification. In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If there has been no production during the next reporting period the manufacturer may be required by the qualifying activity to perform Group C testing in accordance with 4.6.6.2 on the products.

4.6 Quality Conformance Inspection:

4.6.1 Inspection of Product for Delivery: Inspection of product for delivery shall consist of Group A inspection. Except as specified in 4.6.2, delivery of product that has passed Group A inspection shall not be delayed pending results of Group B and C inspection.

4.6.1.1 Inspection Lot: An inspection lot shall consist of all the circuit breakers covered by a single style (see 1.2.1) offered for inspection at one time.

4.6.1.1.1 Group A Inspection: Group A inspection shall consist of the examinations and tests specified in Table 3 and shall be made on the same set of sample units.

4.6.1.1.1.1 Sampling Plan: Statistical sampling and inspection shall be in accordance with MIL-STD-1916 for general inspection Level II. The acceptable quality level (AQL) shall be as specified in Table 3. Critical, major, and minor defects shall be as specified in MIL-STD-1916.

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

TABLE 3 - Acceptance Tests

Test	Inspection Level	Requirement Paragraph	Test Paragraph	AQL Percent Defective		
				Critical	Major	Minor
Product Examination	II	3.7.1	4.7.1	.25	.65	4.0
Dielectric withstanding Voltage	II	3.7.2	4.7.2	N/A	1.0	N/A
Calibration (overload at Minimum and maximum Limit of ultimate trip and 200% rated current only at room temperature)	II	3.7.7	4.7.7	N/A	1.0	N/A
Guillotine test	II	3.7.7.6.1	4.7.7.6.1	N/A	1.0	N/A

NOTE: At the manufacturer's discretion, equivalent test methods may be used to demonstrate performance to the guillotine test requirements in Table 3 based on demonstration and acceptance of equivalency by the qualifying activity.

4.6.2 Periodic Inspection: Periodic inspection shall consist of Group B and C inspection.

4.6.2.1 Group B Inspection: AFCBs shall be tested as specified in Table 4 in the order shown.

TABLE 4 - Group B Inspection.

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

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

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

4.6.2.1.3 Disposition of Sample Units: Sample units that have passed Group B inspection may be delivered against open purchase orders.

4.6.2.2 Group C Inspection: AFCBs shall be tested as specified in Table 5 in the order shown.

TABLE 5 - Sampling Plan C Tests

Sample Group	Sample No. of Units	Tests	Requirement Paragraph	Test Paragraph
1	3	Ambient effect on calibration Mechanical cycling (endurance)	3.7.7 3.7.8	4.7.7.5 4.7.8.2
2	3	Voltage drop Endurance – Inductive	3.7.19 3.7.8	4.7.19 4.7.8.1.1
3	3	Interrupting capacity (1)	3.7.14	4.7.14 Table VII-A
4	3	Interrupting capacity (1)	3.7.14	4.7.14 Table VII-B
5	3	Strength of threaded parts Strength of actuator Moisture resistance	3.7.5 3.7.4 3.7.17	4.7.5 4.7.4 4.7.17
6	3	Reclosing Overload and arc fault cycling	3.7.10 3.7.9	4.7.10 4.7.9
7	3	Temperature-altitude Dielectric withstanding voltage Corrosion	3.7.2 3.7.16	4.7.2.2 4.7.16
8	3	Unwanted tripping and operation inhibition Loose terminal Wet Arc Souce A Circuit 2 Wet Arc Source B Circuit 1	3.7.7 3.7.7 3.7.7 3.7.7	4.7.7.7 4.7.7.6.3 4.7.7.6.2 4.7.7.6.2
9	3	Guillotine Source B Circuit 1	3.7.7	4.7.7.6.1

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

4.6.2.2.1 Sampling Plan: For sampling plan C tests (see Table 5) 27 AFCBs representative of each style (see 1.2.2) shall be selected at random each year to be tested in the 36 month interval as authorized by the qualifying activity. Sample units that have been subjected to and have passed sampling plans A and B tests shall be used, unless the qualifying activity considers it more practical to select separate sample units.

4.6.2.2.2 Failures: If one of more sample units fails to pass Group C inspection, the sample shall be considered to have failed. The qualifying activity must be notified of the failure immediatley.

4.6.2.2.3 Disposition of Sample Units: Sample units that have been subjected to Group C inspection are considered to have undergone destructive testing and shall not be delivered against any purchase orders.

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

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

4.7 Inspection:

4.7.1 Examination of Product: Each AFCB shall be inspected to verify that the materials, design, construction, weight, physical dimensions, marking, and workmanship conform to the applicable requirements.

4.7.2 Dielectric Withstanding Voltage: Each DUT shall be tested in accordance with the following:

a. Magnitude of Test Voltage: 1000 volts (rms) plus twice the maximum rated voltage AC at commercial frequencies (1500 volts (rms) minimum).

b. The potential shall be applied at a maximum rate of increase of 250 volts per second, until the test potential is reached, and shall be maintained for 1 minute during qualification tests.

c. Nature of Potential: AC.

d. Points of Application: Between mutually insulated parts.

NOTE: If the line or load terminal and one or more grounding location(s) on the DUT are electrically interconnected through a solid-state module, they must be shorted together during test.

e. Measurement During Test: The DUT shall show no evidence of breakdown, flashover, or current flow in excess of 1.0 milliamperes.

f. During normal quality conformance tests, a potential equal to 120% of the above values may be applied for a duration of 5 seconds.

4.7.2.1 Dielectric Withstanding Voltage Following Another Test: Where the dielectric withstanding voltage is called for following another test, the dielectric test voltage shall be reduced to 75% of the value specified.

4.7.2.2 Temperature-Altitude Dielectric Withstanding Voltage: Sample units shall be subjected to the dielectric withstanding voltage test in accordance with 4.7.2 at the maximum operating altitude and temperature as defined in this specification, or on the applicable specification sheet. The potential applied shall be 500 volts (rms). The temperature and altitude conditions shall be maintained prior to and during application of the test potential.

4.7.3 Insulation Resistance: Each DUT shall be tested in accordance with Method 302 of MIL-STD-202. The following details shall apply:

a. Test condition letter B

b. Points of measurement – between mutually insulated metal parts

NOTE: If the line or load terminal and one or more grounding location(s) on the DUT are electrically interconnected through a solid-state module, they must be shorted together during test.

4.7.4 Strength of Actuator: The DUT shall be tested per 4.7.4.1 or 4.7.4.2, as applicable, and 4.7.4.3 to meet requirements identified in 3.7.4.

4.7.4.1 Actuating Lever Pivot and Lever Stop Strength:

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

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

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

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

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

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

4.7.4.3 Impact Force on Push Button: The DUT shall be subjected to an impact force of 3 pounds from a height of 5 inches.

a. With the push button in the closed or reset position, the circuit breaker shall be mounted by its normal mounting means to a rigid panel with the push button in the upright or longitudinal direction. The impact force shall be applied by dropping a 3 pound weight from 5 inches (±0.1 inches) onto the extremity of the push button. The DUT shall receive three impacts.

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

c. During or after the impact tests the DUT shall be tested in accordance with and meet the requirements of 200% overload calibration test requirements at 25 °C of 4.7.7.3, guillotine testing per 4.7.7.6.1, Source A, Circuit 2, and operating forces per 4.7.6; or the DUT may fail in a safe manner. A failsafe AFCB in this application is defined as a circuit breaker with a broken or jammed push button (a jammed push button is a push button exhibiting high pull-out or reset forces in excess of the specification limits) in either the open or closed position with the contacts either in the open position or unable to carry current, or in the closed position capable of being tripped to the open position by a 200% overload condition within the prescribed time limits shown on the applicable specification sheet. A failsafe AFCB must also satisfy the dielectric withstanding voltage test requirements of 4.7.2.1.

4.7.5 Strength of Threaded Parts: Unless otherwise specified, the force levels shown in Table 6 shall be applied to the nuts and screws or bolts for the terminals and mounting means. If terminals are tested with lead lugs, the lugs shall conform to the type described in Table 1.

TABLE 6 - Strength of Threaded Parts

Terminals		
Stud or screw Size	Tensile load (pounds)	Torque (inch-pounds)
No. 6	25	10
No. 8	25	15
¼ inch	50	60
5/16	70	80
M4	25	15
M8	70	80
Mounting Means		
Stud or screw Size	Axial loads (pounds)	Torque (inch-pounds)
No. 6	30	10
No. 8	35	20
7/16 inch	N/A	40
15/32 inch	N/A	50
M4	35	20
M12	N/A	50

4.7.5.1 Strength of Terminals: The tensile load as specified in Table 6 shall be applied to each terminal successively, in a direction most likely to cause failure, for a period of 1 minute; then the torque value as specified in Table 6 shall be applied to the screw head about the thread axis for 1 minute.

4.7.5.2 Strength of Mounting Means: The axial load as specified in Table 6 shall be applied for 1 minute after which the specified torque shall be applied to the screw head about the thread axis for 1 minute.

4.7.6 Operating Force: The force shall be applied parallel to the line of travel of the actuator. The forces required for operation of the DUT during or as a result of the tests shall be as specified on the applicable specification sheet. The specified operating force shall be applicable with the DUT at room ambient temperature conditions.

4.7.7 Calibration: Each DUT shall be subjected to calibration tests specified in 4.7.7.1 thru 4.7.7.5. Minimum limit of ultimate trip tests (see 4.7.7.1) and maximum limit of ultimate trip tests (see 4.7.7.2) shall be treated as separate tests. Each DUT shall be stabilized at room ambient temperature while carrying no current for a minimum 1 hour before proceeding to the next test.

4.7.7.1 Thermal Minimum Limit of Ultimate Trip: The DUT shall be subjected to the minimum limit of ultimate trip current for the time specified on the applicable specification sheet. For qualification tests only, the temperature rise of the DUT terminals shall be measured at the terminals outside but adjacent to the DUT case. The DUT shall be monitored to determine that it does not trip and unless otherwise specified (see 3.1), the temperature rise shall be measured at the terminals for a rise not to exceed 75 °C, or the value specified in the applicable specification sheet.

4.7.7.2 Thermal Maximum Limit of Ultimate Trip: The DUT shall be subjected to the maximum limit of ultimate trip current for the time specified on the applicable specification sheet and shall be monitored for tripping within the time limits specified.

4.7.7.3 Thermal Overload Calibration: The DUT shall be subjected to the overload calibration shown on the applicable specification sheet, and shall be monitored for operation within the limits specified.

4.7.7.4 Trip-Free Calibration: The external actuator of the DUT shall be held in the closed position and subjected to the calibration test at maximum ultimate trip current per applicable specification sheet. The test shall be repeated using the values of overload calibration current shown on the applicable specification sheet and arc fault guillotine test method Source A, Circuit 2 per 4.7.7.6.1. The external actuator and a mechanical arc fault trip indicator (if so equipped) shall be held in the closed position for 5 minutes after tripping occurs. When released, the appropriate trip indicator shall be displayed. For recycling a trip-free DUT, the DUT may close momentarily during this waiting period, but subsequent performance shall not be adversely affected. The DUT shall be monitored for automatic tripping within the specified limits and for adverse performance in subsequent testing.

4.7.7.5 Ambient Effect on Thermal Calibration: The DUT shall be tested at the ambient temperatures and loads specified on the applicable specification sheet, and shall be monitored for operation within the time limits specified. Tests shall be performed in chambers with the airflow adjusted to the still air environment specified in 4.7.7.5.1.

4.7.7.5.1 Still Air Environment: Still air environment is the area surrounding the DUT within a given chamber where any reduction in air velocity within the area of the DUT would cause a maximum 2 °C rise in temperature. The still air environment for temperature chambers 4 cubic feet and larger shall be obtained by using the fixture shown on Figure 2. Fixture dimensions are shown on Figures 2, 3, and 4. The test fixture shall be placed in the temperature chamber so that the rear lead port of the fixture is facing away from the direct air flow created by the chamber circulating fan. A typical chamber installation is shown in Figure 5. The distance of the rear lead port from the chamber wall shall be determined by first placing a fully loaded fixture beginning at 1 inch from the chamber wall and performing the minimum limit of ultimate trip test at both temperature extremes. The temperature rise inside the fixture shall be monitored during the test. If the internal temperature exceeds the 2 °C limit, the test shall be stopped and the fixture moved away from the chamber wall in small increments, and the procedure repeated, until the fixture internal temperature maintains the temperature gradient of +2 °C within the area of the fixture. During the performance of all calibration tests, a minimum of 18 inches of lead length shall be kept inside the chamber to cancel any of the effects of heat conduction from the circuit breakers through the leads. Alternate means of obtaining the still air environment must be approved by the Qualifying Activity.

