

*An American National Standard*  
**IEEE Standard for  
Low-Voltage DC Power Circuit Breakers  
Used in Enclosures**

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of the  
IEEE Power Engineering Society**

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# American National Standard

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## Foreword

(This Foreword is not a part of ANSI/IEEE C37.14-1979, Low-Voltage DC Power Circuit Breakers Used in Enclosures.)

This standard was first published in 1951 as AIEE Publication No 20. The first American National Standard was published in 1954 when use was made of the material in AIEE No 20. The basic material for ANSI/IEEE C37.14-1979, which replaces ANSI C37.14-1969, was developed by the IEEE Working Group of the Low-Voltage Switchgear Devices Subcommittee and approved by the IEEE Switchgear Committee.

This revision is based on the premise that the power sources for the circuits that are made, maintained, and interrupted by low-voltage direct-current power circuit breakers are solid-state rectifiers or rotating machines. Since no new installations of mercury arc rectifiers are being made, anode circuit breakers have been deleted from this revision.

At the time of writing this standard there was every indication that transit systems were being designed to require the maximum voltage rating of 1200 volts. As this standard is being published, however, the new systems are 650–750 volts nominal and, therefore, future consideration should be given to the maximum voltage rating of 1000 volts. Another development has been the design of dc electrical systems wherein the ratio of peak current to sustained current is much less than the ratio 1.65 on which the rating structure is based. Therefore, circuit breakers having less than 1.65 ratio capability should be considered for specific applications.

This standard represents standard practice in the United States for low-voltage dc power circuit breaker types currently covered by the American National Standards listed below.

ANSI C37.16-1979, Preferred Ratings, Related Requirements and Application Recommendations for Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors.

ANSI C37.20-1969, Switchgear Assemblies Including Metal-Enclosed Bus (IEEE Std 27-1974, Consolidation Edition).

ANSI C37.100-1972, Definitions for Power Switchgear.

IEEE Std 4-1978, Standard Techniques for High Voltage Testing.

NEMA RI 9-1968, Silicon Rectifier Units for Transportation Power Supplies.

NEMA RI 7-1962, 250 Volt Industrial Silicon Power Rectifier Units, 300 kW and larger.

Molded-case circuit breakers are covered by other standards but in some instances may be able to meet this standard.

The Standards Committee on Power Switchgear, C37, which reviewed and approved this standard, had the following personnel at the time of approval:

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W. E. Laubach, *Vice-Chairman of Low Voltage Switchgear Standards*

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| Tennessee Valley Authority. . . . .                                         | Robert C. St. Clair                                                                                                                                                                             |
| Testing Laboratory Group. . . . .                                           | L. Frier<br>E. J. Huber<br>R. W. Seelbach ( <i>Alt</i> )                                                                                                                                        |
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| U.S. Department of the Interior, Bureau of Reclamation. . . . .             | Edward M. Tomsic                                                                                                                                                                                |
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| U.S. Department of the Navy, Naval Facilities Engineering Command . . . . . | D. M. Hannemann                                                                                                                                                                                 |

The personnel of the IEEE Working Group of the Low-Voltage Switchgear Devices Subcommittee, IEEE Switchgear Committee, who developed this document were:

**R. A. McMaster, *Chairman***

**H. H. Connelley, *Secretary***

L. L. Baird

J. Stewart

V. A. Mortenson

The personnel of the IEEE Low-Voltage Switchgear Devices Subcommittee who reviewed and approved this standard were:

**R. N. Bell, *Chairman***

**H. H. Connelley, *Secretary***

R. J. Alton  
L. L. Baird  
A. N. Eliassen  
W. H. Ferguson  
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W. A. Mathews  
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F. J. Shields  
J. Stewart  
J. R. Truitt

J. P. Werner

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Charles L. Wagner  
William T. Wintringham†

†Deceased

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# *An American National Standard*

## **IEEE Standard for Low-Voltage DC Power Circuit Breakers Used in Enclosures**

### **1. Scope**

This standard covers the following types of enclosed low-voltage dc power circuit breakers:

- (1) Stationary or draw-out type of 1- or 2-pole construction
- (2) Having one or more rated maximum voltages, of 3200, 1600, 1200, 800, 325, or 300 V, for application on systems having nominal voltages of 3000, 1500, 1050, 700, 275, or 250 V
- (3) Manually operated or power operated
- (4) With or without overcurrent trip devices

NOTE: In this standard, the use of the words "circuit breaker" shall be considered to mean "enclosed low-voltage dc power circuit breaker."

### **2. Definitions**

The definitions of terms contained in this standard, or in other American National Standards referred to in this standard, are not intended to embrace all legitimate meanings of these terms. They are applicable only to the subject treated in this standard.

The definitions of most terms used in this standard are found in American National Standard C37.100-1972, Definitions for Power Switchgear. A dagger (†) following a definition indicates that the definition in this standard differs from that appearing in American National Standard C37.100-1972. An asterisk (\*) following a definition indicates that the term defined in this standard is not defined in American National Standard C37.100-1972.

