SUBJECT 489A

OUTLINE OF INVESTIGATION

FOR

CIRCUIT BREAKERS FOR USE IN COMMUNICATIONS EQUIPMENT

Issue Number 1

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FOREWORD

A. This Outline of Investigation contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Outline of Investigation. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of these requirements by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Outline of Investigation will not necessarily be judged to comply with the Outline of Investigation if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction differing from those detailed in the requirements of this Outline of Investigation may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the Outline of Investigation.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Outline of Investigation is processed. UL shall not be responsible to anyone for the use of or reliance upon this Outline of Investigation by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Outline of Investigation.

F. Many tests required by the Outline of Investigations of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements cover single pole or multi-pole DC rated circuit breakers intended for use as branch circuit overcurrent and short-circuit protection in communications equipment.

1.2 All poles of multi-pole circuit breakers covered by these requirements operate at the same potential.

1.3 These requirements are intended to be used with the Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, UL 489, as these requirements modify tests described in that standard.

1.4 Unless otherwise specified, when the term "circuit breaker" is used in this Outline, it refers to a circuit breaker intended for use with communications equipment.

1.5 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this Outline of Investigation, and that involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the acceptable level of safety as originally anticipated by the intent of this Outline of Investigation. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this Outline of Investigation cannot be judged to comply with this Outline of Investigation. Where considered appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this Outline of Investigation.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this Outline of Investigation shall comply with the requirements for that component.

2.2 A component need not comply with a specific requirement that:

a) Involves a feature or characteristic not needed in the application of the component in the product covered by this Outline of Investigation, or

b) Is superceded by a requirement in this Outline of Investigation.

2.3 A component shall be used in accordance with its recognized rating established for the intended conditions of use.

2.4 Specific components are recognized as being incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions for which they have been recognized.

3 Undated References

3.1 Any undated reference to a code or standard appearing in the requirements of this Outline of Investigation shall be interpreted as referring to the latest edition of that code or standard.

CONSTRUCTION

4 General

4.1 A circuit breaker intended for use with communications equipment shall comply with the construction requirements for circuit breakers in the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489, except as described in Sections 5 – 7.

5 Spacings

5.1 Spacings within a circuit breaker shall comply with the requirements in the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489. When installed, only the spacings of the end-product need be met.

5.2 Spacings at terminals between the primary circuit and an auxiliary circuit shall meet the requirements of the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489, unless the circuit breaker is marked in accordance with 16.5.

6 Terminals

6.1 A circuit breaker shall have a wire connector, wire-binding screw, a stud-type terminal, or a spring-action terminal formed to mate with end-product parts, for making electrical connections to the equipment with which it is intended to be used.

7 Manual ON/OFF Operation

7.1 A circuit breaker shall be able to be switched ON and OFF manually. An operation that requires the use of an ordinary tool is considered to be a manual operation.

PERFORMANCE

8 General

8.1 A circuit breaker intended for use with communications equipment shall comply with the performance requirements for circuit breakers in the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489, except as described in Sections 8 –14.

8.2 When the terminal parts are specially formed parts intended to mate with end-product parts, tests shall be made using either parts from the end-product or parts that effectively simulate end-product parts. When the metal-to-metal connection involves dissimilar metals where the coefficients of expansion may interfere with efficient operation, a heat cycling test shall be performed to demonstrate that temperatures at the connection can be expected to be stable. The heat cycling test shall be based on the test described in the Standard for Wire Connectors for Use with Aluminum Conductors, UL 486B.

9 Calibration Test

9.1 A circuit breaker shall comply with the Calibration tests in 7.1.2 of the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489.

9.2 When a circuit breaker is intended to be used in an ambient temperature other than 25°C or 40°C, tests shall be performed with the representative circuit breaker in air at the marked ambient temperature in addition to the tests at 25°C. See 16.2. When the circuit breaker is intended to be used over a range of ambient temperatures, the circuit breaker shall be tested in ambient air at both the maximum and minimum ambient temperatures. See 16.3.

10 Overload Test

10.1 A circuit breaker shall comply with the Overload Test in 7.1.3 of the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489, except that the test current shall be 150% of the current rating. The circuit shall have a time constant not less than 0.003 seconds.

11 Temperature Test

11.1 A circuit breaker shall operate without tripping until constant temperatures are attained, and materials used in the construction of a circuit breaker shall not be affected adversely by the temperatures to which they are exposed during the test. See the Temperature test described in Subsection 7.1.4 of the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489.

11.2 A circuit breaker that is intended to be applied in ambient temperatures other than 25°C or 40°C, shall be tested using the intended ambient temperature. See 16.2. When use is intended over a range of ambient temperatures, the circuit breaker shall be tested in ambient air at the maximum temperature where use is intended. See 16.3.

12 Endurance Test

12.1 A circuit breaker shall be capable of performing as intended when operated manually or by means of a machine constructed to simulate manual operation for 1000 cycles of ON/OFF "with load" operations.

12.2 Test conditions shall be as described in Subsection 7.1.5 of the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489.

13 Interrupting Test

13.1 The interrupting test shall be performed in accordance with the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489, except that the prospective current may be any value as required for the application. The test current for the test in the Y-sequence shall not exceed the short-circuit current rating of the circuit breaker. See 16.6.

14 High Ambient Conditioning Test

14.1 When tested as described in this Section, a circuit breaker shall not become inoperable as a result of exposure to high ambient temperatures.

14.2 To verify that a circuit breaker is not adversely affected by exposure to high ambient temperatures, a set of representative circuit breakers, selected in accordance with Table 7.1.1.1 of the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489, is to be placed in a chamber where the temperature is 100 ±2° C for a period of 7 hours. There shall not be any distortion of materials that would expose live parts.

14.3 After being removed from the chamber and returned to room ambient temperatures, the representative circuit breaker shall be subjected to the calibration test in accordance with 9.1. Tripping times shall not exceed the allowable times.

RATINGS

15 General

15.1 The electrical ratings of a circuit breaker shall be as described in the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489, except that a DC voltage rating of 65 or 80 volts shall be permitted. "Slash" ratings are not permitted.

MARKINGS

16 General

16.1 In addition to the marking requirements in the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489, a circuit breaker shall be marked in accordance with the marking requirements in this Section.

16.2 A circuit breaker intended to be applied in an ambient temperature other than 25°C or 40°C shall be marked with the intended operating ambient temperature. Location Category B.

16.3 When a circuit breaker is intended to be used over a range of ambient temperatures, it shall be marked with that range of ambient temperatures. Location Category B.

16.4 When a circuit breaker that is intended to be connected to insulated wire is rated for use in an ambient temperature greater than 40°C, the circuit breaker shall be marked to indicate the temperature rating of the connected conductor insulation. Location Category C.

16.5 A circuit breaker that has spacings less than those required for an opposite polarity condition between the primary circuit and an auxiliary circuit at the terminals shall be marked: "SAME POLARITY" or the equivalent to alert the user that the same polarity should exist between adjacent line/load and auxiliary terminals. Location Category C.

16.6 When the circuit breaker has been tested for an interrupting rating other than 5000 A, the rating shall be marked on the circuit breaker. Location Category B.