For chambers that are less than 4 cubic feet in volume, the fixture dimensions (stated for the chambers that are 4 cubic feet and larger) can be modified and the DUT quantity that can be tested at one time can be reduced in order to meet the still air requirements.

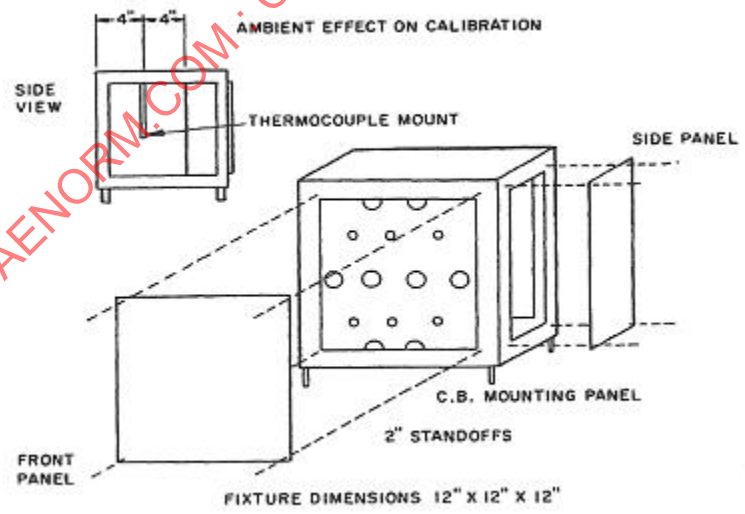


FIGURE 2 - Sample Fixture

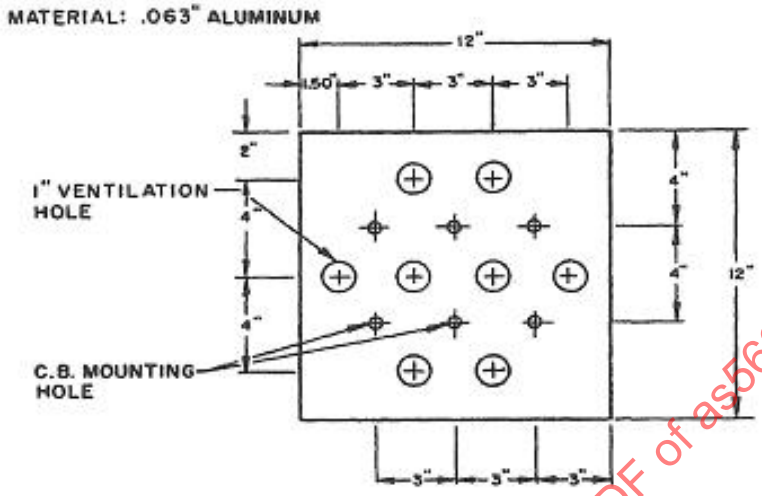


FIGURE 3 - Mounting Panel

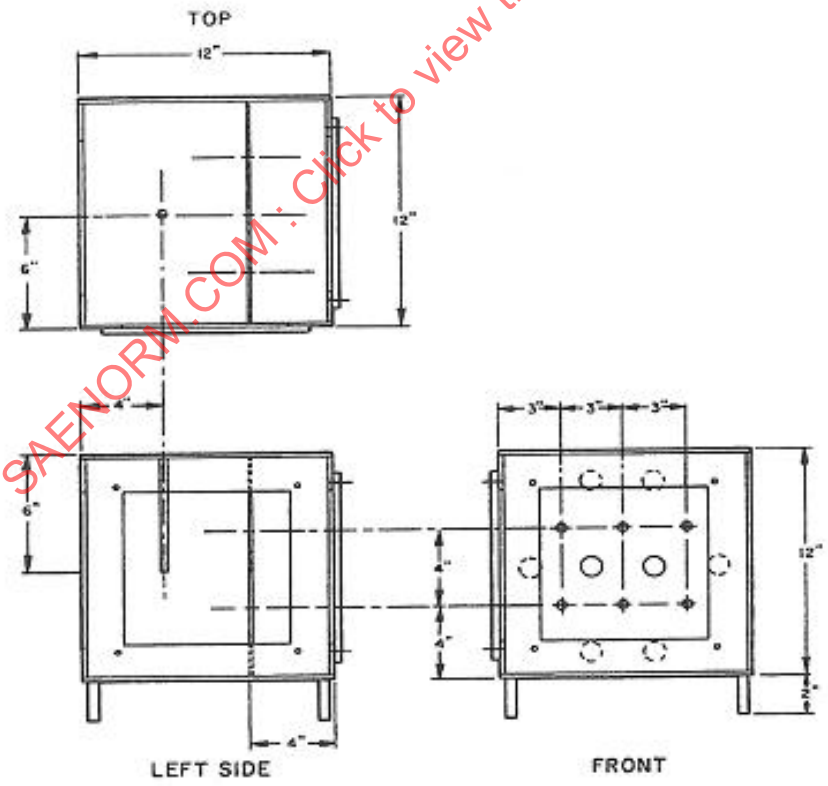


FIGURE 4 - Fixture Dimensions

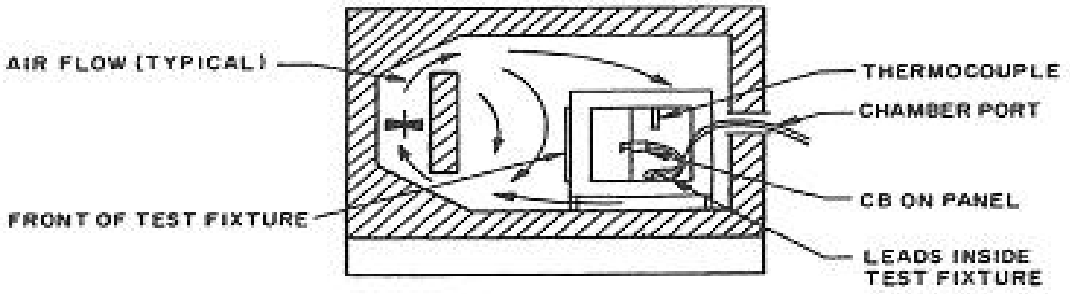


FIGURE 5 - Typical Chamber Installation

4.7.7.6 Arc Fault Detection: All testing is to be conducted with 2 ohms ± .1 ohm of resistance between the DUT ground connection and the actual ground reference unless otherwise specified.

4.7.7.6.1 Guillotine Test: There are two main portions to the set up of the test for guillotine arc testing. The first portion of the set up is targeted towards simulating a range of power sources. The second portion is targeted at simulating different lengths of wire. Each load set up will be run with each source equipment set up, resulting in four tests conducted on each device of each amp rating to be tested.

Two source equipment set-ups will be conducted per Figure 6 below.

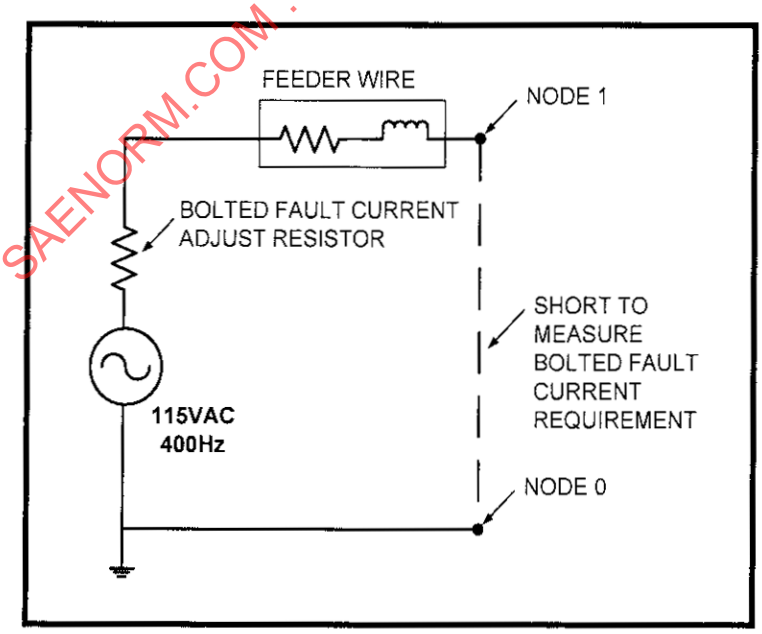


FIGURE 6 - Source Set-Up Circuit

4.7.7.6.1 (Continued):

A source equipment set up shall be defined as a combination of a suitable rotary generator, an appropriate length of feeder wire to ease in set up, and an adjustable resistance that will be used to achieve the bolted fault current required by that particular source equipment set up. The bolted fault current shall be measured when connections node 0 & 1 shown in Figure 6 are electrically shorted together. For example, the feeder wire will be physically flexible enough to connect the nodes 0 & 1 together without adding another resistive member. Two source equipment set-ups, Source A and Source B: are required as defined below.

Source A: This source equipment shall be set up to achieve no more than the maximum bolted fault transient current per the Table 7 below:

Source B: This source equipment test shall be set up to achieve no less than the minimum bolted fault sub transient current per Table 7. The bolted fault sub transient current will differ based on the amp rating of the device being tested.

TABLE 7 - Bolted Fault Transient Currents

Circuit Breaker Rating (Amps)	Source A Low Power Generator (maximum transient fault rms current)	Source B High Power Generator (minimum sub transient fault rms current)
½ - 10	220	390
11 – 20	330	390
21 – 25	330	2000% ($20I_n$)
26 – 40	440	2000% ($20I_n$)
41 – 60	660	2000% ($20I_n$)

The proper test current shall be determined by the following method.

1. From an oscillograph measurement of the bolted fault, measure the peak-to-peak current of the first or second full cycle.

2. Divide the number attained in method 1 above by 2.

3. Divide the number attained in method 2 above by 1.414 to obtain an rms value of sub-transient fault current. This number should be compared to the required value in Table 7, for the appropriate source set-up.

4.7.7.6.1 (Continued):

NOTE: Due to possible DC components in the three phases, the absolute magnitude of sub-transient fault current may exceed the AC rms value. The DC component that causes this increase in absolute current magnitude is not to be considered in the above measurement method.

Load setup: Two load circuit set-ups will be conducted per Figure 7 below.

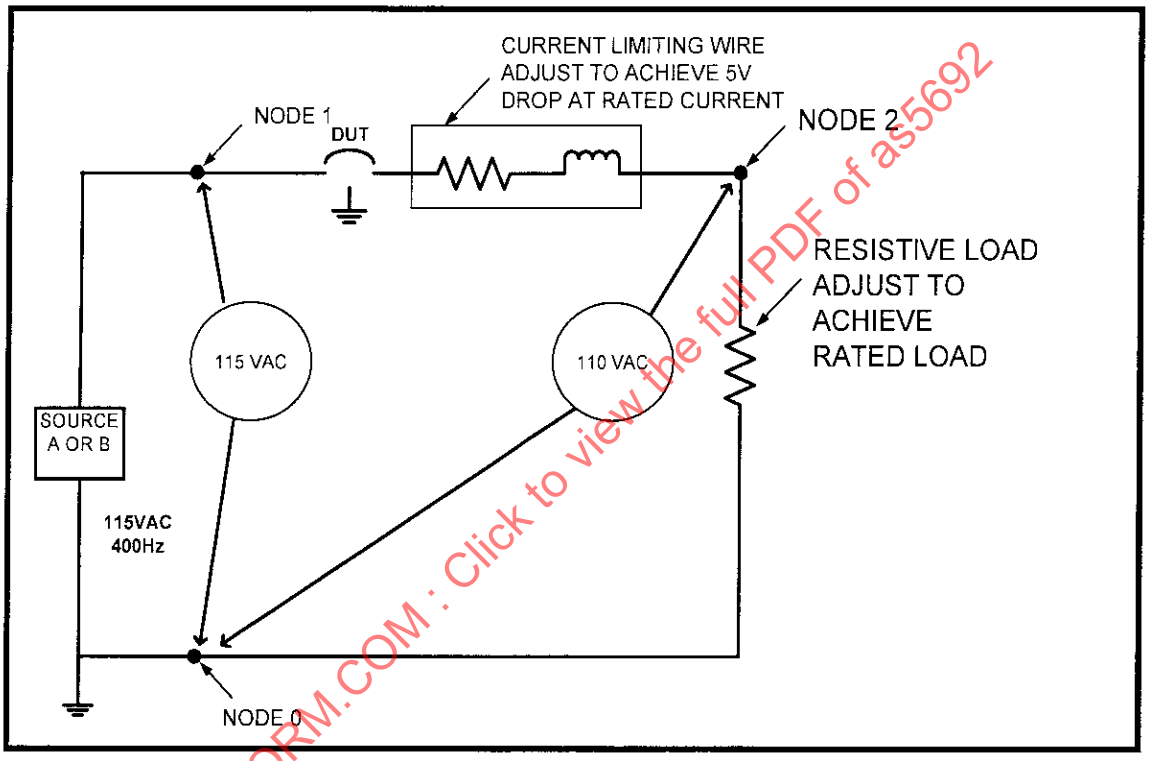


FIGURE 7 - Load Set Up Circuit

A load set up shall be defined as a length of AS22759/34, laid out in a non-inductively coupled manner. Two load circuit set-ups, Circuit 1 and Circuit 2, are required as defined below.