**circuit breaker, general purpose low-voltage dc power.** A circuit breaker which during inter-

ruption does not usually prevent the fault current from rising to its sustained value.†

**circuit breaker, high-speed low-voltage dc power.** A circuit breaker which, when applied in a circuit with the parameter values specified in American National Standard C37.16-1979, Preferred Rating, Related Requirements and Application Recommendations for Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors, Tables 12 and 12A, tests "b" (5 A/ $\mu$ s initial rate of rise of current), forces a current crest during interruption within 0.01 s after the current reaches the pickup setting of the instantaneous trip device.†

NOTE: For total performance characteristics at other than test circuit parameter values, consult the manufacturer.

**current, peak.** The instantaneous value of current at the time of its maximum value.\*

**circuit breaker, semihigh-speed low-voltage dc power.** A circuit breaker which, when applied in a circuit with the parameter values specified in American National Standard C37.16-1979, Tables 11 and 11A, tests "b" (1.7 A/ $\mu$ s initial rate of rise of current), forces a current crest during interruption within 0.030 s after the current reaches the pickup setting of the instantaneous trip device.†

NOTE: For total performance at other than test circuit parameter values, consult the manufacturer.

**trip device (opening release), impulse.** A trip device designed to operate only by the discharge of a capacitor into its release (trip) coil.\*

### 3. References

The following American National Standards are referred to throughout this standard. When any of these standards are superseded by a revision approved by the American National Standards Institute, the revision shall apply.

- [1] ANSI C37.100-1972, Definitions for Power Switchgear.
- [2] ANSI C37.16-1979, Preferred Ratings, Related Requirements and Application Recommendations for Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors.
- [3] ANSI C37.20-1969, Switchgear Assemblies Including Metal-Enclosed Bus (IEEE Std 27-1974).
- [4] IEEE Std 4-1978, Standard Techniques for High Voltage Testing.
- [5] ANSI C37.17-1972, Trip Devices for AC and General Purpose DC Low-Voltage Power Circuit Breakers.

### 4. Service Conditions

A circuit breaker conforming to this standard shall be suitable for operation up to and including all of its standard ratings, providing that:

- (1) The temperature of the air surrounding the circuit breaker is not below  $-5^{\circ}\text{C}$
- (2) The altitude does not exceed 2000 m (6600 ft)
- (3) The relative humidity of the air surrounding the circuit breaker is such that there will be no condensation on the circuit breaker parts at any time
- (4) None of the conditions listed in 10.5.2 prevail.

NOTE: When properly applied in metal-enclosed power switchgear or individual enclosures, a circuit breaker will operate within the limits of ambient temperature of the air surrounding the enclosure as specified in IEEE Std 27-1974, Switchgear Assemblies Including Metal-Enclosed Bus (ANSI C37.20-1969).

Whenever the service conditions depart from those defined in this section, consultation between the user and manufacturer is recommended. Some of the service conditions that may require additional attention are listed in 10.5.2.

### 5. Ratings

**5.1 Rating Information.** The rating of low-voltage dc power circuit breakers is a designated limit of operating characteristics based upon

the service conditions of Section 4 and shall include the following as applicable:

- (1) Rated maximum voltage(s)
- (2) Rated continuous current (rms amperes)
- (3) Rated momentary current
- (4) Rated peak current
- (5) Rated short-time current (rms amperes)
- (6) Rated short-circuit current
- (7) Rated control voltage(s)

The designated ratings in American National Standard C37.16-1979 are preferred but are not to be considered restrictive.

**5.2 Rated Maximum Voltage.** The rated maximum voltage of a circuit breaker is the highest average dc voltage at which it is designed to perform with a recurring crest voltage no higher than occurs with a 3-phase diode bridge rectifier. The circuit breakers shall be rated at one of the following maximum rated voltages: 3200 V, 1600 V, 1200 V, 800 V, 325 V, and 300 V.

**5.3 Rated Continuous Current.** The rated continuous current of a circuit breaker is the designated limit of current in rms amperes that it shall be required to carry continuously without exceeding the temperature limitations designated in Section 7. The preferred continuous current ratings of the various frame sizes are listed in American National Standard C37.16-1979. The rated continuous current of a circuit breaker that is equipped with direct-acting trip devices of a smaller rating than the frame size of the circuit breaker is determined by the rating of those devices.

**5.4 Rated Momentary Current.** The rated momentary current of a circuit breaker is the designated limit of nonrepetitive available (prospective) peak amperes that it shall be required to withstand while remaining in the closed position without impairing its ability to operate and perform all other ratings. This rating will apply both without direct-acting instantaneous overcurrent trip devices and with current flow in the non-active direction of polarized direct-acting instantaneous overcurrent trip devices.

**5.5 Rated Peak Current.** The rated peak current of a circuit breaker is the designated limit of available (prospective) peak amperes that it shall be required to close into and still be able to open and close. This rating will apply to circuit breakers having direct-acting instantaneous trip devices active in the direction of current flow.