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UL 489B

OUTLINE OF INVESTIGATION
FOR
MOLDED-CASE CIRCUIT BREAKERS, MOLDED-CASE SWITCHES, AND
CIRCUIT-BREAKER ENCLOSURES FOR USE WITH PHOTOVOLTAIC (PV)
SYSTEMS

Issue No. 2

April 4, 2012

Summary of Topics

This is the second issue of the Outline of Investigation for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures for Use with Photovoltaic (PV) Systems that includes changes for the following:

Moved the enclosure and molded case switch requirements to separate sections.

Added a column for aluminum cable to Table 8.1.

Added another line in Table 8.1 for 350A wiring.

Revisions to allow bus bar connections.

Revised 9.1 to require the inclined plane tracking test for circuit breakers rated greater than 600V and added the requirement from note g in Table 6.1.6.1.1 of UL 489.

Replaced the term "recalibration" with "trip-out".

Added Tables 10.1 and 21.1 for test sequences.

Added a new clause to detail tests to be conducted in the forward or reverse direction.

Relocated the 100% calibration test at 50 °C after the temperature test.

Addition of line/load marking unless the device is tested in both the forward wired and reverse wired directions.

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Additional verbiage for the pole to be connected to the enclosure or mounting surface during closing and/or opening tests, plus verbiage to address nonmetallic enclosures.

Clarification of the wire size to be used for testing.

Revised the endurance test to be partially conducted before the temperature test.

Revised the temperature test by reducing the allowable temperature rise by 10 °C.

Replaced the overload and interrupting tests with the limited fault interrupting and standard fault interrupting tests, respectively.

Addition of standardized short circuit interrupting ratings plus additional short circuit ratings of 1200A and 1600A to Table 18.1.

Added an exception to allow for dc dielectric testing.

Added a ± 2 °C tolerance for the extreme ambient cycling test.

Added exception to short circuit ratings to allow for HIC test value of UL 489.

Added a "note" in Section 18 in order to delete requirements for a momentary and closing short circuit rating/markings, and testing for a 100% current carrying capability.

Added an exception for a separate publication for those devices with multiple wiring configurations.

Added a new marking requirement for 75 °C conductors.

Added the contact opening test for molded case switches to replace the overload test.

Added verbiage to waive molded case switch testing based on an identical PV circuit breaker previously evaluated to UL 489B.

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ALL DEVICES

INTRODUCTION

1 Scope

1.1 These requirements cover molded-case circuit breakers, molded-case switches, and circuit-breaker enclosures rated up to 1000 V dc, intended for use with photovoltaic (PV) systems and Article 690 of the National Electrical Code, ANSI/NFPA-70.

1.2 These requirements are intended to be used in conjunction with the requirements in the Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, UL 489, hereafter referred to as UL 489, except as modified or supplemented by this Outline.

2 Components

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

2.2 A component is not required to comply with a specific requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this Outline; or
- b) Is superseded by a requirement in this Outline.

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

2.4 Specific components are 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.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

4 Undated References

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

5 Glossary

5.1 For the purpose of this Outline, the following definitions apply.

5.2 PHOTOVOLTAIC (PV) MOLDED-CASE CIRCUIT BREAKER – A molded-case circuit breaker intended to operate in a photovoltaic (PV) system to provide branch circuit overcurrent protection.

5.3 PHOTOVOLTAIC (PV) CIRCUIT-BREAKER ENCLOSURE – A circuit-breaker enclosure intended for use in a photovoltaic (PV) system.

5.4 PHOTOVOLTAIC (PV) MOLDED-CASE SWITCH – A molded-case switch intended to operate in a photovoltaic (PV) system to provide disconnecting means.

MOLDED-CASE CIRCUIT BREAKERS

CONSTRUCTION

6 General

6.1 The construction of a PV circuit breaker shall comply with the requirements as specified in Section 6.1 of UL 489, except as noted in Sections 6 – 9 of this Outline as applicable.

6.2 Multipole PV circuit breakers shall be considered as individual poles for individual loads unless marked in accordance with 19.5. See also 10.8.

7 Spacings

7.1 The electrical spacings for PV circuit breakers rated 600V or less shall meet the requirements of Section 6.1.6 of UL 489. Those PV circuit breakers rated 601 – 1000V shall meet the requirements of UL 489 for 600V.