Circuit 1: Use 3 feet ± 3 inches of the proper gauge wire for the amp rating of the DUT.

Circuit 2: A wire length of the proper gauge wire for the amp rating of the DUT, or equivalent, that results in a 5 ± ½ volt drop when a resistive load is applied at rated current. For example when open circuit voltage is 115 ± 5 VAC the voltage drop across the resistive load shall be 110 VAC at rated current, see diagram.

4.7.7.6.1 (Continued)

The four test combinations required shall be configured in accordance with Figure 8.

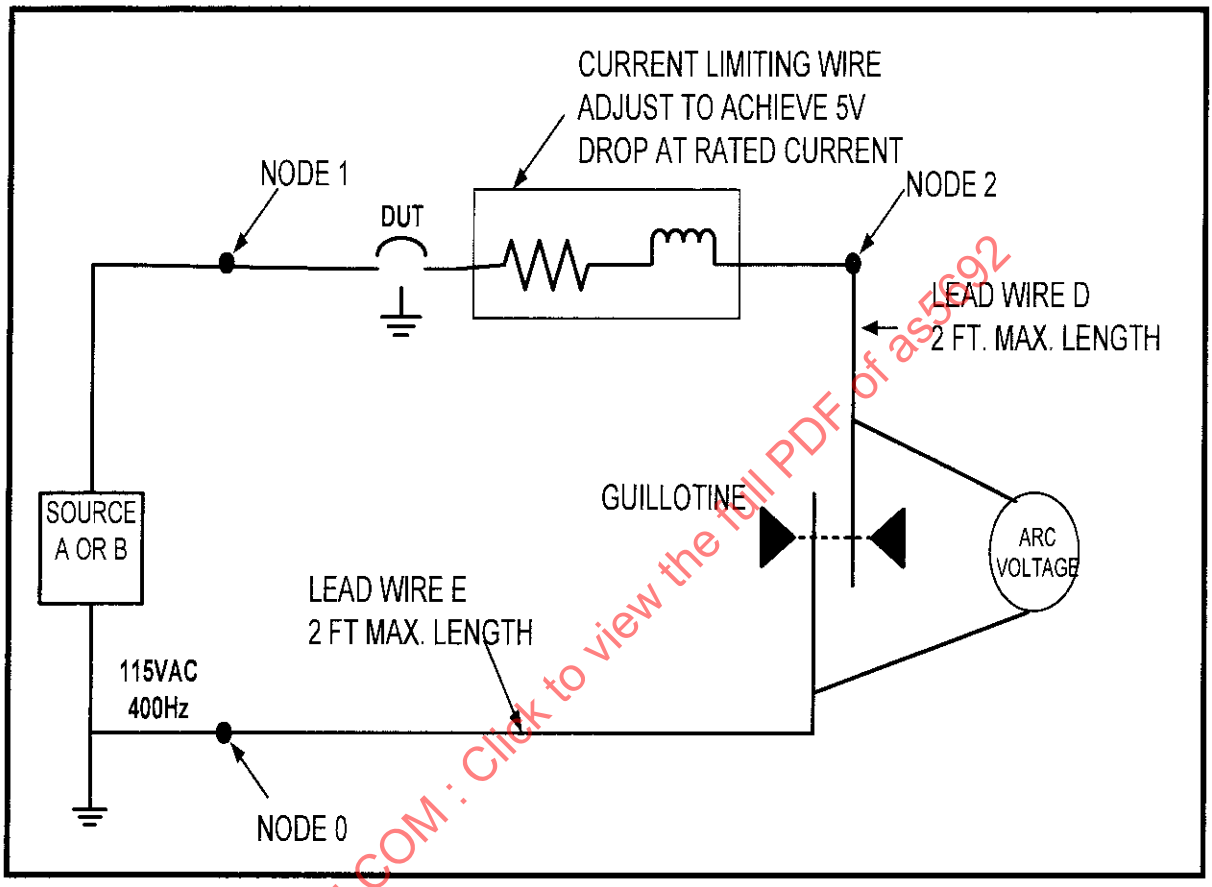


FIGURE 8 - Test Circuit

The open circuit voltage before application of the fault current shall be 115 ± 5 VAC, or as specified in the applicable specification. Power will be applied to the DUT for a minimum period of 1minute before introducing the fault.

To introduce the fault, a sharp razor blade will be used to cut through the insulation of wire D and E, see Figure 8, and the apparatus example below. The circuit shall be closed and a slow steady force shall be applied to the lever arm so as to allow the blade to cut through the insulation of the conductor specimen under test. The blade shall make solid contact with one conductor and point contact with the other conductor. The cutting action should not result in a cut of the conductors.

Records of current, voltage, and time shall be obtained. The DUT shall be subjected to the guillotine tests as specified above unless otherwise specified on the applicable

4.7.7.6.1 (Continued)

specification sheet and shall clear the fault. After the DUT has been exposed to arcing the records of the test must be evaluated to determine if the DUT identified and reacted to an arc within the requirements of this specification, the applicable specification sheet, and the definition for an arcing half cycle.

Figure 9 below defines the results of the guillotine test once the test record has been analyzed, unless otherwise specified in the applicable specification sheet.

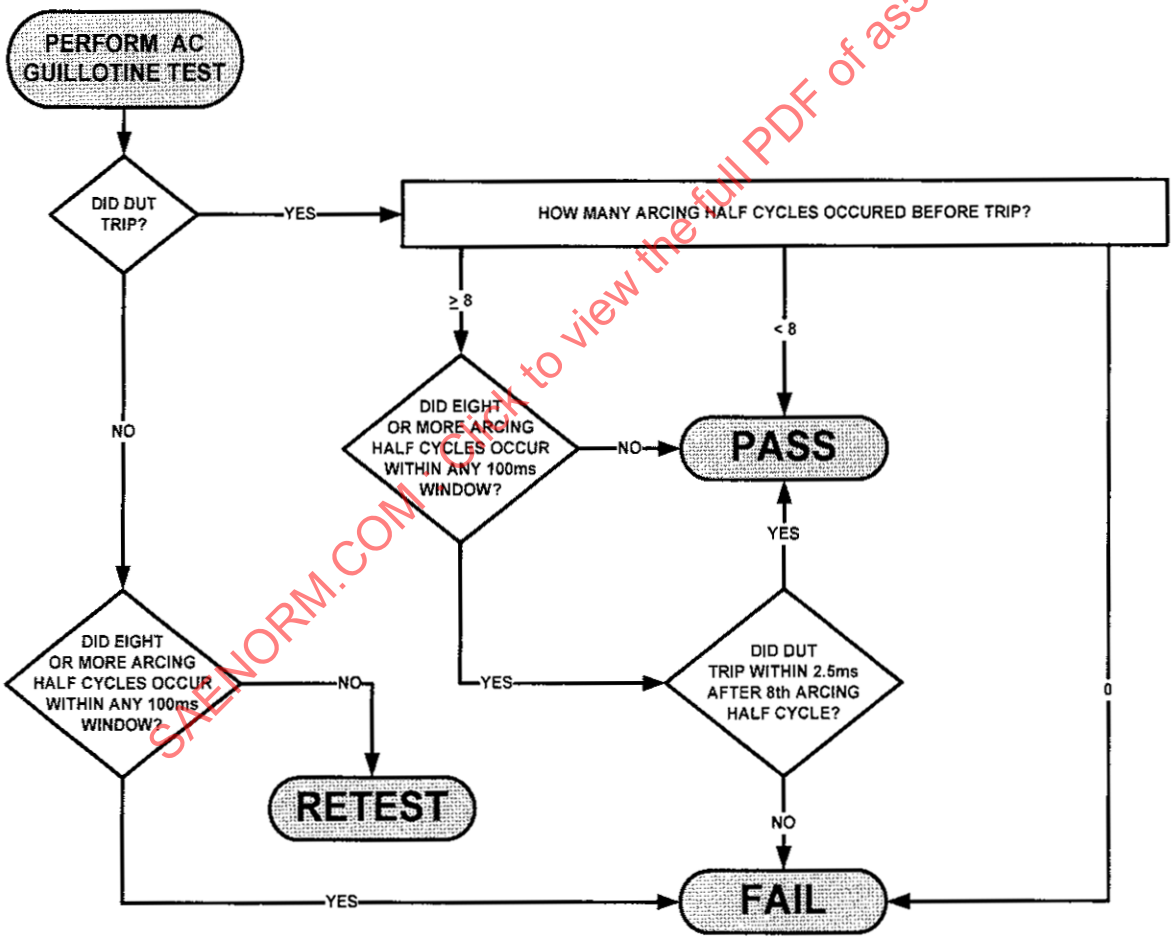


FIGURE 9 - Test Flow Chart

4.7.7.6.1 (Continued):

Apparatus Example:

The test apparatus for the guillotine test can be as shown in Figure 10. A sharp razor blade can be used. The blade shall be replaced as necessary. The blade may be sharpened and reused. The blade shall be attached to a lever arm as shown in Figure 10. The exact dimensions of the tester may vary, however, the required effect must be maintained.

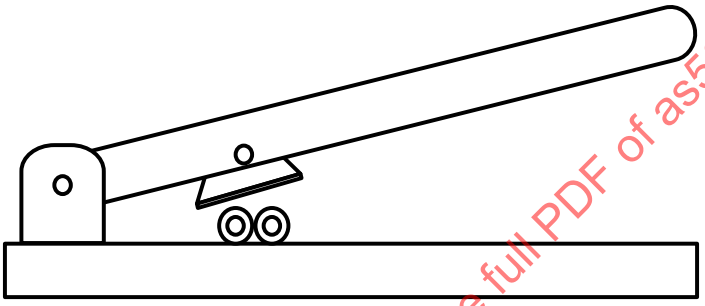


FIGURE 10 - Guillotine Test Apparatus

Definitions Specific to This Test:

Arcing Half Cycle: The trace for the actual current must be analyzed to determine if an arcing half cycle has occurred. An arcing half cycle has occurred if the arc voltage is above 15 volts over at least 5% of the time of the half cycle (0.0625 milliseconds for 400 Hz), and current flow is present at or above 1 amp. A complete sinusoidal half cycle of current flow is not considered to be an arcing half cycle.

Arcing Time Duration & Maximum Arcing Half Cycles:

The arcing time duration is used to define an arcing event that rises to a level that requires clearing. An arcing event that rises to a level that requires clearing is defined as the accumulation of a number of arcing half cycles that occur within a predetermined period of time. The predetermined period of time is the Arcing Time Duration. The number of arcing half cycles, which must occur before the event is deemed requisite of being cleared, is the Maximum Arcing Half Cycles.

4.7.7.6.2 Wet Arc Track: Simulating a parallel arcing event with a Wet Arc Generation Test Description: This arc fault propagation test is similar to the SAE AS4373 Method 509 Wet arc propagation resistance used for testing wire insulation. For Arc Fault Circuit Interrupters this describes the procedure for simulating a conducting fluid bridging the gap between adjacent damaged wires.

4.7.7.6.2 (Continued):

Procedure Overview:

The test apparatus for the wet arc track test is derived from SAE AS4373 Method 509 wet arc propagation test. This procedure uses a seven-wire bundle that has been prepared with non-concurrent insulation breaches. Power is applied to selected wires by a three-phase 115 ± 5 VAC 400 Hz source. A continual salt-water drip is used to bridge the gap between the insulation breaches; and the AFCB units shall interrupt the circuit. The DUT should interrupt the circuit prior to the damage propagating from the "prepared/damaged" wires to the other wires in the bundle. The integrity of the other wires in the bundle will be evaluated by using a wet dielectric test.

Equipment:

1. A variable speed, peristaltic pump and hypodermic needle or burette. The apparatus should be able to deliver the electrolyte solution at a rate of 100 mg ± 10 mg (0.0035 ounces ± 0.00035 ounces) per minute (8 to 10 drops of 3% sodium chloride solution) to the test specimen. An alternative means of delivery is acceptable.

2. A mechanical device for supporting the test bundle in free air in a horizontal position.

3. An electrolyte solution made by dissolving 3% ± 0.5% by weight of sodium chloride (NaCl) in distilled water.

4. A three phase wye connected representative source supply, grounded at wye, derived from rotary machine or solid state power source of not less than the 20 KVA or that required for specific test described in Table 7 and "Source Equipment Set Up" described below, delivering 200 volts ± 10 volts line-to-line at 400 Hz.

5. An AFCB and appropriately sized thermal protective circuit breakers.

6. A-A-52080 through A-A-52084 (Type V) lacing tape, or equivalent.

7. MIL-DTL-81381/11 wire (polyimide insulation) of the appropriate gage for the DUT sizes listed in Table 1. The conductor samples shall consist of bundles composed of seven wires approximately 8 to 16 inches (20.3 to 40.6 centimeters) in length.

4.7.7.6.2 (Continued):

Procedure:

1. The conductor bundles shall be prepared as follows. Conduct a 2500 volt Wet Dielectric test on 100% of the wire in accordance with the Wet Dielectric test procedure described in SAE AS4373 Method 510 before the arc-propagation resistance test is performed. Discard any failed sections of the wire.

2. Cut seven wire segments 8 to 16 inches (20.3 to 40.6 centimeters) in length for each of the bundles. Clean the cut wires using a cloth saturated with isopropyl alcohol or similar cleaning solvent. Strip both ends of five of the seven wire segments. Use these stripped ends for making electrical connections. These five wire segments will be called “Active Wires”. The two unstripped wire segments will be called “Passive Wires”.

3. Using a sharp blade, cut a square groove completely around (360°) the insulation of two of the active wires at their midpoints to expose the conductors. The width of the exposed conductor should be between 0.020 and 0.040 inch (0.5 and 1.0 millimeter).

4. Form the bundle by laying the seven wires segments straight and geometrically parallel. Assemble the wires to form a six-around-one configuration shown in Figure 11. The two pre-damaged wires should be placed in the A1 and B1 position and care should be taken to ensure that there is a longitudinal distance of 0.24 to 0.25 inches (6.0 to 6.5 millimeters) as measured between the stripped windows on the two exposed conductors. The two passive wires correspond to the D1 and D2 components shown in Figure 11.

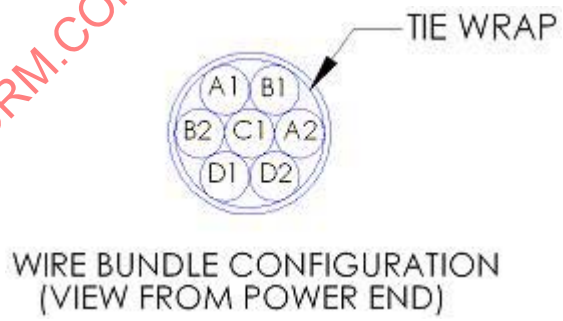


FIGURE 11 - Wet Arc Tracking Wire Bundle

5. Use A-A-52080 through A-A-52084 lacing tapes, or equivalent, to hold the test bundle together. Clean the assembled bundle using a cloth saturated with isopropyl alcohol or similar cleaning solvent prior to installation in the fixture.

4.7.7.6.2 (Continued):

6. Connect the test bundle to the power source using the schematic circuit shown in Figure 12. Connect one end of each active wire to the appropriate phase of the power supply as described in Table 8. The source ground will also need to be connected to the DUT in a manner that is suitable to the manufacturer.

7. Typical Test Current is to be set at 1 amp or 15% of the rating of the DUT, whichever is less.

   NOTE: Tester may remove power immediately upon opening of the DUT to eliminate further collateral damage to the wires. This will eliminate the chance of current flowing from B1 to load side of A1 through the established arcing track path, then to ground. Any additional flow of current after the DUT trips may cause further damage to A2, B2, C1, D1 and D2 potentially resulting in erroneous test results.

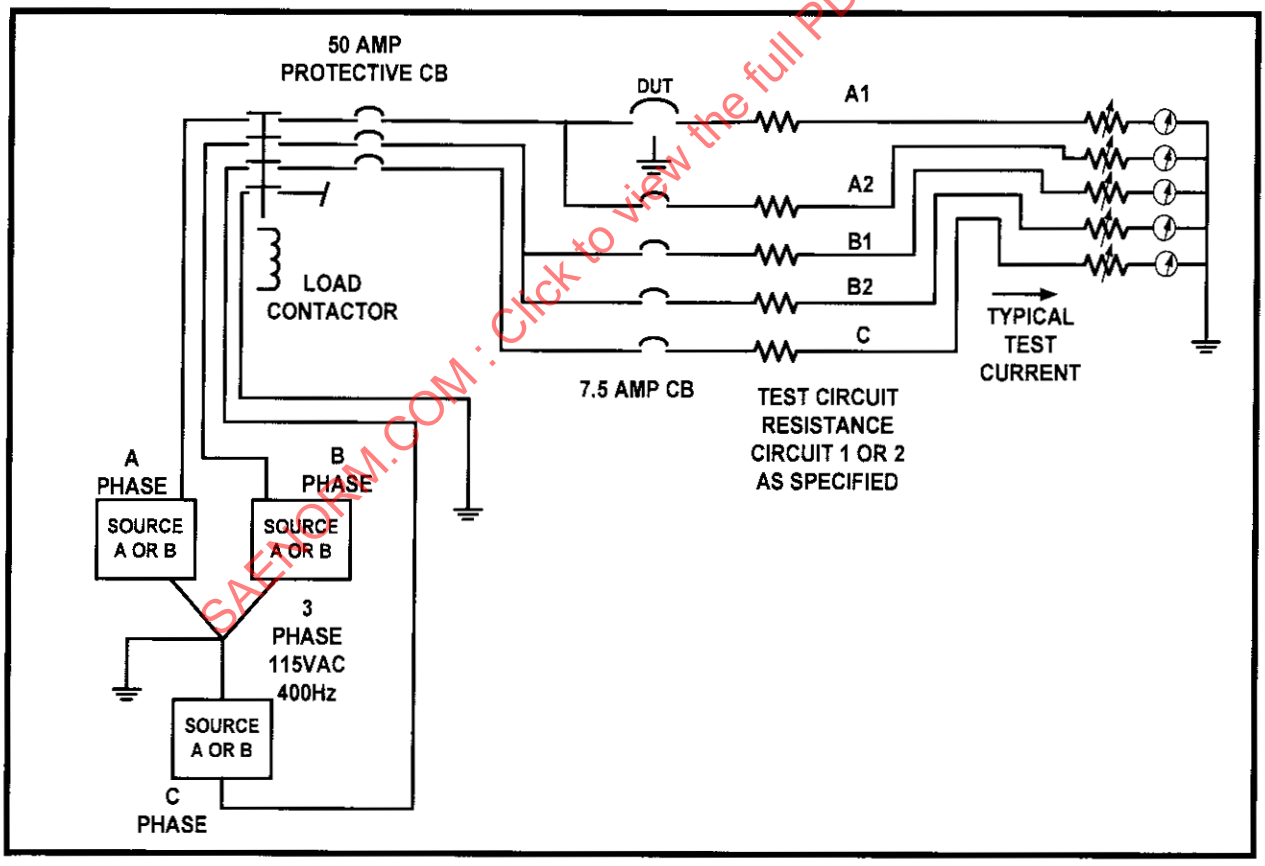


FIGURE 12 - Wet Arc-Track Current Path

4.7.7.6.2 (Continued):

TABLE 8 - Connection Table

Wire Identification	Power Supply	Layer
A1	Phase A	Top
B1	Phase B	Top
C1	Phase C	Middle
A2	Phase A	Middle
B2	Phase B	Middle
D1	None	Lowest
D2	None	Lowest

8. Testing will be conducted under two of the test conditions described in the guillotine test, see 4.7.7.6.1:

   a. Source B & Circuit 1.

   b. Source A & Circuit 2.

9. Use an appropriately rated DUT on A1; the other powered wires will be protected by thermal circuit breakers of the same amp rating or higher amp rating as the DUT, generator kVA and wire length as specified in item 7, in making this connection.

10. The test circuit shall be protected with AS58091 qualified or equivalent circuit breakers, (of approximately two times higher rating than the DUT), connected on the supply side of the test setup.

11. The tests shall be conducted at the rated voltage of the DUT and at the test conditions specified in step 7. The test will be conducted three times. Each wire bundle shall only be used for one test.

12. Using the mechanical supports, mount the test bundle in a draft-free location so that the wires with the exposed conductor are upper most.

13. Close all circuit breakers. Set up the flow of the electrolyte to 8 to 10 drops per minute. Position the hypodermic needle to drop the electrolyte into the grove between the wires with the exposed conductor. Position the tip of the needle so that the vertical distance of the tip is 6 inches ± 0.5 inch above the specimen. Position the protective screen to shield the operator from ejecting objects or UV radiation. Apply three-phase 400 Hz power within 1 minute of first electrolyte contact. Allow the electrolyte to flow.

14. Use one of the following conditions to conduct and complete the test.

4.7.7.6.2 (Continued):

a. If circuit breakers in any of the phases A2, B2, C1 and B1 trips at any time during the test, disconnect the power. Conduct a 1000 volt Wet Dielectric test on wires A2, B2, C1, D1 and D2 in accordance with the Wet Dielectric procedure of SAE AS4373 Method 510. If any of these wires fail the wet dielectric test it is considered a DUT failure. If these wires pass, redo the wet arc test with a new wire bundle.

b. If phase A1 trips the DUT at any time during the test, disconnect the power. Conduct a 1000 volt Wet Dielectric test on wires A2, B2, C1, D1 and D2 in accordance with the Wet Dielectric procedure of SAE AS4373 Method 510. If any of these wires fail the wet dielectric test it is considered a DUT failure.

4.7.7.6.2.1 Cold Startup Time Test: Prepare test in accordance with 4.7.7.6.2 Wet Arc Track Test. Run the Wet Arc Track Test in accordance with the procedures, until the sample arc tracks and the DUT opens. Remove power from the line side of all breakers. Continue the solution drip over the wire samples. Close all the breakers. Apply power to the line side of all breakers after at least 5 minutes. The DUT shall open and provide protection in accordance with the requirements of 4.7.7.6.2.

4.7.7.6.3 Loose Terminal Connection – Vibration Test: Prepare wire jumpers using 12 inch lengths of 16 AWG, terminated on both ends with a #10 sized wire terminals. Fix a terminal strip with eight #10 studs (MS 27212-2-8 or equivalent), to a nonconductive surface on the shaker table. Loop the wire jumpers from stud to stud (two wire terminals per stud) in the fashion shown in Figure 13 producing a series connection from one end of the strip to the other. Tighten a self-locking nut on each stud only until the locking mechanism on the nut engages (these nuts are only used to ensure that the wire terminals do not vibrate off the studs). DO NOT TIGHTEN DOWN ANY FURTHER. The wire terminals must remain free to vibrate while making intermittent contact with each other (see Figure 13 circular insert). The free hanging wire sections of the jumpers must be clamped to a fixed surface to ensure that the wire terminals and the studs do not bind up against one another. These clamps should be spaced approximately 10 inches apart and be completely isolated from the shaker table located between the two clamps. A nonconductive coating shall protect the surface of the shaker table.

Apply a resistive load to the system to ensure that the current is at the rated current of the DUT. Apply voltage to the system and verify current flow. Vibrate the shaker table using the profile defined in Figure 14 for a maximum of 5 minutes or until the DUT trips. If arcing is not visible, shut down the shaker table, remove power, reset the wire jumpers (ensuring free movement of the wire terminals on the terminal strip studs), reapply power, vibrate the shaker table, and verify arcing. The DUT may trip at any point during the test, but must trip within 5 minutes total elapsed time. To minimize further damage to the test fixture, each test shall not exceed 5 minutes. The wire jumpers and terminal strip must be replaced prior to conducting each new test.

4.7.7.6.3 (Continued):

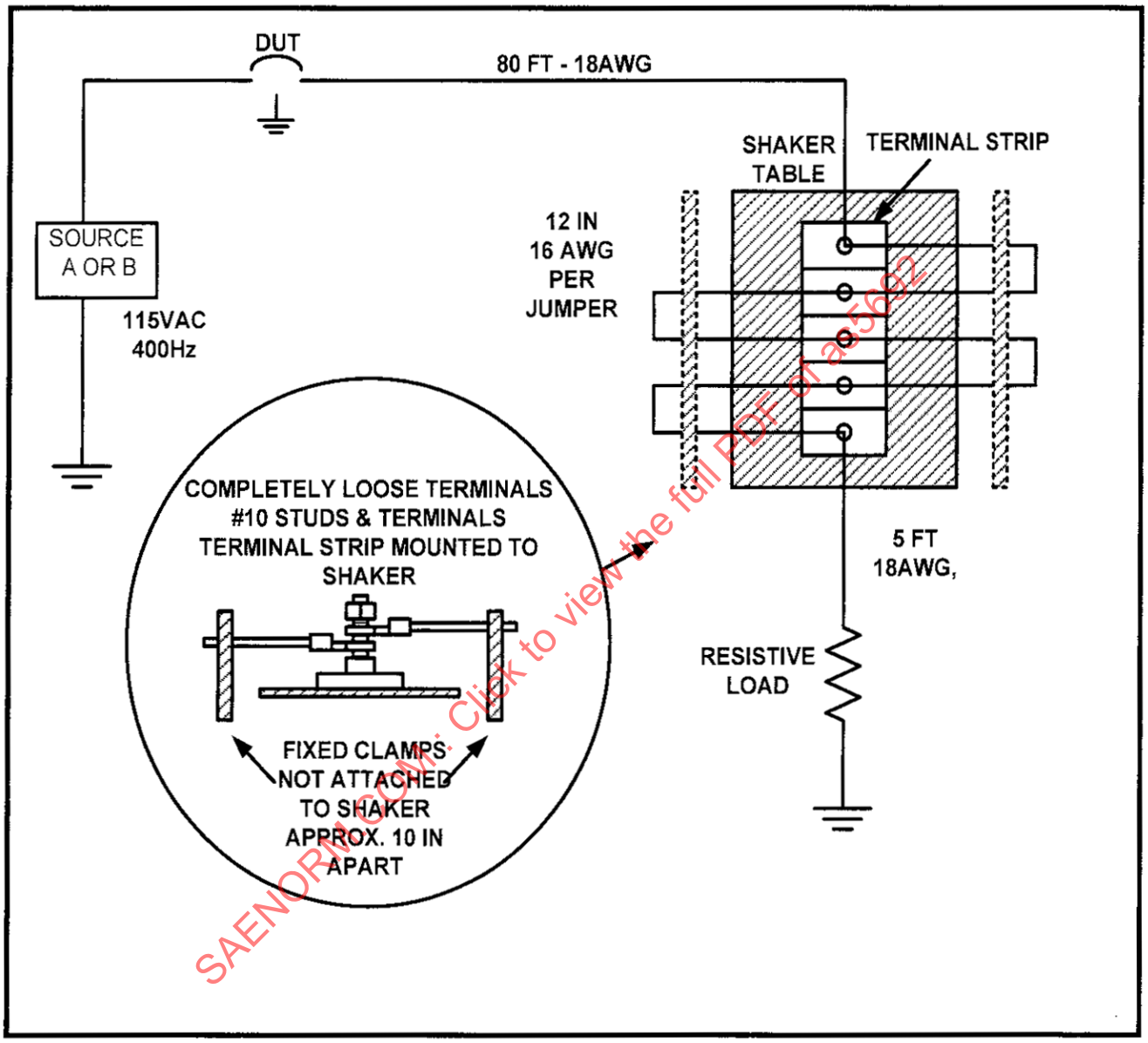
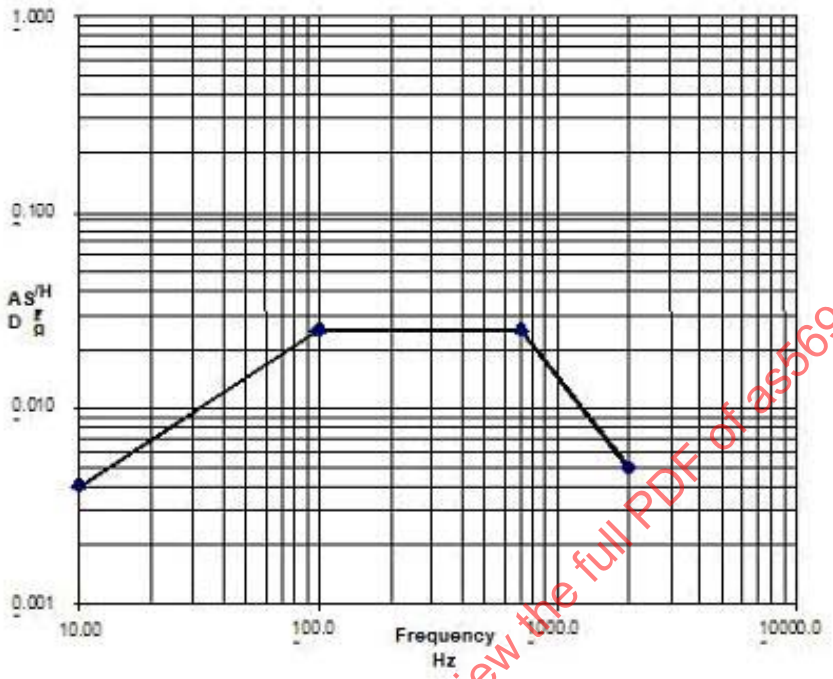


FIGURE 13 - Shaker Table with Loose Terminals

4.7.7.6.3 (Continued):



Frequency (horizontal)	G^2/Hz (vertical)
10	.004
100	.025
700	.025
2000	.005

FIGURE 14 - Vibration Profile (Tolerance is ±3 dB)

4.7.7.7 Unwanted Tripping and Operation Inhibition: Source B generator (refer to 4.7.7.6.1) shall supply power to an AC bus through a contactor capable of producing power interrupts from 50 ms (-10/+0 ms).

The DUT shall be connected to the AC bus in parallel with a 25 kVA resistive load, as shown in Figure 15.

4.7.7.7 (Continued):

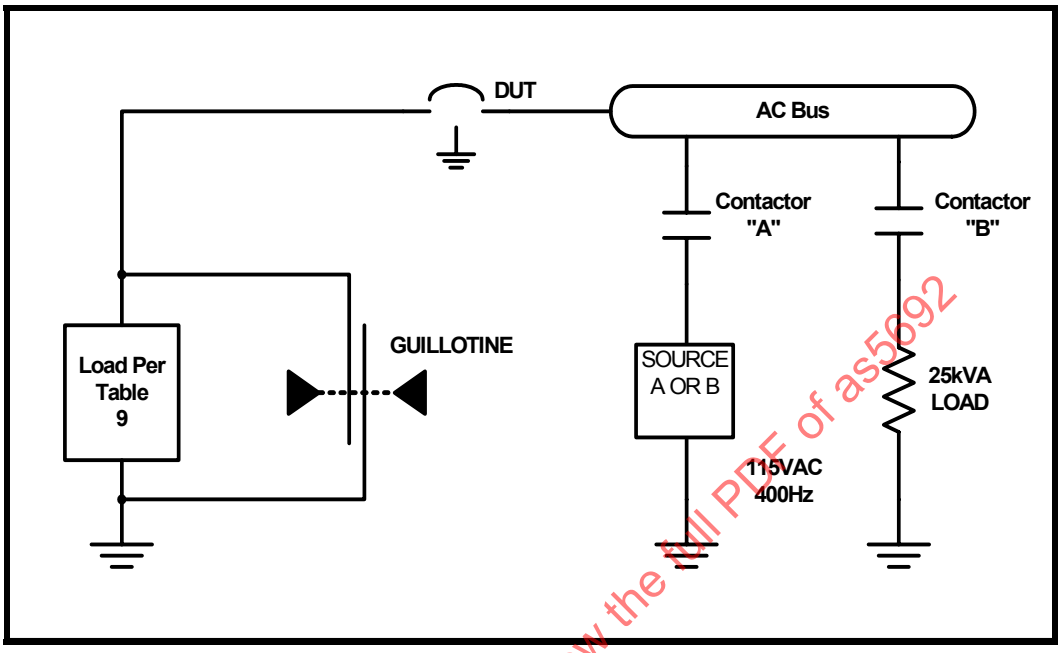


FIGURE 15 - AC Load Test Setup

For each load listed in Table 9, the following tests shall be performed:

a. With Contactors “A” and “B” closed and the DUT open, energize the system and allow it to stabilize for 5 seconds after it reaches a steady state condition, or for a minimum of 30 seconds.

b. The DUT shall be closed into the load listed in Table 9 and the load shall run for 5 seconds after it reaches a steady state condition, or for a minimum of 30 seconds.

c. The load shall then be turned off, or power shall be removed from the load on the load side of the DUT, and the system shall be allowed to stabilize for 5 seconds after it reaches a steady state condition, or for a minimum of 30 seconds.

d. The load shall then be turned on, or power shall be returned to the load on the load side of the DUT, and the system shall be allowed to stabilize for 5 seconds after it reaches a steady state condition, or for a minimum of 30 seconds.

Loads with multiple settings shall be exposed to each setting.
Loads with specified turn on sequences shall be exposed to the full turn on sequence at this point during the test.

4.7.7.7 (Continued):

e. Open Contactor “B” and allow the DUT load to run for 5 seconds after it reaches a steady state condition, or for a minimum of 10 seconds. Close Contactor “B” and allow the DUT load to run for 5 seconds after it reaches a steady state condition, or for a minimum of 10 seconds.

The cycling of Contactor “B” should momentarily cause the generator voltage to drop.

f. Open Contactor “A” momentarily (between 50 and 100 ms) and then close. The DUT load shall run for 5 seconds after it reaches a steady state condition, or for a minimum of 10 seconds.

The momentary break of the contactor will mimic a momentary break bus transfer.

g. Repeat steps “c” and “d” five times.

h. Perform the guillotine test per 4.7.7.6.1 Circuit 2.

i. The DUT shall meet the requirements specified in 4.7.7.6.1.

TABLE 9 - Test Loads

Load Category	Example Load(2)	Amp Ratings	Suggested Manufacturer & Part Number(1)	Load Characterization
Avionics Switching Power Supply	Air Data Computer	2	Honeywell Model HG180	Large inrush, harmonics; (5X <Inrush < 10Z / Duration <20 cycles).
Inductive Load – Incandescent	Left Landing Light Auto Transformer/l Landing Lamp	7½	Oeco or Electrocube: p/n 310-13569-01 or FT1140 310-13569-02 GE or Sylvania: p/n Q4559X	Large peak/short duration inrushes; (5X Inrush <10X / Duration < 10 cycles).
Motor load	Pilot Seat or Motorized Foot Rest	5	813500-415 Weber Aircraft Inc.	Large peak/long duration inrushes; (5X < 10X / 1s < Duration < 4s).
Resistive	Auxiliary Pitot Heater	5	Goodrich Sensor Systems: P/n 851CM-2	Periodicity
Resistive - thermostat controlled	Window Heat	5	Honeywell: G1-1-1 (4)	Switching charateristics of of thermostat
Resistive – SCR controlled (window heater)		5	Cox 2915-5 (4)	Switching charateristics of SCR controller Conduction angle shifts
Fluorescent Load	Left Ceiling Light	15-25	Avtech: p/n 978-1 (11 ballast)	Large inrushes, harmonics, random variation in dim settings.
Strobe Lamps	Beacon	2 – 71/2	Grimes p/n 60-3368-7	Periodicity, large inrush, modulation.
Switching power supply/IFE	Computer power supply	15- 25	Powertech Electronic Co., Power Tronic Switching Power Supply PK-6145DT3 (3)	Large inrush, harmonics; (5X <Inrush < 10X / Duration <20 cycles).
Linear actuated valve	Anti-Ice Valve	5	Whittaker Controls: p/n’s 127055, 129475, 128775, 229165, 129525	Random inrushes as motors are reversed midstream

(1) Equivalent loads may be used
(2) Prior to running the first or subsequent tests the load must be stabilized in a non-energized state.
(3) Six power supplies shall be sequentially turned on within 15 seconds (1-3 seconds between each supply turn on)
(4) Window heater element shall be simulated with 8-12 ohm resistive load

4.7.7.8 Cross Talk Immunity Test: The DUT shall be designed not to trip as a result of faults on adjacent circuits due to coupling. When tested by the procedure below, the DUT shall not trip at any time. Any trip during the test shall be considered a failure. Wire for use in this testing shall be proper gage of SAE AS22759/34.

Sample AFCBs of the highest and lowest rating of each basic product type or family will be tested. They shall be connected between one phase of the generator and a length of 80 feet of wire of the appropriate gage for the rating of the DUT. The DUT shall be terminated in a resistive load at 85 to 90% of the breaker rating.

A 20 amp or greater thermal-only breaker shall be connected between a second phase of the generator and a capacitor load, C, and to a similar length (80 feet) of #16 AWG wire. The test sequence specified below will be repeated at the following capacitive (C) settings: 0 and 5 μF.

- The two wires are to be twisted together at a spacing of approximately 1 turn per foot.
- The resulting twisted pair is to be mounted during the test so as to be electrically similar to a wire bundle in an airframe.
- Coupling is twisted pair, with one loop, 2 inches ± 0.5 inch from the ground plane, and no less than 4 inches separation between loopbacks.
- The return path to the generator feeder connection should consist of an electrical equivalent to an aluminum airframe or a 6 foot maximum length of wire greater in size than the rated wire.
- The #16 AWG wire is to be subjected to three guillotine tests for each breaker rating and capacitive rating for a total of 6 tests per test condition. Refer to figure 16 for circuit schematic.
- The DUT shall not trip in the adjacent circuit for three tests which each produce a minimum arcing of 8 half cycles in 100 ms.
- Except as noted in this test procedure, conduct guillotine test in accordance with 4.7.7.6.1, Source B, Circuit 1.

4.7.7.8 (Continued):

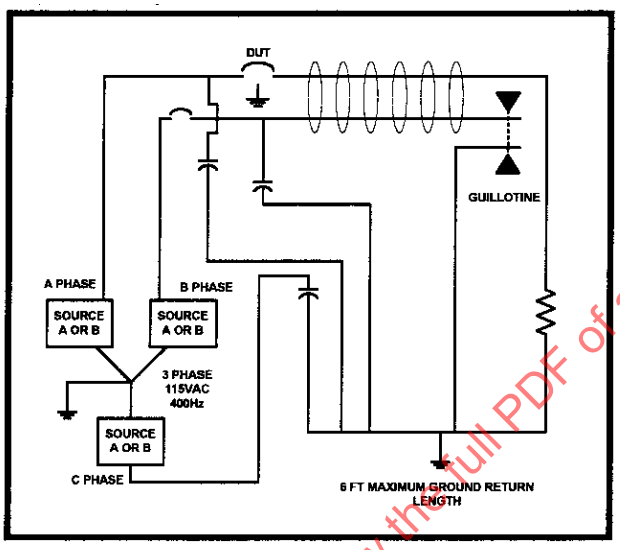


FIGURE 16 - Crosstalk Circuit Diagram

4.7.7.9 Feedback Immunity Resistance Test: The Guillotine test procedure will be used to generate an arcing fault in a simulated aircraft system to determine if the DUT will inadvertently interrupt a circuit because of an arcing fault on another circuit on the same electrical phase.

Procedure Overview:

The DUT shall not nuisance trip as a result of an arcing fault on another circuit on the same phase (both protective devices operating from a common source). Using a setup representative of typical applications, as noted in Figure 17, a guillotine arcing fault will be initiated on a circuit that is not coupled to the circuit protected by the DUT. The highest and lowest rating of each basic type or family of arc fault circuit interrupter will be tested with a faulted breaker 15A. Wire for use in this testing shall be the proper gage of SAE AS22759/34 as specified in 4.5.2. Two tests are to be run per condition.

4.7.7.9 (Continued):

Equipment:

1. Guillotine Test Apparatus similar to that described in 4.7.7.6.1.

2. Conductors sized to the DUT will be used as outlined in 4.5.2 (see Table 1). The insulation type will be of SAE AS22759/34. The test circuit shall be connected to a supply that meets the normally accepted levels of performance. The supply shall be maintained at the rated voltage of 115 VAC ± 5 VAC, 400 Hz. The test shall be run at the highest fault current condition (large source with a short added wire length). This is depicted in the “Source Equipment Set up” description in 4.7.7.6.2 as Source B and Circuit 2.

3. A representative load, commonly a light, may be used in the circuit to readily indicate that the test circuit is energized.

4. Two units of the highest and lowest rating of each basic type or family of arc fault circuit interrupter.

5. Faulted breakers of quantity and rating necessary to perform the testing.

6. An oscilloscope or similar piece of data acquisition equipment capable of monitoring the arcing event and analyzing the test results.

Procedure:

1. A 115 VAC ± 5 VAC 400 Hz source capable of sourcing the current specified, protected by a circuit breaker, with a current rating larger than either the breaker under test or faulted thermal breaker will be connected to the line side of a DUT. The source ground will also need to be connected to the DUT in a manner that is suitable to the manufacturer.

2. Source B Circuit 1, as defined in 4.7.7.6.1 test conditions will be setup.

3. A resistive load shall be applied to the DUT equal to 85 to 90% of its current rating.

4. Wiring of length and size as specified in 4.7.7.6.1 connected to the load side of the Faulted Breaker shall be subjected to the guillotine test outlined in 4.7.7.6.1.

5. After visible arcing has occurred on the guillotine test for approximately 1 second the test may be terminated. A minimum of 8 half cycles of arcing current within 100 ms shall occur. If less than 8 half cycles of arcing occur, the test will be repeated.

4.7.7.9 (Continued):

6. The DUT shall not trip. This test shall be conducted a total of three times.

7. Repeat steps 3 to 6 with Source A Circuit 1.

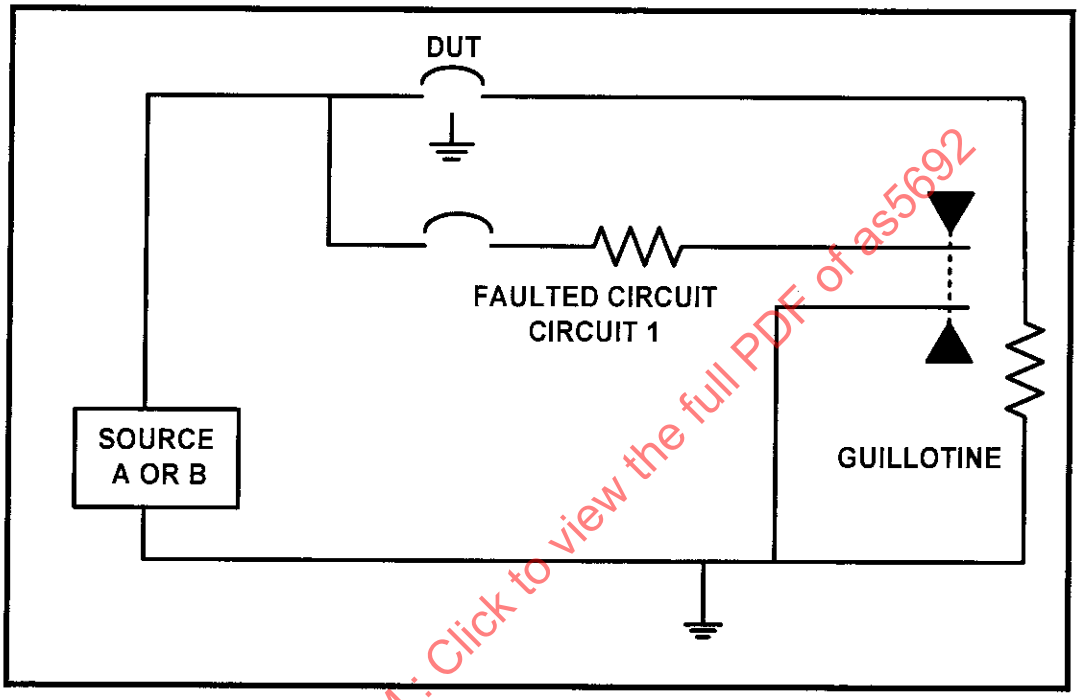


FIGURE 17 - Feedback Test Schematic

4.7.8 Endurance: The DUT shall be subjected to the number of cycles of make-and-break operation specified in the applicable specification sheet, and shall make and break the specified current throughout the cycling period. One operating cycle is defined as the mechanical opening and closing of the DUT. At the option of the manufacturer, testing shall be performed at a minimum rate of 2 operating cycles per minute (cpm) or at a faster rate, and the ON time to OFF time ratio shall be approximately 1 to 5. The mechanical operation shall simulate manual operation, including over travel. The test for operating forces shall be performed at the approximate testing midpoint and again at the completion of the test. The DUT shall calibrate within the limits of 90% of the specified minimum ultimate trip current and 110% of the maximum ultimate trip current (see 4.7.7). Upon completion of endurance cycling, the DUT shall pass the dielectric withstanding voltage test (see 4.7.2), guillotine test, per 4.7.7.6.1, Source A, Circuit 2, and end of life voltage drop (only in the instance that a voltage drop specifically designated as an end of life voltage drop is listed on the applicable specification sheet). In addition, the auxiliary switch contact (if present) shall make and break as specified in the applicable specification sheet.

4.7.8.1 Alternating Current: During the alternating current endurance tests defined in 4.7.8.1.1 and 4.7.8.1.2, the voltage and frequency shall be as specified on the applicable specification sheet.

4.7.8.1.1 Inductive Load: The power factor during this test shall be between 0.6 and 0.7 lag unless otherwise specified by the applicable specification sheet. The load shall be the rating of the DUT unless otherwise specified by the applicable specification sheet.

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

4.7.8.2 Mechanical Cycling: The DUT shall be subjected to the number of cycles of opening and closing specified on the applicable specification sheet. The rate of cycling shall be 6 to 7 cpm.

4.7.9 Overload Cycling: At 200% of rated current resistive load, the DUT shall be subjected to manual make and automatic break applied as follows: The DUT shall be subjected to 50 cycles of normal trip-outs from the closed position and 50 cycles of trip-free trip-outs while the reset actuator is held in the closed position. These tests shall be repeated at a manually controlled cycling rate of 2 to 3 minutes per operation. A single failure to trip automatically within the time limit specified on the applicable specification sheet throughout the test shall constitute DUT failure. Following this test, the DUT shall meet the requirements of the minimum and maximum ultimate trip of 4.7.7.1 and 4.7.7.2. The DUT shall also meet the 200% calibration requirement of 4.7.7.3 at 25 °C, and shall be tested in accordance with and meet the requirements of the guillotine test section 4.7.7.6.1 Source A, Circuit 2.

4.7.9.1 Arc Fault Circuitry Cycling: Using any of the three arc fault tests specified in this document, cycle the DUT through 50 arc fault cycles and 50 trip-free arc fault cycles. The performance of each device shall be validated by conducting a guillotine test in accordance with 4.7.7.6.1 Source A, Circuit 2 at the completion of the 100 cycles. The DUT shall also meet the 200% calibration requirements of 4.7.7.3 at 25 °C.

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

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

a. Mounting: Each DUT shall be mounted as designed in normal application.

b. Electrical Load: Unless otherwise specified, each DUT shall carry rated current load in the (ON) position at room ambient temperature.

c. Measurements: DUT main contacts and auxiliary contacts (if present) shall be continuously monitored by a continuity tester capable of detecting electrical discontinuities of 10 microseconds or less.

d. Post Test Measurements. Following vibration testing, each DUT shall be visually examined for physical damage, then subjected to 200% overload calibration at 25 °C per 4.7.7.3, the dielectric withstanding voltage test per 4.7.2 and the guillotine test using the Source A, Circuit 2 per 4.7.7.6.1.

4.7.11.1 Random Vibration: When listed on the applicable specification sheet, each DUT shall be subjected to random vibration per test method 214 of MIL-STD-202, and/or to other random vibration conditions as specified. Test conditions C through K pertain to vibration levels in test method 214 of MIL-STD-202. Each DUT shall be vibrated 3 hours in each of three perpendicular axes. During the first 1½ hours of vibration in each axis, the circuit breaker shall be monitored for discontinuity. During the remaining time, the circuit breakers shall be monitored for tripping only.

4.7.11.2 Sine Vibration: Each DUT shall be subjected to the vibration test method 204, test condition A, of MIL-STD-202.

4.7.11.3 High Level Sine Vibration: Each DUT shall be subjected to the vibration test Method 204 of MIL-STD-202. The following test conditions shall apply:

a. Test Condition B – No Electrical Load

b. Test Condition C – Rated Electrical Load

4.7.12 Mechanical Shock: Each DUT shall be tested in accordance with Method 213 of MIL-STD-202. The following details and exceptions shall apply:

a. Mounting – by normal means.

b. Test Condition Letter A, or as specified on specification sheet.

c. Electrical load conditions.

Three separate shocks shall be applied to each of the three principle axes with the DUT contacts in the closed position, and three separate shocks shall be applied to each of the axes with the DUT contacts in the open position. All sections of the DUT shall be carrying rated current. A device capable of detecting momentary opening or closing periods not exceeding ½ (0.5) millisecond duration shall be used to determine that the DUT contacts in the closed position remain closed, and the circuit breaker contacts in the open position remain open.

4.7.13 Acceleration: The DUT shall be mounted by its normal means on a centrifuge in a position most likely to cause malfunctioning. The centrifuge shall be brought up to the radial speed required to produce a radial acceleration of 10 g. The rates of centrifuge acceleration and deceleration shall be controlled so that the vector components (radial and tangential) or their vector sum do not exceed 10 g. Once the specified radial acceleration is obtained, it shall be stabilized and maintained for a period of not less than 1 minute. The DUT shall be carrying rated current during, and for 30 minutes prior, to test. The test shall be repeated with the DUT contacts in the open position. Suitable instrumentation shall be used to determine the ability of the DUT contacts to remain in the open position. There shall be no opening or closing of contacts and there shall be no damage caused by acceleration.

4.7.14 Interrupt Capacity: For the interrupting capacity tests, the circuit breaker shall be so connected to the power source that currents specified on the applicable specification sheet are provided at the circuit breaker terminals. The test circuit of Figure 18 may be used. The open circuit voltage before application of the interrupting current shall be as specified on the applicable specification sheet. The open circuit recovery voltage shall be the value specified on the applicable specification sheet. Records of current, voltage, and time shall be obtained. The DUT shall be subjected to the interrupting capacity tests of Table 10 as specified on the applicable specification sheet, and shall close on and open with the interrupting currents and voltages specified. When the specification sheet list multiple current levels under test condition “C”, tests shall be conducted consecutively at listed current levels “a” then “b”, then “c”, in accordance with the applicable specification sheet. After each interruption, the open circuit voltage specified by the applicable specification sheet shall be maintained across the circuit breaker for a minimum of 5 seconds. There shall be sufficient time to permit proper cooling and reset between each cycle of operation. Failure of the DUT to reset after 10 minutes shall be cause for rejection unless it meets the requirements of fail-safe condition. Interrupting tests shall not be repeated within 5 minutes of the previous test.

4.7.14 (Continued):

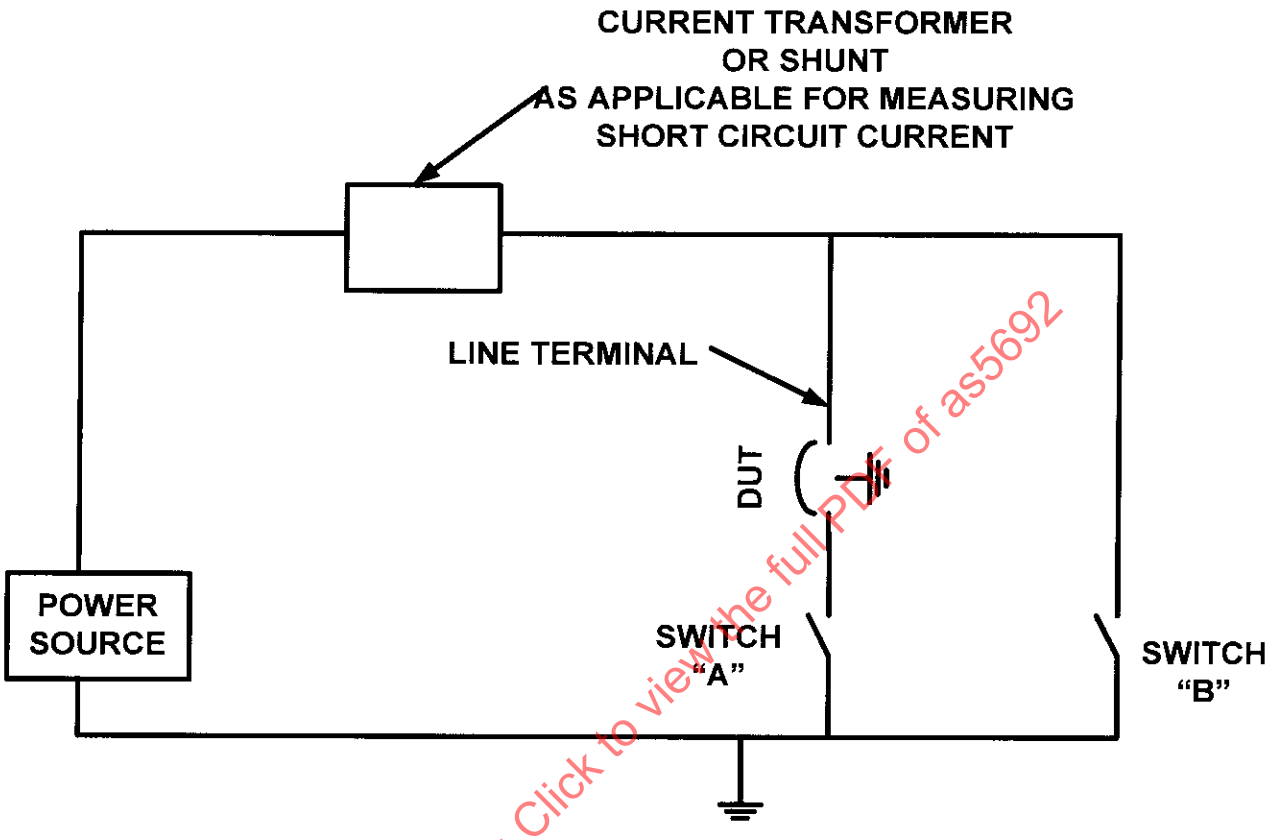


FIGURE 18 - Test Circuit

AC SHORT CIRCUIT INTERRUPT TEST:

1. Open DUT and switch "A".
2. Close switch "B" and adjust current in accordance with applicable AS requirement.
3. Open switch "B".
4. Close DUT.
5. Close switch "A".

AC CLOSE-IN INTERRUPT TEST:

1. Open DUT and switch "A".
2. Close switch ""B" and adjust current in accordance with applicable AS requirement.

4.7.14 (Continued):

3. Open switch “B”.

4. Close switch “A”.

5. Close DUT.

Interrupting current shall be measured by a current transformers or shunt as indicted and suitable recording instrument. The voltage across the DUT shall be recorded simultaneously with interrupting current and at the point indicated.

TABLE 10 - Interrupting Capacity Tests

Test Desig-Nation	Test Description	Operations[1]	System	Open Circuit Voltage	Calibrated Fault Current Amperes	Transient rms Voltage After Calibrated Fault Current Interruption
A	Available current short circuit interruption (ac)	2 CO[2] SL 2 CO Alt	“Y” connected 400 Hz 115 +/-5 / 200 +/-10 volts	120+5	Current specified on applicable specification sheet in 10 to 25 cycles after fault initiation	120 within 3 cycles 150 within 6 cycles 165 maximum
B	Available current close-in interrup-tion (ac)	2 OCO[3] SL 2 OCO Alt				
C	Available inter-mediate current interruption	1 CO Alt 1 OCO SL For each value of current specified on applicable AS			Current as specified on applicable specification	

Alt = Altitude SL = Sea Level

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

4.7.14.1 Interrupt Capacity – Under Loss of Ground: All of the testing requirements of 4.7.14 and the applicable specification sheet shall be performed with the ground connection for the detection circuit disconnected, to preclude the arc fault detection and actuation mechanisms from assisting the DUT to clear the short circuit current.

4.7.15 Sand and Dust: While in the closed (ON) position and mounted on a dummy panel, the DUT shall be subjected to the sand and dust test, Method 110, Test Condition A, of MIL-STD-202 with no evidence of mechanical or electrical failure.

4.7.16 Corrosion: Each DUT shall be mounted in the closed (ON) position with all hardware shown on the applicable specification sheet, and installed finger tight. Each DUT should be mounted such that DUT mounting orientations higher on the panel do not adversely affect any DUT mounted below them (i.e., dripping or concentrating the salt solution on any DUT resulting in these samples being subjected to a more severe test condition than specified). Each DUT shall be subjected to the salt spray test Method 101, Test Condition B, of MIL-STD-202 with a 5% salt solution. Within 10 minutes after the test, each DUT shall be washed for 5 minutes under running water not warmer than 37.8 °C accompanied by a slight brushing, and dried for 6 hours in a forced draft oven at approximately 57 °C.

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

For sample unit 1:

a. Conduct a normal trip test with 500% rated load. Failure to trip within 10 seconds shall constitute failure.

b. Stabilize for 1 hour at room temperature.

c. Conduct a trip-free test with 300% rated load.

d. Stabilize for 2 hours at room temperature.

e. Conduct the specified overload calibration trip test of 4.7.7.3 with 200% rated load except that the tripping time may vary within ±10% of the specified limits.

f. Stabilize for 4 hours at room temperature.

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

4.7.17 (Continued):

h. The DUT shall then be tested in accordance with and meet the requirements of the guillotine test per 4.7.7.6.1 Source A, Circuit 2.

For sample units 2 and 3:

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

4.7.17.1 Contact Resistance: The purpose of this test is to establish a level of contact resistance before and after the tests on moisture resistance (4.7.17) and storage (4.7.17.2). No specific absolute value of contact resistance is required. The parameter desired is comparison of contact resistance before and after 4.7.17 and 4.7.17.2. The DUT contacts (sample units 2 and 3) shall be manually operated to successfully interrupt and make a test circuit having a dc resistance load on one-half the current rating (0.5 In) on the circuit breaker or 200 milliamperes, whichever is less, at 26 volts ± 2 volts. The contact resistance (specified as millivolt drop) shall be computed by averaging the results of ten measurements. Each measurement shall be taken after a consecutive contact closure. All measurements shall be made across the DUT external electrical terminals.

4.7.17.2 Storage Test: Within 24 hours of completing prior applicable tests, each DUT shall then be stored, in an area free from chemicals that give off vapors known to be reactive with metals, for 10 days at a minimum temperature of 20 °C and a relative humidity of not less than 40%. Throughout the above test, DUT contacts shall be maintained in the closed position. Upon completion of 10 days, each DUT shall be subjected to the contact resistance 4.7.17.1. The contact resistance shall not exceed the initial contact resistance by more than 250 millivolts. All measurements shall be made across the DUT external electrical terminals. Each DUT shall be submitted to and pass the test requirements for calibration at room ambient with 200% rated current, except that the tripping time shall be within 80% of the lower limit and 120% of the upper limit specified. All hardware shall be removable without damage. The DUT shall then be tested in accordance with and meet the requirements of the guillotine test per 4.7.7.6.1 Source A, Circuit 2.

4.7.18 Explosion: The DUT shall be subjected to explosion test, Method 109 of MIL-STD-202, except that the test shall be conducted only at sea level. Each DUT shall be subjected to operations required for the interrupting capacity tests of Table 10. One sample unit shall be subjected to test A and one sample unit to test C.

4.7.19 Voltage Drop: The voltage drop of the DUT from terminal to terminal shall be measured while subjected to rated current, and the voltage drop, as measured from terminal to terminal, shall not exceed the value specified by the applicable specification sheet. This test shall be performed after the DUT has been carrying its rated current for at least 30 minutes.

4.7.20 Transit Drop: The intent of this test is to determine the structural and functional integrity of the DUT to a transit drop. All packaging shall be removed from the DUT during transit drop tests. Perform all tests with the drop tester (see Figure 19), or equivalent set up as approved by the qualifying activity. A total of eight units will be subjected to three random drops per unit. Each drop will be from a height of 48 inches ± 3 inches onto a concrete surface. DUT toppling following impact will occur in the field, therefore, DUT toppling following initial impact should not be restrained as long as the DUT does not leave the required drop surface. All drops will be performed at room ambient temperature unless otherwise specified.

The following steps will be performed, at 25 °C:

Perform a visual inspection of each unit and record.

Place the eight AFCB's onto the drop tester. The units shall be set in random directions, and on random faces, and be evenly spaced along the edge of the drop tester.

Raise the drop tester and allow the AFCB's to drop onto the concrete surface.

Repeat steps 1 to 3 for an additional two drops.

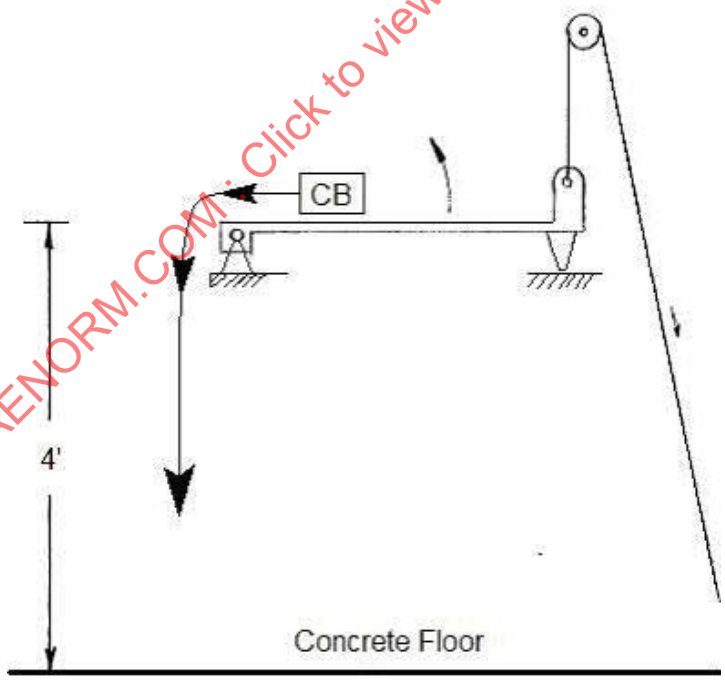


FIGURE 19 - Drop Test Set Up

4.7.21 Temperature/Pressure Circuit Functionality:

4.7.21.1 Temperature Circuit Survivability: The DUT shall be tested in accordance with RTCA/DO-160 Section 4.0 paragraphs 4.5.1, 4.5.2, and 4.5.3, Category E1. The DUT shall carry the minimum limit of ultimate trip current at 71 °C, for testing at the operating high temperature, paragraph 4.5.3. The test shall be modified to include a short-time operating high temperature of 85 °C, and operating high temperature of 71 °C. At the end of each operating cycle, the DUT shall be tested in accordance with and meet the requirements of the guillotine test per 4.7.7.6.1, Source A, Circuit 2.

4.7.21.2 Altitude: The DUT shall be subjected to the altitude test in accordance with RTCA/DO-160 Section 4.0 paragraph 4.6.1 Category E1. At the end of each operating cycle the DUT shall be tested in accordance with and meet the requirements of the guillotine test per 4.7.7.6.1, Source A, Circuit 2.

4.7.21.3 Decompression: The DUT shall be subjected to the decompression test in accordance with RTCA/DO-160 Section 4.0 paragraph 4.6.2, Category A1. At the end of each operating cycle the DUT shall be tested in accordance with and meet the requirements of the guillotine test per 4.7.7.6.1, Source A, Circuit 2.

4.7.21.4 Overpressure: The DUT shall be subjected to the overpressure test in accordance with RTCA/DO-160 Section 4.0 paragraphs 4.6.3, Category A1 with the additional requirement to conduct the testing with the circuit breaker operating. At the end of each operating cycle the DUT shall be tested in accordance with and meet the requirements of the guillotine test per 4.7.7.6.1, Source A, Circuit 2.

4.7.22 Magnetic Effects: The DUT shall be subjected to the magnetic effects test in accordance with RTCA/DO-160 Section 15.0 Category Z.

4.7.23 Electromagnetic Compatibility: The DUT shall be tested under resistive load at 85 to 90% rated current.

4.7.23.1 Audio Frequency Conducted Susceptibility: The DUT shall be subjected to the audio frequency conducted susceptibility test in accordance with RTCA/DO-160 Section 18.0 Category A (CF) or as specified in the specification sheet.

4.7.23.2 Induced Signal Susceptibility: The DUT shall be subjected to the induced signal susceptibility test in accordance with RTCA/DO-160 Section 19.0 Category C or as specified in the specification sheet.

4.7.23.3 Radio Frequency Susceptibility: The DUT shall be subjected to the radio frequency susceptibility test in accordance with RTCA/DO-160 Section 20.0 Category W and R (radiated susceptibility pulse test) or as specified in the specification sheet.

4.7.23.4 Emission of Radio Frequency Energy: The DUT shall be subjected to the emission of radio frequency energy test in accordance with RTCA/DO-160 Section 21.0 Category M or as specified in the specification sheet.

4.7.23.5 Lightning Induced Transient Susceptibility: The DUT shall be subjected to the lightning induced transient susceptibility test in accordance with RTCA/DO-160 Section 22.0 Category XXG33 as specified in the specification sheet.

4.7.23.6 Electrostatic Discharge: The DUT shall be subjected to the electrostatic discharge test in accordance with RTCA/DO-160 Section 25.0 Category A or as specified in the specification sheet.

4.7.24 Maximum Power:

4.7.24.1 Quiescent Power During Normal Operation: With the DUT in the open position and stabilized at 25 °C ambient temperature, apply the specified voltage per the specification sheet after 5 minutes measure the current to the ground connection. Close the circuit breaker on rated current and measure current to ground connection after 30 minutes at rated current. Utilizing this current and voltage information measure the real power dissipation. It shall not exceed 1.2 watts, or as specified in the specification sheet.

4.7.24.2 Current Value and Duration During Arc Fault Trip: With the DUT stabilized at 25 °C ambient temperature and at 100% rated current conditions for 30 minutes, the quiescent current through the DUT shall be measured. The DUT shall be subjected to the guillotine test per 4.7.7.6.1 Source A Circuit 2 and the current drawn through the ground connection shall not exceed 3.5 A peak current or the requirements of the specification sheet. The duration of the increase above the quiescent current to the ground connection shall not exceed 50 ms unless otherwise specified in the specification sheet.

4.7.25 Power Quality:

4.7.25.1 Power Input: The DUT shall be subjected to the ac power input tests in accordance with MIL-STD-704A (the requirements of Rev.A of MIL-STD-704 must be met), or as specified in the specification sheet.

4.7.25.2 Voltage Spike: The DUT shall be subjected to the voltage spike test in accordance with RTCA/DO-160 Section 17.0 Category A or as specified in the specification sheet. The DUT shall not trip or otherwise malfunction. Following signal injection, but prior to first removal of power, each DUT must be subjected to and meet the requirements of the guillotine test per 4.7.7.6.1, Source A, Circuit 2. The DUT shall also meet the calibration test requirements for 200% overload at 25 °C, as specified in section 4.7.7.3.

4.7.26 Reverse Installation: The DUT must satisfy one of the following three performance criteria:

1. The DUT shall provide full functionality in a bi-directional fashion for both thermal and arc fault protection functions. This shall be verified through performance of the following tests:

    a. Connect the DUT with line power supplied to the load terminal; perform a 200% overload test in accordance with 4.7.7.3, the DUT shall meet all performance requirements of this test.

    b. Perform a guillotine test in accordance with 4.7.7.6.1, Source A, Circuit 2, the DUT shall meet all performance requirements of this test.

    c. Connect the DUT with line power supplied to the line terminal (reversing the connections); perform a 200% overload test in accordance with 4.7.7.3, the DUT shall meet all performance requirements of this test.

    d. Perform a guillotine test in accordance with 4.7.7.6.1, Source A, Circuit 2, the DUT shall meet all performance requirements of this test.

2. The DUT shall provide full functionality in a bi-directional fashion for the thermal protection function, and a visible indication of an inactive arc fault protection function per the specification sheet, if installed incorrectly. This visible indication can be satisfied with coding (as defined in the specification sheet) as well as with a more active method. This shall be verified through performance of the following tests:

    a. Connect the DUT with line power supplied to the load terminal; perform a 200% overload test in accordance with 4.7.7.3, the DUT shall meet all performance requirements of that test. Subject the DUT to an arc fault condition per 4.7.7.6.1, Source A, Circuit 2. The DUT must experience a minimum of 8 half cycles of arcing within a 100 ms window, per 4.7.7.6.1, however, it is not required that the DUT clear the fault. In the case where the DUT does not experience a minimum of 8 half cycles of arcing within a 100 ms window, the DUT shall be retested until 8 half cycles of arcing are achieved within a 100 ms window.

    b. Connect the DUT with line power supplied to the line terminal (reversing the connections); perform a 200% overload test in accordance with 4.7.7.3, the DUT shall meet all performance requirements of this test.

    c. Perform a guillotine test in accordance with 4.7.7.6.1, Source A, Circuit 2, the DUT shall meet all the requirements of 4.7.7.6.1.

4.7.26 (Continued):

3. The DUT shall open on reverse power application. This shall be verified through performance of the following tests:

   a. Connect the DUT with line power supplied to the load terminal, apply 115 VAC and the DUT shall open.

   b. Connect the DUT with line power supplied to the line terminal (reversing the connections); perform a 200% overload test in accordance with 4.7.7.3, the DUT shall meet all performance requirements of this test.

   c. Perform a guillotine test in accordance with 4.7.7.6.1, the DUT shall meet all performance requirements of this test.

5. PREPARATION FOR DELIVERY:

Preservation, Packaging, Packing and Marking: AFCBs shall be preserved and packaged in accordance with Level A or C of MIL-E-17555 (no commercial equivalent), as specified. They shall be packed in accordance with Level A, B, or C, as specified and marked in accordance with MIL-E-17555.

6. NOTES:

6.1 Intended Use:

The trip-free AFCBs defined herein are intended for use in aircraft circuits as noted on the applicable specification sheet. SAE AS5692 AFCBs are not generally designed to be used as switches and should not be used as such per MIL-HDBK-454.

6.2 Qualification:

The activity responsible for the QPL is the Department of the Navy, Naval Air Systems Command, Electrical Power System Air 4.4.4.3, 22229 Elmer Road, Building 2360, Patuxent, River MD 20670. Copies of “Provisions Governing Qualification” may be obtained upon application to Commanding Officer, DODSSP Standardization Documents Order Desk, 700 Robbins Avenue, Bldg, 4D, Philadelphia, PA 19111-5094.

6.3 Definitions:

6.3.1 Ultimate Trip Current: For overload protection, ultimate trip current is the smallest value of current that will cause tripping of the AFCB under a given set of ambient conditions.